

Hornsea Project Three
Offshore Wind Farm



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Environmental Statement:
Non-Technical Summary

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Date: May 2018

Hornsea 3
Offshore Wind Farm

Orsted

Environmental Impact Assessment

Environmental Statement

Non-Technical Summary

Liability

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This report is also downloadable from the Hornsea Project Three offshore wind farm website at:

www.hornseaproject3.co.uk

Ørsted

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Glossary

Term	Definition
Array cables	Cables carrying the electrical current produced by the turbines will link the turbines to an offshore substation or HVDC converter station.
Cable corridor	The specific corridor of seabed (seaward of Mean High Water Springs (MHWS)) and land (landward of MHWS) from the Hornsea Three array area to the Norwich Main National Grid substation, within which the export cables will be located (see Figure 1.1).
Code of Construction Practice	A set of management measures to ensure that best practice construction work is undertaken with minimal impacts upon local people and the environment. Approved by the relevant planning authority prior to the commencement of works.
Compound	Collective term used to refer to secondary construction compounds along the Hornsea Three onshore cable corridor as well as the landfall construction compound (defined in detail in volume 1, chapter 3: Project Description). Although there is also a main construction compound, this is referred to individually due to its distant location relative to the onshore cable corridor.
Cumulative effects	The combined effect of Hornsea Project Three in combination with the effects from a number of different projects, on the same single receptor/resource.
Cumulative impact	Impacts that result from changes caused by other past, present or reasonably foreseeable actions together with Hornsea Project Three.
Design Envelope	A description of the range of possible elements that make up the Hornsea Project Three design options under consideration, as set out in detail in the project description. This envelope is used to define Hornsea Project Three for Environmental Impact Assessment (EIA) purposes when the exact engineering parameters are not yet known. This is also often referred to as the "Rochdale Envelope" approach.
Development Consent Order (DCO) as made	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Projects (NSIP).
Draft Development Consent Order (DCO) as submitted with the application	A draft order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Projects (NSIP) as submitted with the application.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
EIA Directive	European Union Directive 85/337/EEC, as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC and then codified by Directive 2011/92/EU of 13 December 2011 (as amended in 2014 by Directive 2014/52/EU).
EIA Regulations	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended).
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Statement (ES).

Term	Definition
Former Hornsea Zone	The Hornsea Zone was one of nine offshore wind generation zones around the UK coast identified by The Crown Estate (TCE) during its third round of offshore wind licensing. In March 2016, the Hornsea Zone Development Agreement was terminated and project specific agreements, Agreement for Leases (Afls), were agreed with The Crown Estate for Hornsea Project One, Hornsea Project Two, Hornsea Project Three and Hornsea Project Four. The Hornsea Zone has therefore been dissolved and is referred to throughout the Hornsea Project Three Scoping Report as the former Hornsea Zone (see Figure 1.1).
High Voltage Alternating Current (HVAC)	High voltage alternating current is the bulk transmission of electricity by alternating current (AC), whereby the flow of electric charge periodically reverses direction.
High Voltage Direct Current (HVDC)	High voltage direct current is the bulk transmission of electricity by direct current (DC), whereby the flow of electric charge is in one direction.
Horizontal Directional Drilling	Method for the installation of pipes, conduits and cables using a surface launched drilling rig. This is used as a proxy for trenchless technology.
Hornsea Three onshore cable corridor	The corridor in which the onshore export cables will be located (see Figure 1.1).
Hornsea Three offshore cable corridor	The corridor in which the offshore export cables will be located (see Figure 1.1).
Hornsea Three array area	The area in which the Hornsea Three turbines are located (see Figure 1.1).
Hornsea Project Four offshore wind farm	The fourth offshore wind farm project within the former Hornsea Zone. Referred to as Hornsea Four throughout the Environmental Statement.
Hornsea Project One offshore wind farm	The first offshore wind farm project within the former Hornsea Zone (see Figure 1.1). It has a maximum capacity of 1.2 gigawatts (GW) or 1,200 MW and includes all necessary offshore and onshore infrastructure required to connect to the existing National Grid substation located at North Killingholme, North Lincolnshire. Referred to as Project One throughout the Environmental Statement.
Hornsea Project Three offshore wind farm	The third offshore wind farm project within the former Hornsea Zone (see Figure 1.1). It includes offshore and onshore infrastructure to connect to the existing National Grid substation located at Norwich Main, Norfolk. Referred to as Hornsea Three throughout the Environmental Statement.
Hornsea Project Two offshore wind farm	The second offshore wind farm project within the former Hornsea Zone (see Figure 1.1). It has a maximum capacity of 1.8 GW (1,800 MW) and includes offshore and onshore infrastructure to connect to the existing National Grid substation located at North Killingholme, North Lincolnshire. Referred to as Project Two throughout the Environmental Statement.
Impact	Change that is caused by an action; for example, land clearing (action) during construction which results in habitat loss (impact).
Inter-related effects	Multiple effects on the same receptor arising from Hornsea Project Three. These occur either where a series of the same effect acts on a receptor over time to produce a potential additive effect or where a number of separate effects, such as noise and habitat loss, affect a single receptor, for example marine mammals.
Magnitude	A combination of the extent, duration, frequency and reversibility of an impact.
Measures adopted as part of the project	Enhancement, mitigation or monitoring commitment (which may include process or design measures) intended to avoid, reduce and where possible, remedy significant adverse impacts of a development.
National Policy Statement (NPS)	A document setting out national policy against which proposals for NSIPs will be assessed and decided upon.

Term	Definition
Nationally Significant Infrastructure Project (NSIP)	Large scale development including power generating stations which requires development consent under the Planning Act 2008. An offshore wind farm project with a capacity of more than 100 MW constitutes an NSIP.
Norwich Main National Grid Substation	The existing National Grid Norwich Main substation which Hornsea Project Three will ultimately connect to.
Onshore elements of Hornsea Three	Hornsea Three landfall, onshore cable corridor, construction compounds, the onshore HVAC booster station, the onshore HVDC converter/HVAC substation and the interconnection with the Norwich Main National Grid substation.
Offshore accommodation platforms	Offshore platforms to allow operations staff to be housed at the Hornsea Three array area for a number of weeks at a time, and to allow spares and tools to be stored at the Hornsea Three array area.
Offshore export cables	Offshore export cables are used for the transfer of power from the offshore substations to the landfall point.
Offshore HVAC booster station	Offshore HVAC booster station(s) are required in HVAC transmission systems only. Long distance, large capacity HVAC transmission systems require reactive compensation equipment to reduce the reactive power generated by the capacitance of the export cable in order to allow the power delivered to the National Grid to be useable.
Offshore HVDC converter substations	Offshore HVDC converter substations convert the three-phase Alternating Current (AC) power generated at the turbines into Direct Current (DC) power. This is then transmitted to the onshore HVDC converter/HVAC substation via the export cables. Offshore HVDC converter substations are required in HVDC transmission systems only.
Offshore interconnector cables	Offshore interconnector cables interconnect the offshore substations in order to provide redundancy in the case of cable failure elsewhere, or to connect to the offshore accommodation platforms in order to provide power for operation.
Offshore transformer substations	Offshore transformer substations collect the electricity generated by the operational turbines via the array cables. The voltage will be "stepped up" by transformers on the substation before transmission to the onshore HVDC converter/HVAC substation by export cables; this will be via the offshore HVAC converter substation in the case of the HVDC transmission option, or the offshore and/or onshore HVAC booster station(s) in the case of the HVAC transmission option.
Orsted Hornsea Project Three (UK) Ltd	The company promoting the development of the Hornsea Project Three offshore wind farm and submitting the application for Development Consent. Orsted Hornsea Project Three (UK) Ltd is owned by Orsted Power (UK) Limited, which is owned by Ørsted Vind A/S, which is owned by Ørsted VE A/S, which is owned by Ørsted Wind Power A/S, which is owned by Ørsted Wind Power Holding A/S, and which is owned by Ørsted A/S.
Planning Act 2008	The key legislation providing a framework for obtaining development consent for Nationally Significant Infrastructure Projects (NSIPs). The 2008 Act led to the development of National Policy Statements (NPSs) to guide the decision making processes for NSIPs.
Planning Inspectorate (PINS)	The executive agency of the Ministry of Housing, Communities & Local Government responsible for operating the planning process for NSIPs.
Project Description	A summary of the engineering design elements of Hornsea Three.
Receptor	A component of the natural or man-made environment that is affected by an impact, including people.
Sensitivity	The extent to which a receptor can accept a change, of a particular type and scale
Significance	The significance of an effect combines the evaluation of the magnitude of an impact and the sensitivity of the receptor.

Term	Definition
Statement of Community Consultation (SoCC)	A document explaining how consultation is planned to be conducted with the community and key stakeholders.
Transboundary	Crossing into other European Economic Association (EEA) States.

Acronyms

Acronym	Description
AC	Alternating Current
ADDs	Acoustic Deterrent Devices
AfL	Agreement for Lease
ASACS	Air Surveillance and Control Systems
cSAC	candidate Special Area of Conservation
DC	Direct Current
DCO	Development Consent Order
EA	Environment Agency
EEA	European Economic Area
EIA	Environmental Impact Assessment
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables Group
FSA	Formal Safety Assessment
GVA	Gross Value Added
HDD	Horizontal Directional Drilling
HMR	Helicopter Main Route
HSC	Historic Seascape Character
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IAQM	Institute of Air Quality Management
ICES	International Council for the Exploration of the Sea
LEP	Local Enterprise Partnership
LOS	Line of Sight
MCA	Maritime and Coastguard Agency
MDA	MOD Managed Danger Area
MGN	Marine Guidance Note
MHWS	Mean High Water Spring
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation

Acronym	Description
MOD	Ministry of Defence
NETS	National Electricity Transmission System
NPS	National Policy Statements
NPS EN-1	Overarching National Policy Statement for Energy
NPS EN-3	National Policy Statement for Renewable Energy Infrastructure
NPS EN-5	National Policy Statement for Electricity Networks Infrastructure
NRA	Navigational Risk Assessment
NSIP	Nationally Significant Infrastructure Project
NTS	Non-Technical Summary
PEIR	Preliminary Environmental Information Report
PEMMP	Project Environmental Management and Monitoring Plan
PINS	Planning Inspectorate
PRoW	Public Right of Way
pSPA	proposed Special Protection Area
PSR	Primary Surveillance Radar
RES	Renewable Energy Strategy
REWS	Radar Early Warning Systems
SAC	Special Area of Conservation
SAR	Search and Rescue
SoCC	Statement of Community Consultation
SPA	Special Protection Area
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
SVIA	Seascape and Visual Impact Assessment
TCE	The Crown Estate
TH	Trinity House
UK	United Kingdom
WFD	Water Framework Directive
ZTV	Zone of Theoretical Visibility

Units

Unit	Description
GW	Gigawatt (power)
Ha	Hectare
kJ	Kilojoules
Km	Kilometre
kV	Kilovolt (electrical potential)
kW	Kilowatt (power)
M	Metre
MW	Megawatt (power)
Nm	Nautical Mile

1. Introduction

1.1 Purpose of this document

- 1.1.1.1 Orsted Hornsea Project Three (UK) Ltd., on behalf of Orsted Power (UK) Ltd., is promoting the development of the Hornsea Project Three Offshore Wind Farm (hereafter referred to as Hornsea Three). Hornsea Three is a proposed offshore wind farm located in the southern North Sea.
- 1.1.1.2 The Hornsea Three array area (i.e. the area in which the turbines are located) is approximately 696 km², and is located approximately 121 km northeast off the Norfolk coast and 160 km east of the Yorkshire coast (Figure 1.1). The Hornsea Three array area lies to the east of Hornsea Project One and Hornsea Project Two offshore wind farms, and is located within the former Hornsea Zone (as shown on Figure 1.1). Hornsea Three is a project that will consist of an offshore generating station(s) with a capacity of greater than 100 MW and therefore is a Nationally Significant Infrastructure Project (NSIP), as defined by Section 15(3) of the Planning Act 2008. As such, there is a requirement to submit an application for Development Consent to the Planning Inspectorate (PINS) to be decided by the Secretary of State for Business, Energy and Industrial Strategy.
- 1.1.1.3 The Hornsea Three application for Development Consent has been submitted to PINS with the prescribed forms and documents as required by the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009.
- 1.1.1.4 This document is a Non-Technical Summary (NTS) of the Environmental Statement prepared for Hornsea Three. The Environmental Statement provides the environmental information which has been gathered in order to carry out an assessment of the likely significant environmental effects of Hornsea Three. The NTS presents a summary of the main findings of the Environmental Impact Assessment (EIA) undertaken for Hornsea Three. The Environmental Statement, including the NTS, accompanies the application for the Development Consent Order (DCO).
- 1.1.1.5 This NTS is intended to act as a stand-alone document that will provide an overview of the environmental effects of the proposed development in non-technical language. For more detailed information, the full Environmental Statement should be referred to, which can be downloaded from www.hornseaproject3.co.uk.

1.1.1.6 The purpose of the Environmental Statement is to provide the environmental information which has been gathered in order to carry out an assessment of the likely significant environmental effects of Hornsea Three. The Environmental Statement specifically:

- Provides statutory and non-statutory consultees with technical information to enable an understanding of Hornsea Three;
- Presents the existing environmental baseline information, established from desktop studies, offshore and onshore surveys and consultation;
- Describes the methodology used within the Environmental Impact Assessment (EIA) process;
- Presents the potential environmental impacts arising from Hornsea Three, based upon the baseline information and data gathered, and the analysis and impact assessments completed;
- Indicates any limitations encountered during the compilation of the environmental information, including the acknowledgement of any data gaps or deficiencies and confidence in the information gathered;
- Puts forward potential mitigation measures that could prevent, minimise, reduce or offset potential adverse environmental impacts identified during the EIA process. Where additional mitigation measures have been identified, the residual significance of effect has also been identified; and
- Provides an outline of the main project alternatives considered for Hornsea Three and an indication of the main reasons for the project selection.

1.2 Ørsted (formerly DONG Energy)

1.2.1.1 Ørsted A/S (owner of Orsted Power (UK) Ltd. and Orsted Hornsea Project Three (UK) Ltd.) specialises in procuring, producing, distributing and trading energy and related products in Northern Europe. Ørsted A/S is the world leader in the development, construction and operation of offshore wind farms, with more than 25 years' experience and a strong track record delivering successful projects, with approximately 4.4 GW of operational offshore wind farms worldwide, and a further 4.5 GW under construction in the lead up to 2022.

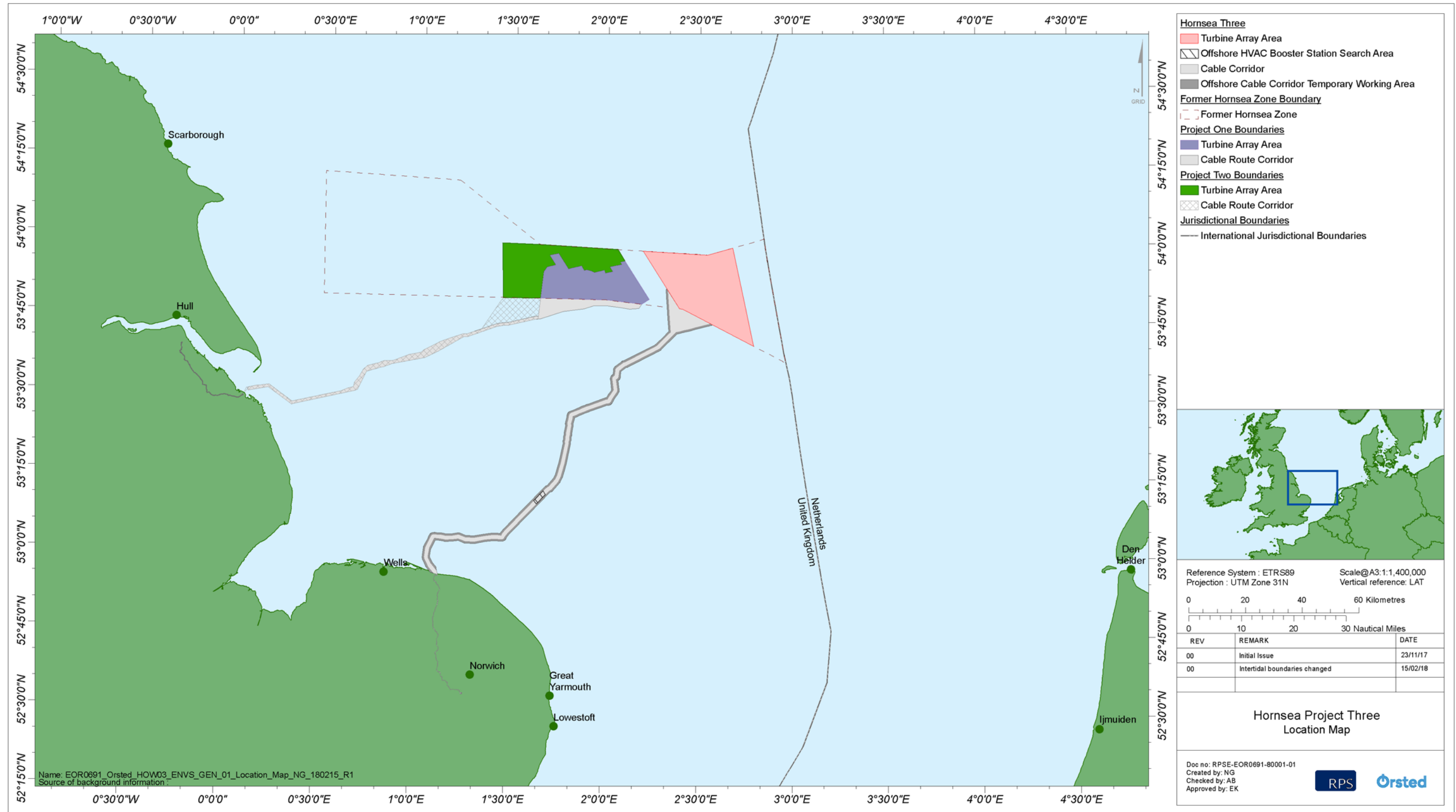


Figure 1.1: Location of the proposed Hornsea Three within the former Hornsea Zone.

1.3 Hornsea Zone

- 1.3.1.1 The former Hornsea Zone was one of nine offshore wind generation zones around the UK coast identified by The Crown Estate (TCE) during its third round of offshore wind licensing. The former Hornsea Zone was located in the southern North Sea, approximately 31 km east of the Yorkshire coast and 1 km from the median line between UK and Dutch waters (Figure 1.1). As part of a competitive tender, SMart Wind Ltd. (a 50/50 joint venture between International Mainstream Renewable Power (Offshore) Limited and Siemens Project Ventures GmbH; hereafter referred to as SMart Wind) was awarded the rights to the development of the former Hornsea Zone by entering into a Zone Development Agreement (ZDA) with TCE in 2009.
- 1.3.1.2 DONG Energy Wind Power A/S (now Ørsted Wind Power A/S) acquired the development rights to Hornsea Project One in February 2015 and, in August 2015, Orsted Power (UK) Ltd. (formerly DONG Energy Power (UK) Ltd.) acquired SMart Wind Ltd and the then Hornsea Zone, together with the development rights for Hornsea Project Two, Hornsea Three and Hornsea Project Four offshore wind farm. Subsequently in March 2016, the Hornsea ZDA was terminated and project specific agreements, Agreement for Leases (AfLs), were agreed with TCE for Hornsea Project One, Hornsea Project Two, Hornsea Three and Hornsea Project Four. The Hornsea Zone has therefore been dissolved and is referred to throughout the Hornsea Three Environmental Statement and this NTS as the former Hornsea Zone.

1.4 Hornsea Three

- 1.4.1.1 The Hornsea Three array area (i.e. the area in which the offshore wind turbine generators (hereafter referred to as turbines) are located) is approximately 696 km², and is located approximately 121 km northeast off the Norfolk coast and 160 km east of the Yorkshire coast (Figure 1.1). The Hornsea Three offshore cable corridor extends from the Norfolk coast, offshore in a north-easterly direction to the western and southern boundary of the Hornsea Three array area. Hornsea Three has a different onshore and offshore cable corridor, as well as grid connection, to Hornsea Project One and Hornsea Project Two (Figure 1.1).
- 1.4.1.2 The electricity generated from Hornsea Three will be transmitted via buried High Voltage (HV) cables using either Direct Current (DC) or Alternating Current (AC), or a combination of the two. From the Norfolk coast, underground onshore cables will connect the offshore wind farm to an onshore High Voltage Alternating Current (HVAC) substation or a High Voltage Direct Current (HVDC) converter substation, which will in turn connect to an existing National Grid substation. Hornsea Three will connect to the Norwich Main National Grid substation, located to the south of Norwich.
- 1.4.1.3 Further details of the project are provided under the "Project Description" sub-heading below (section 3).

2. Policy and Legislation

2.1 Energy policy and the role of renewable sources of energy

- 2.1.1.1 In October 2014, the EU Council agreed on a policy framework for climate and energy in the period from 2020 to 2030, which included targets and policy objectives for that period. The targets to be achieved by 2030 include:
- A 40% cut in greenhouse gas emissions compared to 1990 levels;
 - At least a 27% share of renewable energy consumption; and
 - At least 27% improvement in energy efficiency.
- 2.1.1.2 To meet these targets, the European Commission published a proposal for a revised Renewable Energy Directive on 30 November 2016, which addressed the points in the Renewable Energy Directive's evaluation conducted between 2014 and 2016, stakeholder consultations, and expert independent studies commissioned by the Commission. This proposed revised Renewable Energy Directive seeks to build on the success of the Renewable Energy Directive.
- 2.1.1.3 A range of UK government strategies and measures have defined the over-arching need for renewable energy generation in the UK. Key documents include:
- National Renewable Energy Action Plan for the UK (DECC, 2010);
 - UK Renewable Energy Strategy (RES; DECC, 2009a);
 - UK Low Carbon Transition Plan (DECC, 2009b);
 - The Renewable Energy Roadmap (DECC, 2013); and
 - The UK Carbon Plan (DECC, 2011a).
- 2.1.1.4 The central objective of Government energy policy is to ensure the security of energy supply, whilst responding to the challenge of climate change by reducing carbon emissions. To meet these objectives, more energy infrastructure is required with an increased emphasis on energy generation from low carbon sources, including renewables.
- 2.1.1.5 The need for this infrastructure is fully recognised in many areas of Government policy. The Energy Act 2013 includes provisions intended to incentivise investment in low carbon electricity generation, ensure security of supply and help the UK meet its emission reduction and renewables targets.

2.1.1.6 Under the Planning Act 2008, National Policy Statements (NPS) provide the primary basis for decisions regarding NSIPs made by the Secretary of State. The UK's commitment to renewable energy has been captured in the publication of the following NPSs:

- Overarching NPS for Energy (NPS EN-1; DECC, 2011b);
- NPS for Renewable Energy Infrastructure (NPS EN-3; DECC, 2011c); and
- NPS for Electricity Networks Infrastructure (NPS EN-5; DECC, 2011d).

2.1.1.7 NPS EN-3 and NPS EN-5 identify certain environmental topic-specific policy considerations. Where relevant, these are outlined within the individual chapters of the Environmental Statement.

2.2 Planning consents and EIA

2.2.1.1 The Planning Act 2008, and associated secondary legislation, sets out a comprehensive statutory framework for the principal consents required to develop, operate and decommission NSIPs, together with any related associated infrastructure. Hornsea Three is defined as an NSIP, as it will be an offshore generating station with a capacity of greater than 100 MW.

2.2.1.2 Permission to build and operate an NSIP is given in a DCO, granted by the Secretary of State in accordance with the policy framework provided in the NPSs. The application will cover all offshore and onshore works and the draft DCO has been submitted with the application for Development Consent.

2.2.1.3 Directive 2014/52/EU on the assessment of the effects of certain public and private projects on the environment was brought into force on 15 May 2014. In the context of DCOs the Directive was implemented into domestic legislation by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (referred to as 'the 2017 EIA Regulations'). As a Scoping Opinion was sought for Hornsea Three in October 2016, the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended) continue to apply, however it has been decided that in the interests of good practice the spirit of the 2017 EIA Regulations will be adhered to where possible.

2.2.1.4 Only certain types of project require an EIA to be carried out under the EIA Regulations. According to Schedule 2 of the EIA Regulations, an EIA is required for installations for the harnessing of wind power for energy production likely to have significant effects on the environment. A full EIA has therefore been undertaken for Hornsea Three and an Environmental Statement produced. The Environmental Statement, of which this NTS forms a part, presents the findings of the EIA.

2.2.1.5 The EIA process can be broadly summarised as consisting of three main elements that take place prior to the submission of the DCO and Environmental Statement:

- **Scoping:** To determine the subject matter of the EIA and to identify potentially significant effects;
- **Consultation:** The project promoter is required to conduct pre-application consultation in accordance with the Planning Act 2008 plus associated guidance and Regulations, which includes the above EIA Regulations. The Statement of Community Consultation (SoCC) identifies the proposed consultation activities (see section 2.3 for further information); and
- **Environmental Statement Preparation:** The Environmental Statement (i.e. reporting on the EIA process as described in paragraph 1.1.1.6; updating the information provided in the PEIR and continuing with design iteration and consultation) is prepared.

2.3 Consultation process

2.3.1 Statement of Community Consultation

2.3.1.1 Under Section 47 of the 2008 Act, the Applicant has a duty to prepare a Statement of Community Consultation (SoCC), which sets out how it plans to consult local communities on the proposed development, and must conduct its consultation in line with this statement. The Applicant must consult on and agree the contents of the SoCC with each of the Local Authorities, in whose area the proposed development is situated (as prescribed in section 43(1) of the 2008 Act).

2.3.1.2 In the case of Hornsea Three, land affected by the onshore works falls within the administrative boundaries of the following Local Authorities:

- North Norfolk District Council;
- Broadland District Council;
- South Norfolk District Council; and
- Norfolk County Council.

2.3.1.3 The above organisations were consulted on the contents of a draft SoCC in July 2016.

2.3.1.4 In addition to those organisations, the following Local Authorities, which adjoin the Local Authorities within which the Hornsea Three onshore cable corridor is located, were also consulted on the draft SoCC:

- Norwich City Council;
- Breckland District Council;
- Broads Authority; and
- Great Yarmouth Borough Council.

2.3.1.5 The SoCC in its final format was published on 30 September 2016 and copies were issued in local newspapers the following week. The Hornsea Three SoCC (DONG Energy (now Ørsted), 2016a) can be downloaded from: www.hornseaproject3.co.uk.

2.3.2 Phase 1 consultation

2.3.2.1 The publication of the Hornsea Three SoCC (DONG Energy (now Ørsted), 2016a) marked the start of the first phase of consultation for Hornsea Three, hereafter referred to as Phase 1 consultation. During Phase 1 consultation, Hornsea Three published and received feedback on its Scoping Report and held two rounds of Community Consultation Events (Phase 1.A and Phase 1.B). Phase 1 consultation commenced 31 October 2016 and was completed 9 November 2016.

2.3.3 Phase 2 consultation

Phase 2.A consultation

2.3.3.1 Phase 2.A consultation was marked by the beginning of formal consultation under Section 42, Section 47 and Section 48 of the Planning Act 2008, and commenced 27 July 2017 and was completed 20 September 2017. The Preliminary Environmental Information Report (PEIR) and accompanying documents were published at the start of Phase 2.A consultation to help inform the wider formal consultation. The PEIR presented the preliminary environmental information for the project, and utilised the Scoping Report (DONG Energy (now Ørsted), 2016b) and Scoping Opinion (PINS, 2016), as well as comments received from the first two rounds of community events under Phase 1 consultation. As part of the Phase 2.A consultation, Hornsea Three held a third round of community consultation events in September 2017.

Phase 2.B consultation

2.3.3.2 Phase 2.B consultation under Section 42, Section 47 and Section 48 of the Planning Act 2008 was undertaken between 25 November and 22 December 2017. This consultation related to additional areas in which works are proposed beyond the Hornsea Three offshore and onshore cable corridor identified in Phase 2.A consultation. These new areas were identified following consultation responses received during Phase 2.A consultation and through ongoing design development.

Phase 2.C consultation

2.3.3.3 Phase 2.C consultation under Section 42(1) of the Planning Act 2008 was undertaken between 28 February and 30 March 2018. Phase 2.C consultation related to six additional areas in which works are proposed beyond the Hornsea Three onshore cable corridor identified in the Phase 2.B further consultation. These new areas were identified following consultation responses received during the Phase 2.B further consultation.

2.3.4 Consultation Report

2.3.4.1 A Consultation Report explaining how Hornsea Three has had regard to all consultation responses received during all stages of the Hornsea Three pre-application consultation process accompanies the Development Consent application. The Consultation Report sets out the comments and feedback that have been received and describes how the comments raised have been taken into account as part of the application. The Consultation Report can be downloaded from: www.hornseaproject3.co.uk.

3. Project Description

3.1 Introduction

- 3.1.1.1 This section of the NTS provides an outline description of the potential design of both the onshore and offshore infrastructure, as well as the activities associated with the construction, operation and maintenance, and decommissioning of Hornsea Three. The full indicative project description is set out in volume 1, chapter 3: Project Description of the Environmental Statement.
- 3.1.1.2 The boundary of Hornsea Three can be seen in Figure 1.1 above. This area encompasses the following project elements, which are described further in section 3.3 and Figure 3.2:
- Hornsea Three array area: This is where the offshore wind farm will be located, which will include the wind turbines and offshore structure foundations, array cables, offshore accommodation platforms and a range of offshore substations as well as interconnector cables and export cables;
 - Hornsea Three offshore cable corridor: This is where the permanent offshore electrical infrastructure (offshore export cable(s), as well as the offshore HVAC booster station(s) and their foundations (if required)) will be located; and
 - Hornsea Three onshore cable corridor: This is where the permanent onshore electrical infrastructure (onshore export cable(s), as well as the onshore HVAC booster station (if required)), onshore HVDC converter/HVAC substation and connections to the National Grid will be located.
- 3.1.1.3 The Environmental Statement, as summarised in this NTS, sets out a series of options and parameters for which maximum values are shown. The maximum values constitute the maximum design scenario in relation to Hornsea Three for the purposes of assessing the potential environmental impacts of Hornsea Three (see also section 5.3). The final design will be refined later in the project development from, but not exceeding, the maximum design scenario.

3.2 Agreement for Lease (AfL) area

- 3.2.1.1 The AfL area for the Hornsea Three array area covers approximately 696 km² and is broadly a diamond shape with a length of approximately 29 km west to east and 35 km north to south. The AfL area is where the offshore infrastructure, such as the turbines, offshore substation(s) and array cables, will be located (see Figure 1.1).
- 3.2.1.2 Hornsea Three has applied for an AfL for the Hornsea Three offshore cable corridor.

3.3 Hornsea Three infrastructure overview

- 3.3.1.1 The key components of Hornsea Three, described in the following sections, are likely to include:
- Offshore wind turbines;
 - Foundations (for wind turbines, offshore substation platforms, and offshore accommodation platforms);
 - Scour protection;
 - Offshore accommodation platform(s);
 - Array cables linking the individual wind turbines to offshore substation platforms;
 - Connection works to existing Norwich Main Substation;
 - Temporary construction compounds, including soil storage areas;
 - Permanent and temporary access roads; and
 - HVAC or/and HVDC transmission system including either:
 - HVAC:
 - Offshore transformer substation(s);
 - Offshore interconnector cables(s);
 - Offshore export cable(s);
 - Offshore HVAC booster station(s) (unless specified otherwise this refers to both surface and subsea designs);
 - Onshore export cable(s);
 - Onshore HVAC booster station (either instead of, or as well as offshore HVAC booster station(s));
 - Onshore HVAC substation; and
 - Grid connection export cable(s).
 - HVDC:
 - Offshore transformer substation(s);
 - Offshore interconnector cables(s);
 - Offshore HVDC converter substation(s);
 - Offshore export cables(s);
 - Onshore export cables(s);
 - Onshore HVDC converter substation; and
 - Grid connection export cable(s).

3.4 Turbine and surface infrastructure layouts

- 3.4.1.1 Designing and optimising the layout of the turbines and other offshore surface infrastructure (offshore substations and offshore accommodation platforms) is a complex, iterative process taking into account a large number of inputs and constraints.
- 3.4.1.2 In order to inform the EIA, Hornsea Three has identified two indicative layout scenarios. The indicative layout scenarios have been used within the EIA for contextual purposes where appropriate. As the location of the infrastructure is not yet defined, the layouts do not distinguish between what type of infrastructure is placed in each location. Individual assessment chapters have therefore made assumptions as to which locations are turbines or platforms in order to inform the assessment. Layout A (Figure 3.1) includes the maximum number of structures (300 turbines and 19 platforms (consisting of offshore accommodation and substations)). It includes a dense border at an approximate spacing of 1 km between turbines, and a single line of orientation inside the border. Layout B (Figure 3.1) shows an indicative scenario with larger turbines, and hence greater spacing between turbine locations. The total number of locations in this layout is 179 (160 turbines and 19 platforms (consisting of offshore accommodation and substations)), the border spacing is approximately 5.6 km and the internal spacing is varied. The final layout will be refined later in the project development from, but not exceeding, the maximum design scenario.

3.5 HVAC/HVDC transmission systems

- 3.5.1.1 There are a range of transmission (electrical) system designs that can be used to transport the power from the Hornsea Three array area to the UK National Grid. These fall under two primary transmission types defined by how the current is delivered to the export cables; HVAC or HVDC. Both transmission types have a range of relative benefits and drawbacks. Offshore wind farms have traditionally used HVAC connections; however, HVDC connections become more technically and/or economically viable in the context of far from shore projects and are used on a number of projects in Germany.
- 3.5.1.2 Hornsea Three may use HVAC or HVDC transmission, or could use a combination of both technologies in separate electrical systems. As a consequence, depending on the option selected, Hornsea Three will have slightly different key components, see paragraph 3.3.1.1 and Figure 3.2. If a combination of the two technologies is used, the total infrastructure installed will not exceed the maximum values assessed within the Environmental Statement.
- 3.5.1.3 Hornsea Three requires flexibility in transmission system choice to ensure that anticipated changes in available technology and project economics can be accommodated within the Hornsea Three design, and will make a decision on which transmission type to use during the detailed design phase (post consent).

3.6 Onshore infrastructure

- 3.6.1.1 Onshore export cables will be brought ashore on the north Norfolk coast in the vicinity of Weybourne (Figure 3.3). The cables will be buried underground along their entire length. The cables will be buried in a corridor approximately 80 m wide (this includes both the permanent installation area (60 m) and temporary working area (20 m)) and installed predominantly in agricultural land, minimising complex crossings of roads, watercourses and environmentally sensitive locations wherever possible. The cable will be brought to site in sections (typically 750 m to 2,500 m in length) which will be laid in the trenches, jointed together and buried.
- 3.6.1.2 If a HVAC electrical transmission system is developed it may be necessary to construct an onshore HVAC booster station (instead of, or in addition to, an offshore HVAC booster station(s)). This would provide reactive compensation to the cable and enable long distance HVAC transmission. If an onshore HVAC booster station is required it would be constructed at the upper end of the Hornsea Three onshore cable corridor (approximately 10 km inshore from the cable landfall) (Figure 3.3). If a HVDC electricity system is developed, an onshore HVAC booster station would not be required.
- 3.6.1.3 To connect Hornsea Three to the National Electricity Transmission System (NETS) it is necessary to construct a new HVDC converter station or HVAC substation (referred to within the documents as onshore HVDC converter/HVAC substation), depending on which transmission system is developed. Hornsea Three will connect to the National Grid at the Norwich Main 400 kV substation, located between Swardeston and Stoke Holy Cross in South Norfolk. The Hornsea Three onshore HVDC converter/HVAC substation will also be located in this vicinity (Figure 3.3).
- 3.6.1.4 During the construction phase, temporary construction compounds of various sizes will also be required along the Hornsea Three onshore cable corridor, for laydown and storage of materials, plant and staff, as well as space for small temporary offices, welfare facilities, security and parking. Construction compounds will also be required for crossings of other infrastructure to house operations such as drilling works. The construction compounds will be removed and sites restored to their original condition when construction has been completed.

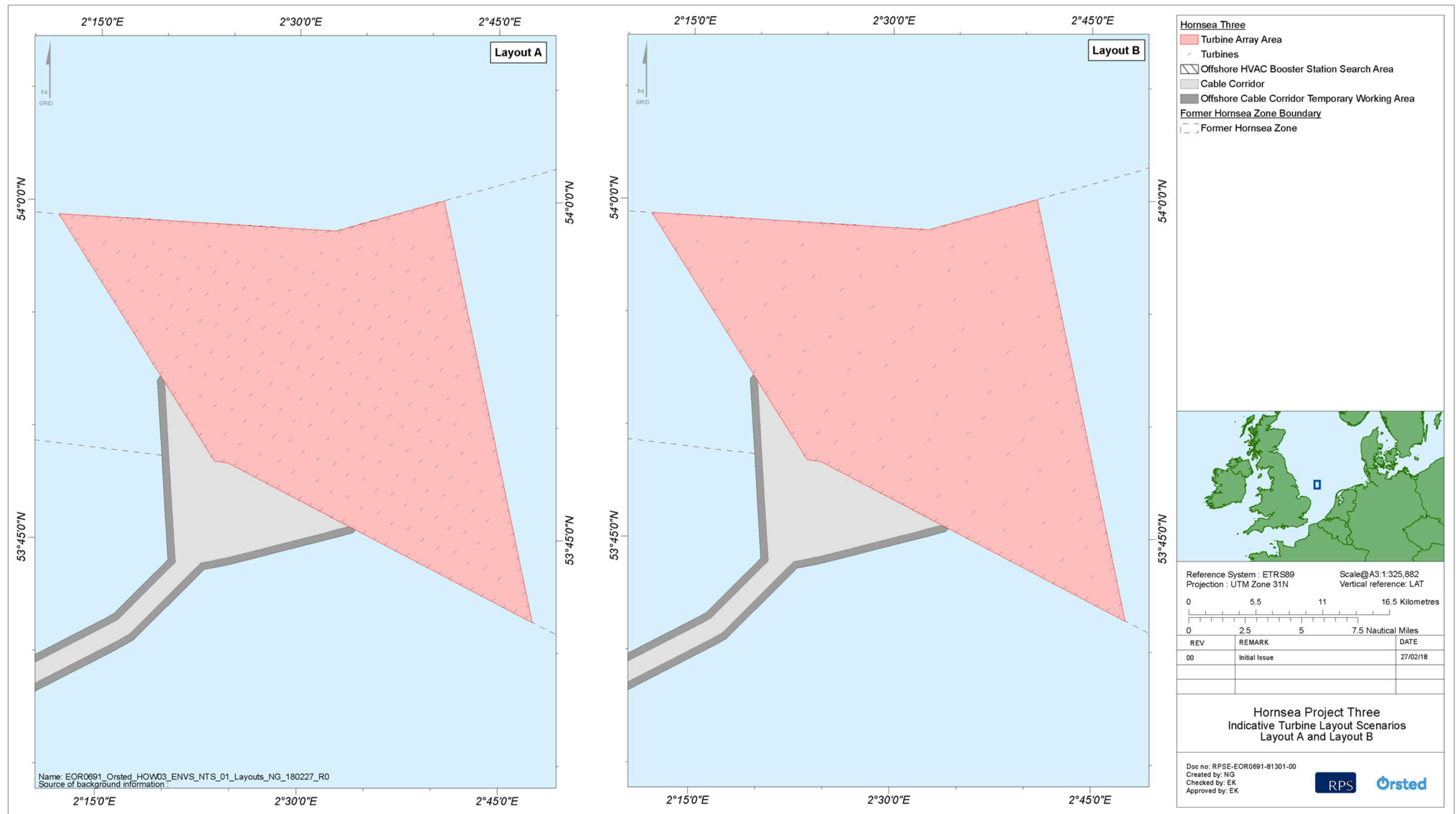


Figure 3.1: Layout A with 300 turbines and 19 platforms and layout B with 160 turbines and 19 platforms.

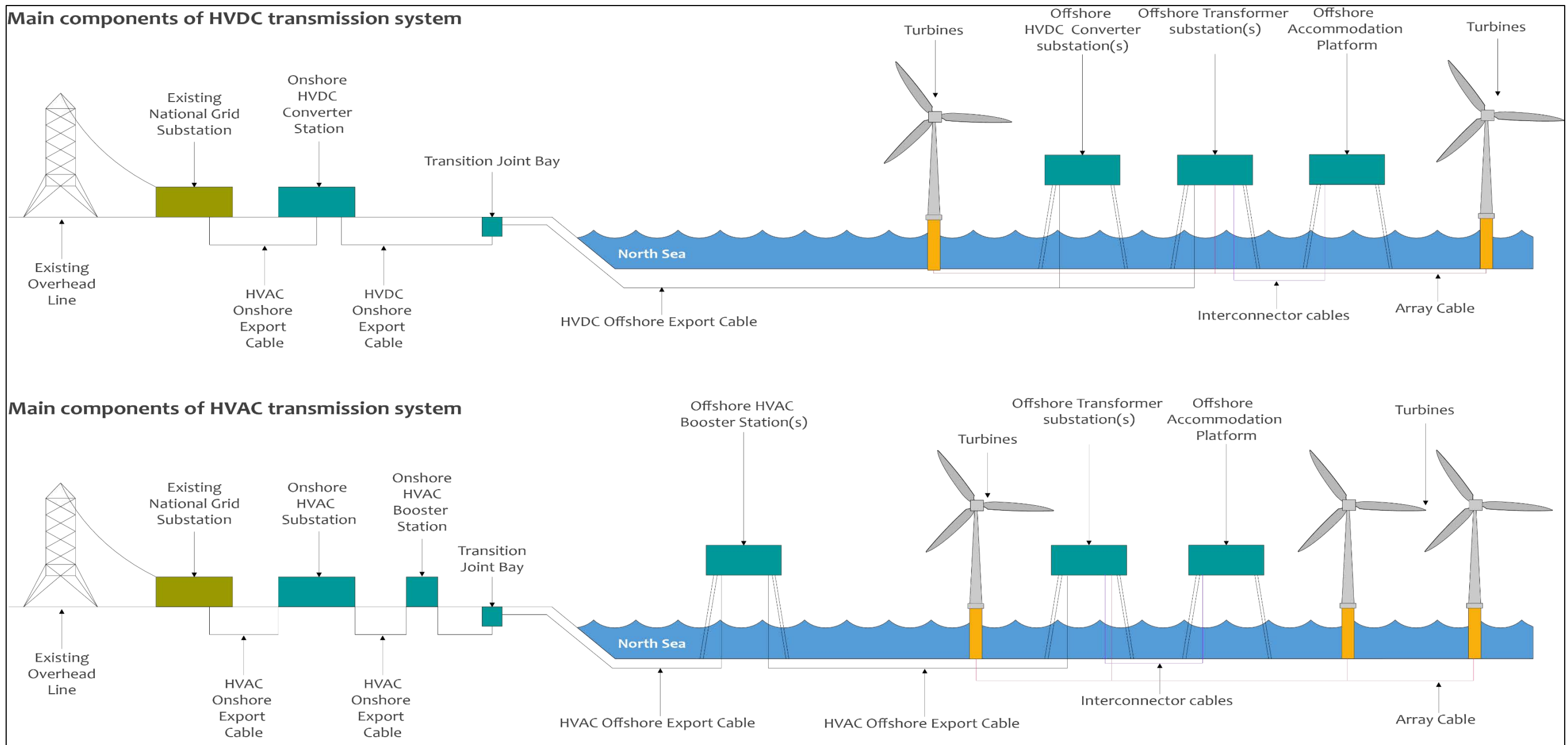


Figure 3.2: Main components of HVDC and HVAC transmission options for Hornsea Three.

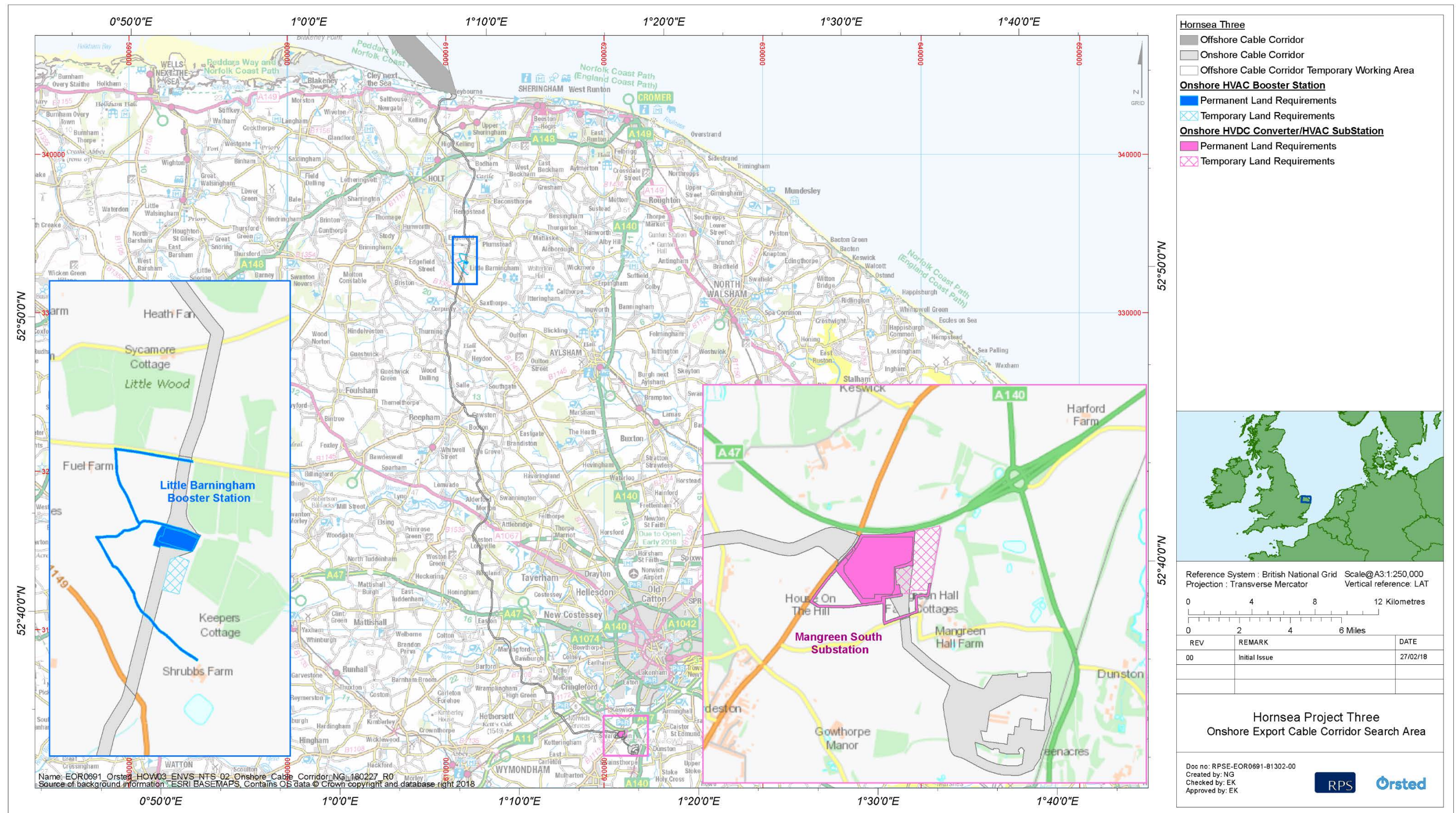


Figure 3.3: Hornsea Three onshore cable corridor and locations for the onshore HVAC booster station and onshore HVDC converter/HVAC substation.

3.7 Construction programme

3.7.1.1 Hornsea Three may be constructed in a single phase or in two phases. There are various possible reasons for this including, for example, constraints in the supply chain or the requirements of the government's Contract for Difference process which offshore wind farms currently rely on to secure a price for the electricity produced by a project. As such, there is the potential for an overlap or a gap between the completion of construction of one phase and the start of construction of another. The total durations for construction of each component will not exceed those stated in the Environmental Statement, however there may be periods where work stops as one phase is completed and is initiated again for the following phase after a gap. It is also possible that some activities may be carried out during an earlier phase for the benefit of the later one. However, any works completed for the later phase would be left in a safe state, as agreed with the relevant authorities, to await the appropriate phase for completion. Onshore construction is currently planned to commence in 2021.

Table 3.1: Maximum duration of construction activities if project is built in a single phase or two phases.

Project component	Maximum duration (single phase or two phases ^a)
Onshore HVDC converter/HVAC substation	36 months
Onshore HVAC booster station	24 months
Onshore export cables	30 months
Landfall	32 months
Offshore export cables	36 months
Offshore substations	Two months (per substation) – 38 months in total
Foundations	30 months
Array cables	30 months
Turbines	30 months
a	If a two phase construction occurs, there could be a gap of up to 36 months between an activity finishing in the first phase and starting in the second phase, for any of the project components listed above. The maximum duration of construction activity (not including the gap between phases) will not exceed those durations specified above for a single phase.

4. Site Selection and Consideration of Alternatives

4.1 Introduction

4.1.1.1 The site selection process for Hornsea Three was an iterative process, combining technical, commercial and consenting considerations alongside the feedback from stakeholder engagement undertaken throughout the consenting process. Volume 2, chapter 4: Site Selection and Consideration of Alternatives of the Environmental Statement describes in detail the relevant stages of this process and they can be summarised as follows:

- Stage 1 – Identification of the former Hornsea Zone;
- Stage 2 – Identification of the Hornsea Three array area within the former Hornsea Zone;
- Stage 3 – Identification of grid connection and strategic landfall assessment;
- Stage 4 – Identification and refinement of coastal landfall options;
- Stage 5 – Identification of project for Scoping, Statement of Community Consultation (SoCC) and Phase 1.A Consultation;
- Stage 6 – Refinement of project for Phase 1.B Community Consultation Events and EIA preparation;
- Stage 7 – Refinement for PEIR and Phase 2 Consultation;
- Stage 8 – Refinement of Hornsea Three from PEIR to Further Consultation; and
- Stage 9 – Submission of the final preferred option(s) as part of the DCO application.

4.1.1.2 The following text provides a summary of the stages in the site selection process and consideration of alternatives undertaken by Hornsea Three.

4.2 Stage 1: Identification of the former Hornsea Zone

4.2.1.1 The former Hornsea Zone within which Hornsea Three is located was identified as part of a UK wide process, led by the owners of the seabed (TCE) to identify a number of discrete areas in UK waters for the development of offshore wind required to meet the UK Government's commitments on climate change and renewable energy generation. The former Hornsea Zone was one of nine zones identified in 2009.

4.3 Stage 2: Identification of the Hornsea Three array within the former Hornsea Zone

4.3.1.1 A company named SMart Wind Ltd was awarded the rights to develop the former Hornsea Zone in 2009 and between this point and 2015 brought forward the first two projects (Hornsea Project One and Hornsea Project Two) within the former Hornsea Zone. A further two potential projects were identified within the former Hornsea Zone at this point in time.

4.3.1.2 In February 2015, Ørsted (formerly DONG Energy (UK) Ltd.) acquired SMart Wind and the development rights to the remainder of the former Hornsea Zone. In March 2016 the formal “Zones” identified by TCE were terminated and individual projects were brought forward on a case by case basis where Agreement for Leases (AFLs) could be agreed with TCE. At this point, Ørsted secured an AFL with TCE for one of the projects originally identified by SMart Wind within the former Hornsea Zone. This project was termed Hornsea Three.

4.4 Stage 3: Identification of grid connection and strategic landfall assessment

4.4.1.1 The connection of energy generating stations (such as offshore wind farm projects) to the national grid infrastructure is managed through a controlled process by National Grid Energy Transmission Limited. Hornsea Three worked with the National Grid to identify a potential connection point to the national grid. In July 2016 National Grid Energy Transmission Limited offered a connection option for Hornsea Three at Norwich Main Substation.

4.4.1.2 Subsequent to this, high level exploratory work was undertaken to assess potential landfall areas for Hornsea Three along the North Norfolk coastline. This process was informed by engineering and environmental constraints. A total of five landfall zones were identified for further consideration.

4.5 Stage 4: Identification and refinement of coastal landfall options

4.5.1.1 Stage 4 of the site selection process comprised the refinement of landfall options and the identification of broad onshore and offshore search areas within which potential cable corridors from the Hornsea Three array area to the grid connection at Norwich Main Substation would be located.

4.5.1.2 This process was primarily a desk based exercise informed through a consideration of technical, commercial and environmental constraints at the landfall zones and included initial landfall site visits across much of the North Norfolk coastline where feasible landfall was deemed possible. This desk based and field verified evaluation process was then used to consider the offshore and onshore environments between potential landfall zones and the Hornsea Three array area and grid connection point respectively.

4.5.1.3 This process resulted in a preferred landfall in the vicinity of Sheringham (Zone 2; between Salthouse and Cromer) being identified.

4.6 Stage 5: Identification of Hornsea Three boundaries for Scoping, Statement of Community Consultation (SoCC) and Phase 1.A Consultation

4.6.1.1 Subsequent to Stage 4, Hornsea Three established a preliminary set of “search areas” for each project component (offshore cable corridor, landfall and onshore cable corridor) for the purposes of consulting with a wide range of project stakeholders both formally and informally. These search areas comprised the Hornsea Three array area, an offshore cable corridor search area approximately 10 km in width from the array area to the landfall zone, a landfall zone north of Weybourne and an onshore cable corridor search area of approximately 5 km in width that extended south to the connection point at Norwich Main Substation. The boundary that was defined as a result of this process was consulted on through the Scoping Report, the SoCC and at a series of community consultation events.

4.6.1.2 The documents consulted on by Hornsea Three at this stage made clear that within the cable corridor search areas there would potentially be further infrastructure (beyond just export cables) required. These comprise a new onshore HVDC converter/HVAC substation located in proximity to the existing Norwich Main Substation, and in the event that HVAC transmission system is selected, then potentially both offshore and onshore facilities (termed HVAC booster stations), to provide reactive compensation to the cable and enable long distance HVAC transmission from the Hornsea Three array area to the substation.

4.7 Stage 6: Refinement of project for Phase 1.B consultation and EIA preparation

4.7.1.1 Stage 6 of the selection process comprised further refinement of the Hornsea Three cable corridor search area including:

- Identification of a refined 1.5 km wide offshore cable corridor search area;
- Identification of an offshore HVAC booster station search area;
- Identification of a refined landfall zone;
- Identification of a refined onshore cable corridor search area from 5 km to a 200 m wide corridor with a 100 m technical buffer either side of the corridor;
- Identification of three onshore HVAC booster station site options (and associated cable corridors); and
- Constraint heat mapping for the identification of two potential onshore HVDC converter/HVAC substation locations within a 3 km search area.

- 4.7.1.2 The selection process built on the preferred offshore and onshore cable corridors within the search areas identified in Stage 5. These cable corridors were refined in width from 10 km to 1.5 km for the refined offshore cable corridor search area, and from 5 km to 200 m plus a 100 m technical buffer either side for the refined onshore cable corridor search area. As part of this refinement process options were also identified for the potential onshore HVAC booster station and onshore HVDC converter/HVAC substation. Three locations were initially identified for the potential onshore HVAC booster station search area and consulted on extensively as part of the second round of community consultation events (Phase 1.B), with the preferred location identified by the community being taken forwards. In addition, the landfall area was also refined, taking into account a number of technical, commercial and consenting constraints, to a 1.2 km stretch of coastline near to Weybourne. Finally, an area was defined within the offshore export cable corridor as a potential offshore HVAC booster station search area.
- 4.7.1.3 These refinements were established from stakeholder feedback during consultation described in Stage 5, site investigation work, further engineering studies and results from early survey work undertaken as part of the EIA process. Effort was made to ensure the cable corridor search areas and sites selected sought to avoid or minimised overlap with key environmental and technical constraints.
- 4.7.1.4 Consultation was then undertaken on these refined cable corridor search areas and sites.

4.8 Stage 7: Refinement for PEIR and Phase 2 Consultation

- 4.8.1.1 During Stage 7 of the site selection process a number of refinements were made to Hornsea Three. This included refinement of the offshore cable corridor search area and landfall zone, refinement of the onshore cable corridor search area and onshore HVAC booster station sites, refinement of the onshore HVDC converter/HVAC substation and identification of potential main compound sites.
- 4.8.1.2 The further site selection work was informed through stakeholder engagement, landowner discussions and technical studies.

4.9 Stage 8: Refining Hornsea Three from PEIR to Further Consultation

- 4.9.1.1 Following publication of the PEIR, a number of modifications were made to Hornsea Three, as a result of design refinements and in response to Section 42 consultation responses. Some of these alterations required the proposed cable corridor to fall outside of the stage 7 (PEIR) cable corridor search areas so further consultations were therefore held. These addressed potential reroutes for sections of the offshore cable corridor, a single preferred onshore cable corridor search area of 200 m in width with alternative route cable corridors around design constraints or as a consequence of stage 7 feedback, refinements to the onshore HVDC converter/HVAC substation and onshore HVAC booster station sites, potential construction compounds, storage areas and access routes.

4.10 Stage 9: Identification of the application boundary

- 4.10.1.1 The final Hornsea Three offshore and onshore cable corridors, as presented within this Environmental Statement, is the result of multi-disciplinary workshops, discussions and decision making across the entire cable corridor, in order to balance a wide range of environmental, technical, economic and social effects, to drive and derive the final cable corridor choices. Decisions made by the multi-disciplinary team in response to consultee comments and feedback, detailed technical, commercial and environmental studies, have directly informed the preferred route alignment and selection of the HDD locations.
- 4.10.1.2 The optimum route for an onshore grid connection can be considered to be the shortest route from A to B from landfall to the main National Grid substation. The final route presented within this Environmental Statement is considered to effectively achieve this optimisation, within the environmental, technical and social constraints that have been identified along the Hornsea Three offshore and onshore cable route corridor.

5. Environmental Impact Assessment Methodology

5.1 Introduction

- 5.1.1.1 This section presents an outline of the EIA methodology that has been employed for Hornsea Three in the preparation of the Environmental Statement. The EIA for Hornsea Three describes the likely effects on the environment arising from the construction, operation and maintenance, and decommissioning of Hornsea Three. Where significant effects are predicted, it identifies mitigation to reduce the significance of these effects where that is practicable.
- 5.1.1.2 A Scoping Request, supported by a Scoping Report (DONG Energy, 2016b), for Hornsea Three was submitted to the Secretary of State in October 2016 (see section 2.3.2). Advice and information provided in the formal Scoping Opinion (PINS, 2016) and in the Section 42 responses following publication of the PEIR (see section 2.3.3 and 2.3.4 above), has informed the EIA undertaken for Hornsea Three. All of these documents can be downloaded from www.hornseaproject3.co.uk.

5.2 Structure of the EIA

- 5.2.1.1 This Environmental Statement contains separate chapters for the offshore and onshore aspects of the EIA. For the purposes of the EIA, 'offshore' generally refers to the receptors on the seaward side of Mean High Water Springs (MHWS) and 'onshore' refers to the receptors on the landward side of MHWS. Where particular onshore and offshore assessments in volume 2 and volume 3 of the Environmental Statement respectively overlap in the Hornsea Three intertidal area, the extent of the study area is defined. This is shown in Figure 5.1.

5.3 Maximum design scenario

- 5.3.1.1 The Hornsea Three EIA has employed a maximum design scenario approach, which reflects the design envelope approach (also often referred to as the "Rochdale Envelope" approach). This approach allows for a project to be assessed on the basis of maximum project design parameters in order to provide flexibility, while ensuring all potentially significant effects (positive or adverse) are assessed on this basis (see section 3 above and volume 1, chapter 3: Project Description of the Environmental Statement for details of the design envelope considered for Hornsea Three) within the EIA process and reported in the Environmental Statement. By employing the maximum design scenario approach, Hornsea Three retains flexibility in the design of the offshore wind farm and associated offshore and onshore infrastructure within certain maximum extents and ranges, all of which are fully assessed in the Environmental Statement.

- 5.3.1.2 This approach has been taken for the EIA because it is not possible to provide precise final design details of Hornsea Three, or the way it will be built, a number of years ahead of the time it will be constructed. The use of the maximum design scenario approach has been recognised in National Policy Statements (NPSs) such as NPS EN-1 (DECC, 2011b) and NPS EN-3 (DECC, 2011c). The NPSs acknowledge that not all of the precise details of the design of an NSIP may be settled at the time an application is made. This approach has been used in the majority of offshore wind farm EIAs and has been fully discussed and agreed with statutory bodies.

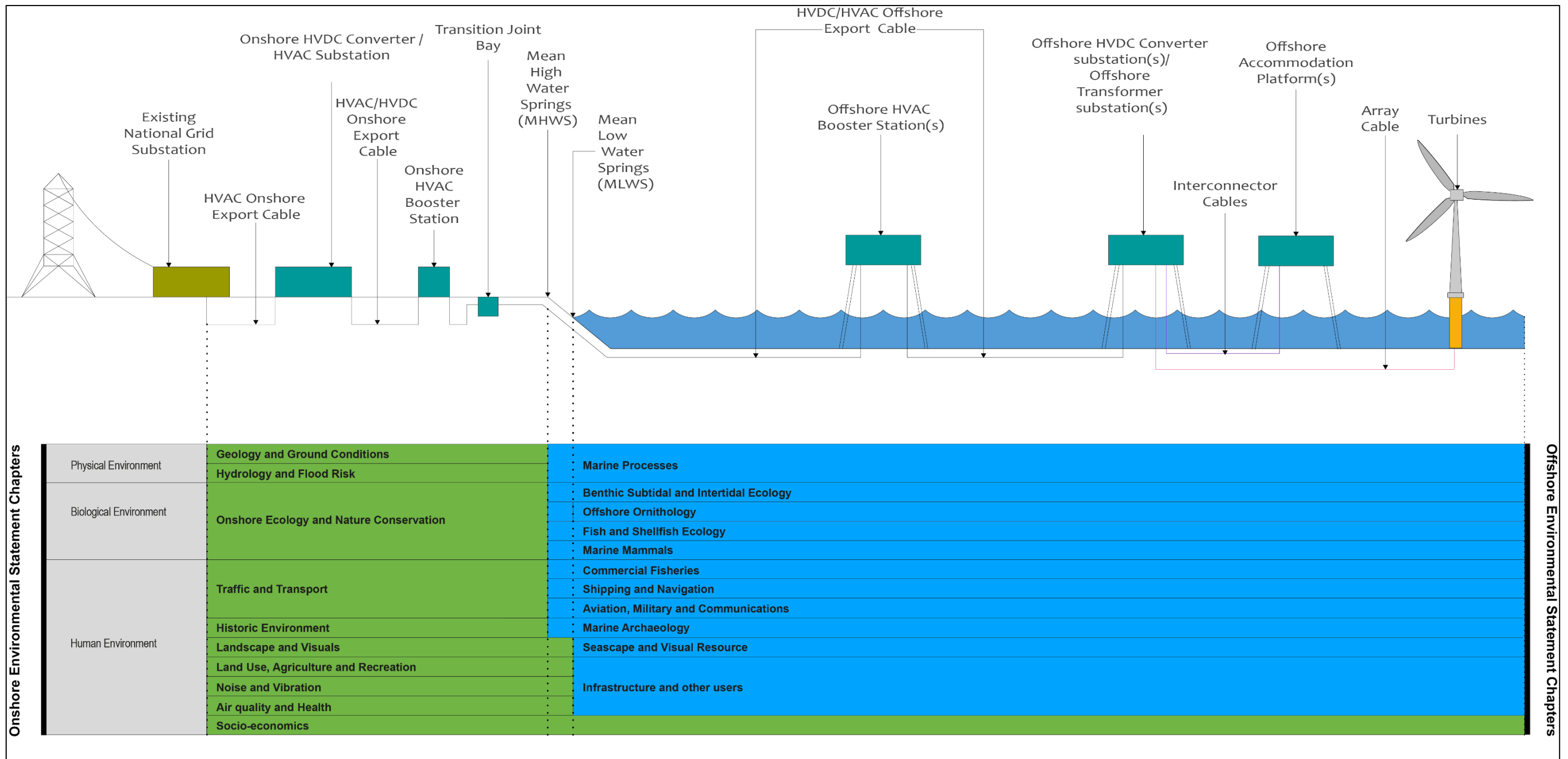


Figure 5.1: Extent of the offshore and onshore assessments.

5.4 Environmental baseline conditions

- 5.4.1.1 A systematic, evidence-based approach was utilised for the Hornsea Three EIA. An evidence based approach to EIA involves utilising existing data and information from sufficiently similar or analogous studies to inform baseline understanding and/or impact assessments for a new proposed development. In this way, the evidence based approach does not always require new data to be collected, or new modelling studies to be undertaken, in order to characterise the potential impact with sufficient confidence for the purposes of EIA.
- 5.4.1.2 Hornsea Three is located within the former Hornsea Zone, for which extensive data and knowledge regarding the baseline environment is already available. This data/knowledge has been acquired through zonal studies and from the surveys and characterisations undertaken for Hornsea Project One and Hornsea Project Two. There is also detailed existing technical work (including modelling and comprehensive assessments) available from Hornsea Project One, Hornsea Project Two and other publicly available desktop data sources (e.g. from other Environmental Statements) that provide a valuable source of evidence to inform the assessment of likely significant environmental effects associated with Hornsea Three. Hornsea Three has maximised, where possible, the use of these data and assessments, in order to:
- Characterise the baseline environment to inform the EIA where data is sufficient and appropriate to do so;
 - Scope out impacts where there is a clear evidence basis; and
 - Where impacts are scoped in, to draw upon the existing evidence base and previous impact assessment work where appropriate.
- 5.4.1.3 It is also important to maximise the use of this existing relevant data and assessments to the extent possible and appropriate to do so, in the context of the offshore wind industry positively responding to government drivers to reduce the cost of offshore wind.
- 5.4.1.4 In addition to the historical data that is already available, the EIA was also informed by a number of project-specific data collection surveys. Key offshore surveys undertaken include geophysical surveys of the Hornsea Three array area and offshore cable corridor to gather data on seabed conditions and sediments, marine ecological surveys to identify key seabed communities and aerial surveys of birds and marine mammals. Onshore surveys undertaken include ecological field surveys (e.g. bird, bat, badger, invertebrate and reptile), archaeological desktop and geophysical surveys, baseline noise surveys and landscape and visual assessments. All survey data gathered was utilised to inform the EIA presented in this Environmental Statement.

5.5 Measures adopted as part of Hornsea Three

- 5.5.1.1 The Hornsea Three assessment uses an iterative approach. This approach has been employed in order to demonstrate commitment to appropriate mitigation of project-related impacts. The process of EIA has therefore been used as a means of informing the Hornsea Three design.
- 5.5.1.2 The iterative approach to EIA employed in this Environmental Statement, as outlined in Figure 5.2, involves a feedback loop during the impact assessment process. A specific impact is initially assessed for its significance of effect, and if this is deemed to be significant adverse in EIA terms, changes are considered and then made (where practicable) to relevant project parameters to reduce the magnitude of that impact.

5.6 Assessment of effects

- 5.6.1.1 Data from project-specific surveys and studies is used to inform the impact assessment stage of the EIA so that site-specific issues are identified and addressed. The magnitude of each impact, defined by the spatial extent, duration, frequency and reversibility of the impact is then identified. The sensitivity of receptors (e.g. marine archaeology, onshore ecology etc.) is then determined, based on the vulnerability, recoverability and value/importance of each receptor. The overall significance of effect is then determined by consideration of the magnitude of impact alongside the sensitivity of receptor using a matrix approach. The definitions for each of the significance levels are shown in Table 5.1. Where a differing methodology is required in a specific topic assessment, the methodology has been explained within the Environmental Statement chapter.
- 5.6.1.2 The Environmental Statement sets out the aspects of the environment likely to be significantly affected by Hornsea Three (as required by the EIA Directive). Only effects, in general, judged to be of **moderate** significance or greater are considered 'significant' in EIA terms (where this differs for specific assessments, this is explained within the appropriate Environmental Statement chapters). Where effects are considered significant in EIA terms, this will normally trigger additional analysis, consultation and possibly further mitigation measures, where practicable. When the determining authority (in this case, the Secretary of State) makes a decision for consent, it therefore, does so in the knowledge of all likely significant effects on the environment.

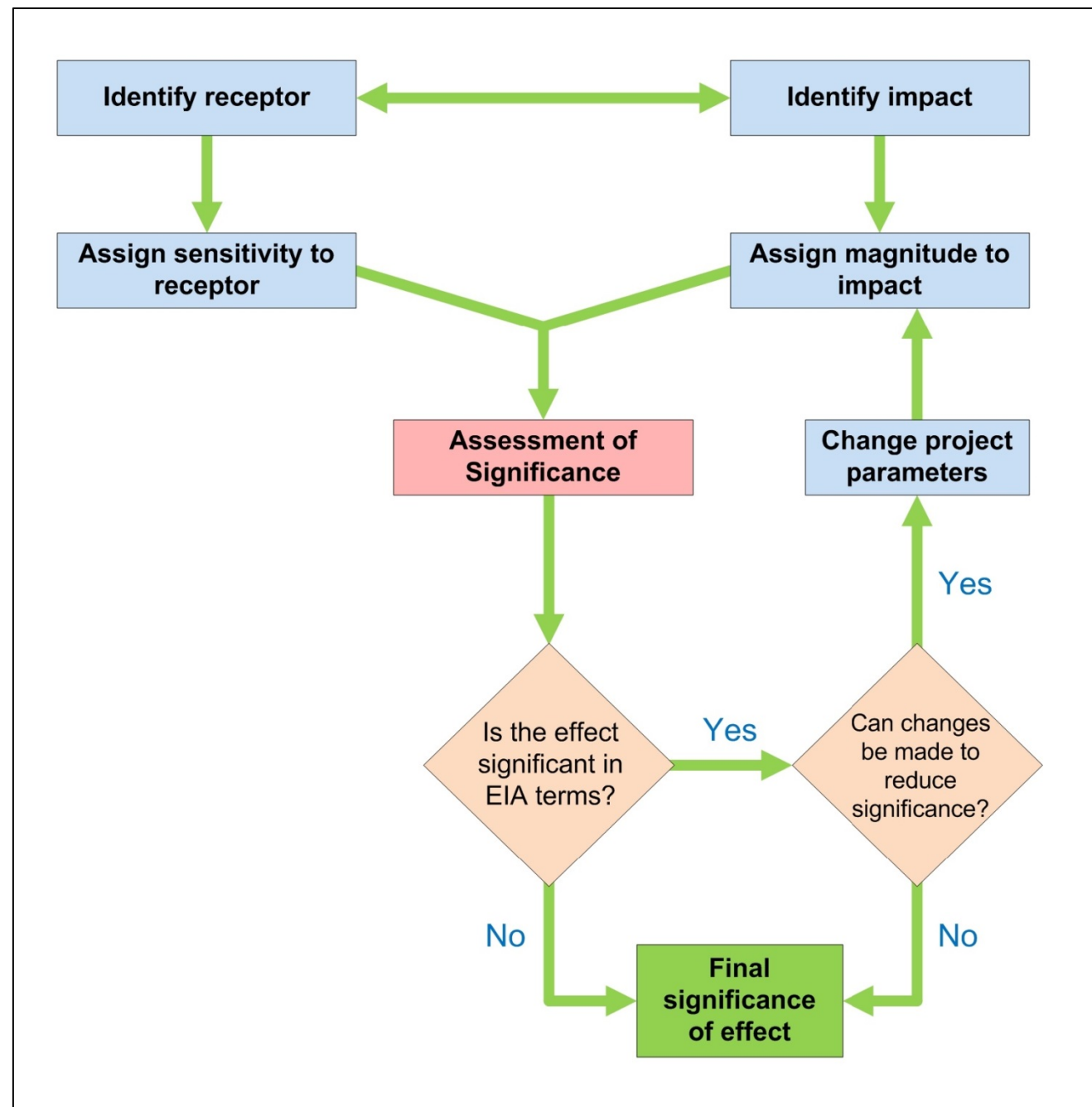


Figure 5.2: Interactive approach to mitigation within the Hornsea Three EIA.

Table 5.1: Definition of significance levels.

Term	Definition
Negligible	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.
Minor	These beneficial or adverse effects are generally, but not exclusively, raised as local factors. They are unlikely to be critical in the decision making process, but are important in enhancing the subsequent design of the project.
Moderate	These beneficial or adverse effects have the potential to be important and may influence the decision-making process. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse or beneficial effect on a particular resource or receptor.
Major	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
Substantial	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category. Effects upon human receptors may also be attributed this level of significance.

5.6.1.3 The EIA also included a full consideration of potential cumulative, transboundary and inter-related effects:

- Cumulative impacts: The potential for Hornsea Three to interact with other projects, plans and activities both within parts of Norfolk (including planned developments) and in the southern North Sea (including other offshore wind farm projects) was assessed and the significance of any effects identified;
- Transboundary impacts: The potential for Hornsea Three to affect the environment of another EEA state was assessed. The significance of transboundary impacts were defined using the matrix approach outlined above in paragraph 5.6.1.1; and
- Inter-related effects: Consideration of the inter-relationships between topics that may lead to environmental effects was considered. The significance of inter-related effects was not assessed, instead the EIA considered the potential for inter-related effects to increase as a result of Hornsea Three.

5.7 Additional mitigation measures

5.7.1.1 In certain cases, additional mitigation measures have been outlined within the topic chapters. This includes mitigation measures where:

- An issue is significant in EIA terms, when already including designed in mitigation measures; and there are additional mitigation measures that could further reduce the level of effect.
- Mitigation has been proposed but has not yet been confirmed as feasible or deliverable (i.e. awaiting sign-off from regulators, stakeholders etc.) as agreed mitigation, or is as yet unproven (i.e. the mitigation is not yet proven to be effective at reducing the residual significance of effect).

5.8 Environmental Statement

5.8.1.1 The EIA for Hornsea Three is presented within the Environmental Statement, of which this NTS forms a part. The Hornsea Three Environmental Statement includes a description of Hornsea Three, the main alternatives studied by the applicant and an indication of the main reasons for site selection. Each topic chapter of the Environmental Statement includes:

- A review of the existing environmental baseline established from desk studies, site specific survey(s) (if/as required) and consultation;
- Identifies the potential environmental effects arising from Hornsea Three, based on the information gathered and the analysis and assessments undertaken;
- Identifies any assumptions and limitations encountered in compiling the environmental information; and
- Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process. Where additional mitigation measures have been identified, the residual significance of effect has also been identified.

6. Potential Environmental Impacts (Offshore)

6.1 Introduction

6.1.1.1 The EIA process has assessed the potential for the construction, operation and maintenance, and decommissioning of Hornsea Three to create impacts upon the offshore environment, as characterised by the review and analysis of site-specific data collected from the surveys outlined above, peer reviewed papers, desk based studies and modelling of specific parameters. This section provides a non-technical summary of the offshore assessments undertaken to date for Hornsea Three. Further information on the assessments undertaken to date can be found in each of the topic chapters in volume 2 of the Environmental Statement.

6.2 Marine processes

6.2.1.1 Marine processes is a collective term for the following:

- Water levels;
- Currents;
- Waves (and winds);
- Water column stratification and frontal systems;
- Sediments and geology: (including seabed sediment distribution and sediment transport);
- Seabed geomorphology; and
- Landfall geology and geomorphology.

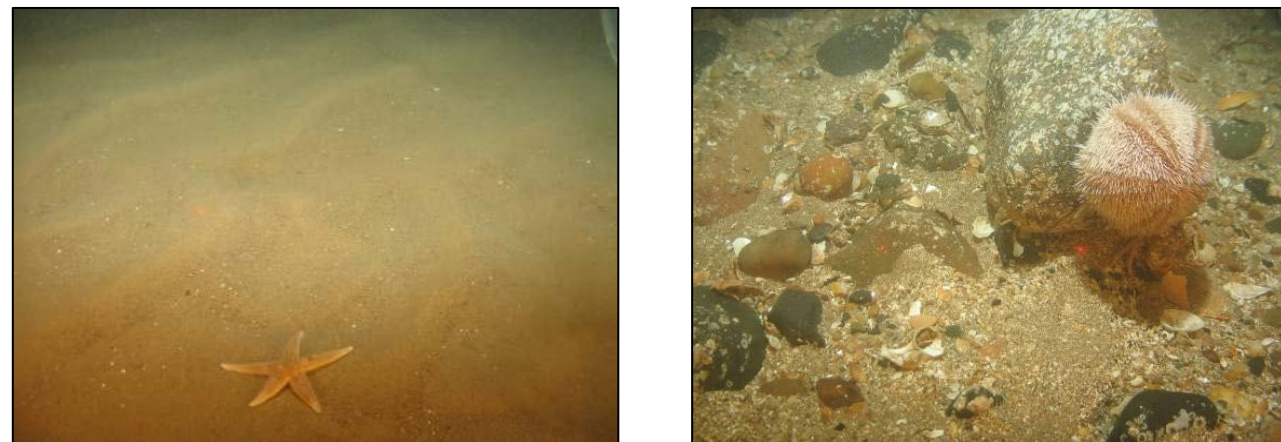
6.2.1.2 Baseline characterisation of the above parameters across the Hornsea Three array area and along the Hornsea Three offshore cable corridor has been undertaken using outputs from project-specific surveys, surveys from the former Hornsea Zone and Hornsea Project One and Hornsea Project Two, as well as existing publicly available data and reports (including from the BGS, UKHO and BODC).

6.2.1.3 The Hornsea Three array area is situated in an area with a mean spring tidal range of between 2 and 2.5 m. The tidal range increases with proximity to the Norfolk and Lincolnshire coast, such that at the Hornsea Three landfall area, the mean spring tidal range is approximately 5.0 m. Tidal currents across the Hornsea Three array area and offshore sections of the Hornsea Three offshore cable corridor generally increase in strength towards the coast. The dominant wave direction within the Hornsea Three array area is from the northwest to north, although there is also a large contribution of waves from southerly sectors.

- 6.2.1.4 Within the Hornsea Three array area, water depths vary from approximately -26.6 mLAT to -72.7 mLAT. The shallowest depths are found in the central eastern parts of the site. Deeper areas are also present within the Hornsea Three array area with depths of up to approximately -60 mLAT along the northern boundary (associated with Outer Silver Pit) and depths of up to approximately -73 mLAT in central areas (associated with Markham's Hole). The water depth of the Hornsea Three offshore cable corridor is typically less than -30 mLAT.
- 6.2.1.5 The majority of the Hornsea Three array area and offshore cable corridor is characterised by the presence of coarse grained sediments of variable thickness. In many areas, coarse grained sediments are either present as a thin layer (<1 m thick) or absent, although where sandwaves are present, may be up to 6 m thick. Finer grained muddy material is present in places although the fines component of the collected sediment samples very rarely exceeds 50%. Active tidal bedforms are present in many areas and include sandwaves, mega ripples and sand ribbons.
- 6.2.1.6 Physical changes to the shoreline, offshore sandbanks and the Flamborough Front arising from modification of the hydrodynamic, wave and/or sediment transport regime were considered during the operation and maintenance phase of Hornsea Three. All assessments result in effects of either **minor adverse** or **negligible** significance during the operation and maintenance phase (not significant in EIA terms).
- 6.2.1.7 Sandwaves are present in several locations along the Hornsea Three offshore cable corridor and are often associated (moving) with the sandbanks of the North Norfolk Sandbanks and Saturn Reef Special Area of Conservation (SAC). These sandwaves may require partial removal via dredging or jetting to enable cable installation into the upper few metres of the sandbank. Although dredging/jetting will cause a localised disturbance of the sandwave, the patterns of processes governing the overall evolution of the wider sandwave system (the flow regime, water depths, sediment availability and sandbank evolution) are at a much larger scale, and so would not be affected by, the proposed works. As such, effects on sandwaves are predicted to be of **minor adverse** significance (not significant in EIA terms).
- 6.2.1.8 Parts of the Norfolk and Lincolnshire coast are potentially sensitive to modification of the wave regime, through resulting changes to the rate and direction of sediment transport. An assessment of the extent to which waves could be modified by the presence of turbine and substation foundations was undertaken using the existing modelling evidence from Hornsea Project One and Hornsea Project Two, together with a quantitative rule-based model. The rule-based model setup and results were also validated against the results from a new spectral wave model. It was found that any changes to the wave regime at the coast would be very small and as such, the potential for change to the form and structure of the shoreline would be extremely limited. Accordingly, effects on the shoreline are predicted to be of **negligible** significance (not significant in EIA terms).
- 6.2.1.9 The North Norfolk Sandbanks are considered to have high sensitivity to physical loss via obstruction to the wave and tidal regime, caused by the presence of structures (such as turbines). However, the majority of the North Norfolk sandbanks (as well as other sandbanks within the Hornsea Three marine processes study area) are dynamic and mobile, and therefore considered to have moderate levels of recoverability enabling them to return to a state close to that which existed before any impact. Accordingly, effects on the sandbanks are predicted to be of **minor adverse** significance (not significant in EIA terms).
- 6.2.1.10 The potential for cumulative effects of Hornsea Three with aggregate extraction operations (resulting in elevated levels of SSC) and offshore wind farms (resulting in enhanced blockage of waves) has been considered. Whilst there are a number of planned, consented and operational offshore wind farms within the Hornsea Three marine processes study area, the potential for cumulative changes to the wave regime are found to be limited. Accordingly, any effect on the shoreline, offshore sandbanks and the Flamborough will be of **negligible** or **minor adverse** significance.
- 6.2.1.11 No transboundary effects with regard to marine processes from Hornsea Three on the interests of other European Economic Area (EEA) States were predicted.

6.3 Benthic ecology

- 6.3.1.1 Benthic ecology refers to the communities of animals and plants which live on or in the seabed and the relationships that they have with each other and with the physical environment. The subtidal and intertidal benthic ecology of Hornsea Three was characterised via a detailed desktop study and data from a series of historic and site-specific surveys comprising grab sampling, underwater video surveys and fish trawls.
- 6.3.1.2 These surveys indicated that the seabed within Hornsea Three supports a variety of plant and animal communities that are typical of this part of the southern North Sea. Key habitats recorded included shallow coarse and mixed sediments supporting a range of species such as worms and amphipods, as well as deeper, fine sand, coarse and mixed sediment habitats characterised by marine worms, amphipods and bivalves. Overlying these sediment based communities were plant and animal assemblages comprised of larger, more mobile species, such as brown shrimp, hermit crab, common starfish, edible sea urchin and brittlestars (Figure 6.1). The intertidal area comprises a barren shingle beach dominated by barren pebbles and cobbles.



(a) (b)
Figure 6.1: Species recorded during the underwater video surveys of the Hornsea Three array area and offshore cable corridor included (a) common starfish and (b) edible sea urchin.

- 6.3.1.3 A number of potential impacts on benthic subtidal communities/species, associated with the construction, operation and maintenance, and decommissioning of Hornsea Three in isolation, were identified. During the construction phase, these included temporary habitat loss/disturbance and increased suspended sediment concentrations and deposition. With the proposed designed-in measures in place (i.e. the implementation of appropriate measures to avoid direct impacts to reef features, where possible and the implementation of a Project Environment Management and Monitoring Plan (PEMMP)), all potential impacts during construction, including impacts to benthic features of designated sites (i.e. North Norfolk Sandbanks and Saturn Reef SAC, The Wash and North Norfolk Coast SAC, Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ) and Markham's Triangle recommended MCZ), will result in effects of **negligible** or **minor adverse** significance (not significant in EIA terms).
- 6.3.1.4 The operation of Hornsea Three may affect benthic subtidal ecology through the presence of infrastructure resulting in long term habitat loss, an increase in habitat for colonisation (including the potential for the introduction of invasive non-native species (INNS)) and alterations to physical processes. Maintenance activities may also affect benthic ecology through the removal or disturbance of sediments resulting in temporary habitat disturbance. With the proposed mitigation measures in place (i.e. a PEMMP implemented, development of a Biosecurity Plan and the use of sensitive cable and scour protection within designated sites that will consider the local seabed conditions), the impacts on benthic receptors and designated features of nature conservation sites have also been assessed to be of **negligible** or **minor adverse** significance (not significant in EIA terms).
- 6.3.1.5 Decommissioning activities are predicted to have effects of **negligible** or **minor adverse** significance (not significant in EIA terms) on benthic subtidal ecology.

- 6.3.1.6 Cumulative impacts upon benthic ecology from the construction, operation and decommissioning phases of Hornsea Three have been considered together with the construction and operation of other planned nearby wind farm projects, planned oil and gas operations, cables and pipelines, aggregate extraction activities (licensed and application) and coastal defence projects within a 50 km buffer of Hornsea Three. Overall, the cumulative effects on benthic receptors and designated features of nature conservation sites will be of **minor adverse** significance (not significant in EIA terms).
- 6.3.1.7 Transboundary effects, with regard to benthic ecology, on the interests of other EEA States from Hornsea Three were also investigated. The only transboundary impact that may result for Hornsea Three is increased SSC that may reach Klaverbank Site of Community Importance (SCI). Overall, the effect on features of the Klaverbank SCI will be of **negligible** significance. As such, any transboundary effects on Klaverbank SCI are predicted to be not significant.

6.4 Fish and shellfish ecology

- 6.4.1.1 The fish and shellfish ecology assessment focusses on the fish and shellfish communities within the Hornsea Three site and surrounding area. These include fish and shellfish populations which are important to commercial fisheries in the area (although the effects on those fisheries themselves have been assessed in the Commercial Fisheries assessment (see section 6.7 below)), species which are protected under national and international conservation legislation and those species which provide an important ecological function to the marine ecosystem (e.g. as food for birds, marine mammals and larger fish species). The fish and shellfish ecology of the Hornsea Three site was characterised via a detailed desktop study and pre-existing data from surveys across the former Hornsea Zone, including beam trawl and otter trawl surveys.
- 6.4.1.2 The baseline characterisation indicated that the fish and shellfish communities recorded within Hornsea Three are typical of the southern North Sea. Some of the key species reported in abundance in the offshore parts of Hornsea Three included whiting (Figure 6.2(a)), sprat, dab, plaice, gurnard and solenette. Within the inshore section of the offshore cable corridor, many of these fish species also occur, with crab (Figure 6.2(b)) and lobster populations also known to be important, with local fisheries targeting these species.
- 6.4.1.3 Spawning and nursery habitats were identified for a range of species including plaice, lemon sole, dab, common sole, cod, whiting, sandeel, sprat, brown crab and *Nephrops*. Migratory fish species, including sea and river lamprey, Atlantic salmon, sea trout, allis and twaite shad, European smelt and European eel, have the potential to occur in the Hornsea Three site. Many of these species are protected under the Habitats Regulations with some of these listed as features of Special Areas of Conservation (SACs) in both the UK and continental Europe, including sea and river lamprey which are listed as features of the Humber Estuary SAC.

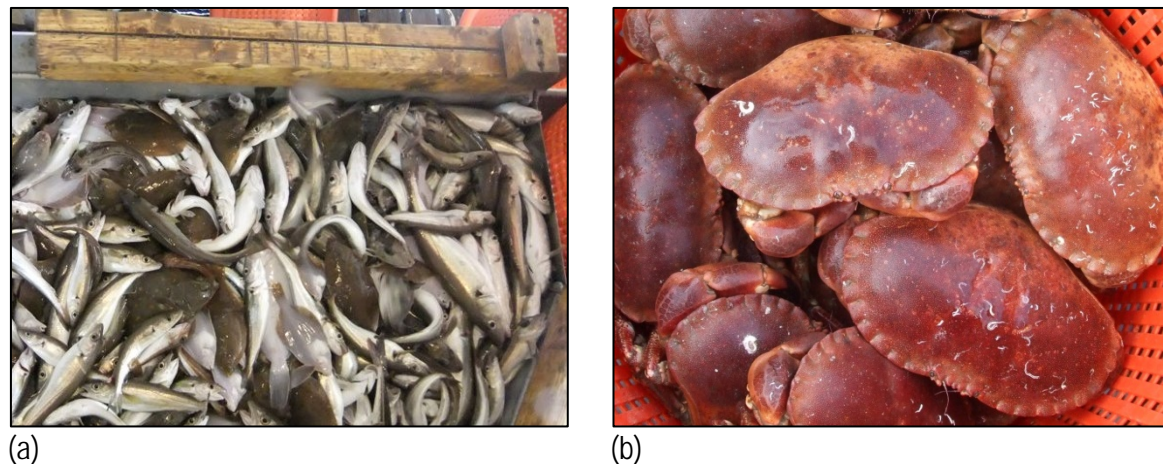


Figure 6.2: Fish and shellfish recorded in the vicinity of Hornsea Three including (a) whiting and flatfish recorded during trawl surveys and (b) brown crab known to occur in the inshore sections of the Hornsea Three offshore cable corridor.

- 6.4.1.4 A number of potential impacts on fish and shellfish communities, associated with the construction, operation and maintenance, and decommissioning phases of Hornsea Three were identified. These included underwater noise, increased suspended sediment concentrations and associated sediment deposition, temporary habitat disturbance, long term habitat loss, electromagnetic field emissions from subsea cables, introduction of new habitat and potential for reduced fishing pressure during operation. With the proposed mitigation measures (i.e. a PEMMP implemented, cables to be buried and a soft start during piling operations) in place, the majority of these impacts result in effects of either **negligible, minor adverse** or **minor beneficial** significance (not significant in EIA terms).
- 6.4.1.5 Temporary and long term habitat loss/disturbance from Hornsea Three was predicted to be of **minor adverse** significance (not significant in EIA terms) to fish and shellfish receptors, as the proportion of habitat lost/disturbed was predicted to be small in the context of available habitats in the southern North Sea.
- 6.4.1.6 Underwater noise from construction activities such as pile driving was not predicted to overlap with key fish spawning habitats within the southern North Sea fish and shellfish study area. Noise disturbance effects on fish communities, as a result of piling to install foundations, were predicted to be of **minor adverse** significance (not significant in EIA terms). In addition, there was no potential for noise during the construction of Hornsea Three to lead to barrier effects on migratory fish species when transiting to/from spawning grounds in estuarine environments or SACs along the coasts of the UK or continental Europe.
- 6.4.1.7 Effects associated with electromagnetic field emissions from subsea cables during the operation and maintenance phase were predicted to be of **minor adverse** significance (not significant in EIA terms), due to the highly localised spatial extent of any potential effects on sensitive species. Electromagnetic field emissions were also not anticipated to act as barriers to migratory fish species.

6.4.1.8 The assessment of cumulative impacts from Hornsea Three and other developments and activities, including offshore wind farms and aggregate extraction, concluded that the effects of any cumulative impacts would generally be of **minor adverse** significance, and not significant in EIA terms. Habitat loss was predicted to affect a relatively small proportion of the habitats in the southern North Sea fish and shellfish study area, with effects predicted to be spatially and temporally limited at any one time, meaning that other habitats within the southern North Sea fish and shellfish study area would remain undisturbed. The cumulative effects of underwater noise and EMF were also considered with regard to construction and operational phases of other offshore wind farms. These impacts may result in temporary displacement of fish populations however these were not predicted to have any significant effects on fish and shellfish populations and no potential for barrier effects to migratory fish species.

6.4.1.9 Transboundary effects, with regard to fish and shellfish ecology, on the interests of other EEA States from Hornsea Three were also investigated. Potential exists for transboundary effects only for Annex II migratory species as a result of direct habitat loss or disturbance to fish and shellfish habitat and underwater noise. These effects have been assessed to be of **minor adverse** significance (not significant in EIA terms) with Hornsea Three construction or operation not predicted to represent a barrier to migration to/from estuaries along the coast of continental Europe (some of which are designated as SACs). In addition there is potential for effects on fish species which are targeted by fishing fleets from other EEA states, although the predicted **minor adverse** significance (not significant in EIA terms) will not lead to significant effects on these populations.

6.5 Marine mammals

- 6.5.1.1 The marine mammal assessment considers the effects of Hornsea Three on cetaceans (i.e. whales, dolphins and porpoises) and pinnipeds (i.e. seals). The baseline, in terms of the distribution, abundance and density of marine mammals in the Hornsea Three marine mammal study area, was informed by the use of existing site-specific boat-based survey data gathered across the former Hornsea Zone plus a 10 km buffer, together with the use of aerial survey data collected across the Hornsea Three array area plus a 4 km buffer, and a desktop review of published marine mammal data.
- 6.5.1.2 The results of the baseline identified that Hornsea Three lies within an area frequently used by some species of marine mammal, in particular harbour porpoise and harbour seal. During surveys, harbour porpoise (Figure 6.3a) were the most frequently occurring species of marine mammal within the Hornsea Three marine mammal study area, with minke whale (Figure 6.3b), white-beaked dolphin, grey seal (Figure 6.3c) and harbour (common) seal also being recorded throughout the survey area.

- 6.5.1.3 The above species are protected under the 'Habitats Regulations'¹ with some listed as features of SACs or SCIs in both the UK or other European member states' territorial waters. These include grey seal which is listed as a qualifying interest feature of the Humber Estuary SAC, and harbour seal which is a primary reason for designation of The Wash and North Norfolk SAC. Harbour porpoise is listed as a qualifying interest feature of a number of SACs/SCIs of other EU states, as well as of the Southern North Sea candidate SAC (cSAC) which lies in close proximity to the Hornsea Three array area and overlaps with the Hornsea Three offshore cable corridor (Figure 6.4).
- 6.5.1.4 A number of potential impacts on marine mammals associated with the construction, operation and maintenance and decommissioning phases of Hornsea Three were identified. Underwater noise from piling activities, increased suspended sediments, changes to prey (fish) resources, accidental release of contaminants, increased vessel traffic and electric and magnetic effects from subsea cables were assessed. With the proposed Marine Mammal Mitigation Protocol (MMMP) in place, these impacts were predicted to result in effects of either **negligible** or **minor adverse** significance (not significant in EIA terms).
- 6.5.1.5 Cumulative impacts from other offshore wind farm developments, aggregate extraction activities, disposal areas, cables and pipelines and coastal developments in conjunction with Hornsea Three were also assessed. These were mainly predicted to result in effects of **minor adverse** significance (not significant in EIA terms) on marine mammal receptors. The cumulative effects of underwater noise from piling on harbour porpoise was assessed to be of **moderate adverse** significance in the short term (during the period when foundation installation is proposed), with this expected to decrease to a **minor adverse** in the long term (following completion of construction onwards).
- 6.5.1.6 The screening of transboundary impacts identified that there was potential for transboundary effects on marine mammals from Hornsea Three upon the interests of other EEA states, including direct impacts due to underwater noise from piling operations and indirect impacts from changes to prey availability. For all impacts except disturbance to harbour porpoise cumulatively, these impacts were not predicted to have significant effects on marine mammal populations of other EEA states. Cumulative disturbance to harbour porpoise was assessed as of **moderate adverse** significance in the short term (during the period when foundation installation is proposed), with this decreasing to **minor adverse** in the long term (following completion of construction onwards).



Picture source: <http://commons.wikimedia.org> Attribution Sebastiaan Koreman.

Figure 6.3: (a) Harbour porpoise, (b) Minke whale and (c) Grey seal seen during Hornsea Three marine mammal surveys.

¹ Habitats Regulations refer to 'the Conservation of Habitats and Species Regulations 2017' (consolidates and updates the Conservation of Habitats and Species Regulations 2010) and 'the Conservation of Offshore Marine Habitats and Species Regulations 2017' (which consolidates and updates the Offshore Marine Conservation (Natural Habitats, & c.) Regulations 2007).

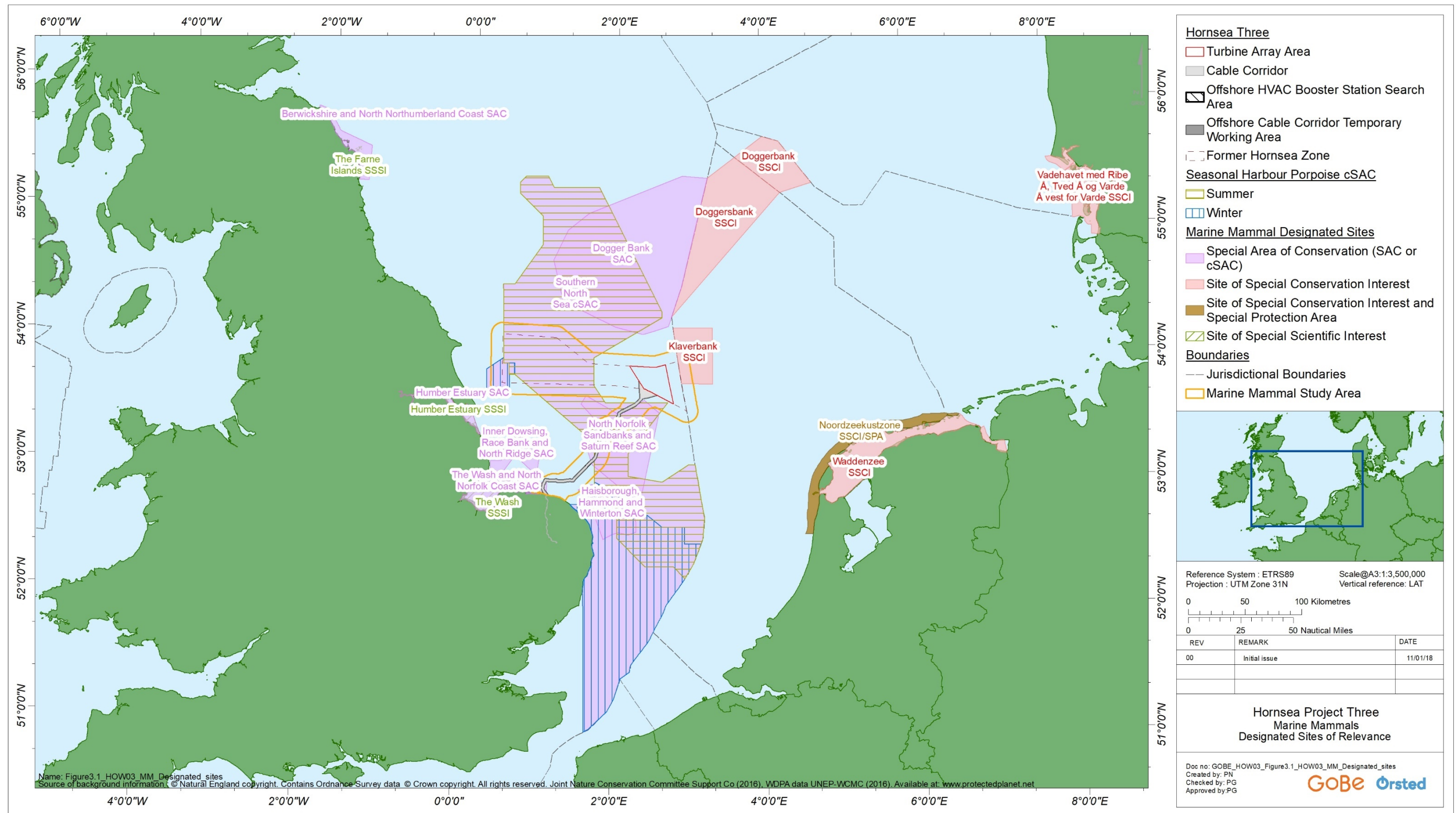


Figure 6.4: Designated sites with marine mammals as notified interest features within proximity to Hornsea Three.

6.6 Offshore ornithology

- 6.6.1.1 The offshore ornithology (bird) chapter describes the abundance, spatial and temporal distribution, and behaviour of the bird assemblage present within the Hornsea Three ornithology study area. The study area encompasses both the Hornsea Three array area and offshore cable corridor that is seaward of MHWS. The offshore ornithology chapter presents a description of the environmental baseline from desk studies and dedicated offshore surveys considered within the wider context of the North Sea.
- 6.6.1.2 Results from the site-specific aerial surveys and desk-based research indicate that the bird assemblage present is typical of that in the offshore environment of the central North Sea. A total of 17 seabird species were recorded in the survey area during the period April 2016 to November 2017. 'True' seabird groups such as gannet, small and large gulls and auk species were the most abundant. Also present are some species which spend part of their annual life cycle at sea (e.g. divers). Guillemot was the most frequently encountered species. Kittiwake and razorbill were respectively the second and third most abundant species.
- 6.6.1.3 The abundances of the most frequently recorded species tended to peak during summer and early winter (November/December). The summer peak may pertain to breeding adult or immature birds associated with the Flamborough and Filey Coast proposed Special Protection Area (pSPA) at 149 km distant, including gannet and fulmar. There was clear evidence for migratory movements through Hornsea Three occurring in both spring and autumn.
- 6.6.1.4 A number of potential impacts on the offshore ornithological assemblage, associated with the construction, operation and maintenance, and decommissioning of Hornsea Three were identified. These included disturbance-displacement impacts, habitat loss, collision mortality, barrier effects, and indirect effects associated with impacts on prey items. With the proposed mitigation measures in place, the identified impacts for Hornsea Three alone will have no more than a **minor adverse** significance (not significant in EIA terms).
- 6.6.1.5 The impact of barrier effects from the physical presence of turbines during the operation and maintenance phase preventing clear passage to birds on migration is considered to be of **negligible** or **minor adverse** significance (not significant in EIA terms) for all receptors. All species are considered to be of low vulnerability to barrier effects with respect specifically to the Hornsea Three array area, and Hornsea Three is likely to be transited at most on two occasions per year by the vast majority of birds from any population.
- 6.6.1.6 Mortality due to potential collision with operational turbines was estimated for each species, using standard offshore collision risk modelling as well as a migratory collision model for potentially under-recorded migratory species. The level of mortality is species-specific and is a reflection of abundance, flight behaviour and biological characteristics. Overall its predicted an effect of **negligible** or **minor adverse** significance (not significant in EIA terms) for all receptors.
- 6.6.1.7 Operational displacement effects to seabird species caused mainly by the presence of turbines are species-specific, with gulls in particular likely remaining unaffected. Evidence suggests that auks may be more susceptible to operational displacement effects. A range of mortality rates and displacement rates were used to consider receptor sensitivity to displacement. A range of population sizes were used to consider the magnitude of impact during different seasons (breeding, post-breeding, non-breeding and post breeding as most applicable to species). During the breeding season and non-breeding period, the significance of effect for fulmar, gannet and razorbill was considered to be **negligible** or **minor adverse** (not significant in EIA terms). Based on the defined population sizes over different seasons, the significance of effect to puffin and guillemot is predicted to be **minor adverse** (not significant in EIA terms).
- 6.6.1.8 Cumulative impacts from other offshore wind farm developments were assessed along the east coast of the UK, as well as non-UK projects in the North Sea. The main cumulative impacts identified for offshore ornithology were operational displacement and collision mortality. A seasonal approach considered impacts on the receptor populations during relevant biological seasons, based on presented values from Hornsea Three and other offshore projects' Environmental Statements. At a cumulative level when considering other projects and activities, several effects of **moderate adverse** significance (significant in EIA terms) are predicted. These include cumulative displacement impacts on guillemot and cumulative collision risk impacts on gannet and great black-backed gull. It is however considered that these predictions involve considerable precaution including the use of precautionary analysis parameters, maximum adverse scenario assumptions on regional breeding populations and the use of impacts for projects considered cumulatively calculated for consented scenarios which represent an impact of larger magnitude when compared to as-built scenarios.
- 6.6.1.9 Transboundary impacts of Hornsea Three on offshore ornithological receptors were considered based on the potential connectivity with continental Special Protection Areas (SPAs) or other important bird areas such as Dogger Bank and Brown Ridge in the breeding and non-breeding seasons for the following species: fulmar, gannet, kittiwake, great black-backed gull, puffin, razorbill and guillemot. No important sites were considered to be within regular foraging range of Hornsea Three during the breeding season, and although some degree of connectivity may exist during winter months, when seabird species are wider ranging, no significant impacts are predicted on any site, with any associated impacts being short-term. A significance of no more than **minor adverse** (not significant in EIA terms) is predicted across all species of assessment. No transboundary impacts with regard to offshore ornithology from Hornsea Three on the interests of other EEA States were therefore predicted.

6.7 Commercial fisheries

6.7.1.1 Commercial fishing is defined as any form of fishing activity legally undertaken for taxable profit. The activity of UK and non-UK commercial fishing fleets operating across the Hornsea Three array area and offshore cable corridor, and also the regional commercial fisheries study area was characterised via analysis of landing statistics and mapping of fishing grounds, including vessel monitoring system data, aerial surveillance, vessel plotter data and consultation with the industry. The regional commercial fisheries study area was defined as the area encompassing the following International Council for the Exploration of the Sea (ICES) rectangles: 37F0 to F3, 36F0 to F3, 35F0 to F3 and 34F0 to F3.

6.7.1.2 The key fleets operating across the Hornsea Three array area and offshore cable corridor include (in no particular order) include:

- UK potters targeting brown crab, lobster and whelk (vessels typically 10 to 12 m and under in length), operating across the Hornsea Three offshore cable corridor;
- UK (Dutch owned), Dutch and Belgian beam trawlers targeting sole and plaice, and/or Norway lobster *Nephrops* and mixed demersal species (vessels >25 m in length), operating across the Hornsea Three array area;
- UK demersal otter trawlers targeting *Nephrops* and mixed demersal species (vessels 12 m in length), operating within the Hornsea Three array area;
- Dutch and Belgian fly shooting vessels targeting sole, plaice, *Nephrops* and mixed demersal species (vessels >25 m in length), operating across the regional commercial fisheries study area;
- Danish demersal trawlers targeting sandeel (vessels >25 m in length), including specific fishing grounds within the Hornsea Three array area; and
- French, Danish and Norwegian pelagic trawlers targeting mackerel (vessels 15 to 25 m in length), operating across the regional commercial fisheries study area (but not regularly in the Hornsea Three array area), targeting highly mobile species that consistently move/shoal throughout the wider southern North Sea.

6.7.1.3 A number of potential impacts on commercial fisheries, associated with the construction, operation and maintenance, and decommissioning of Hornsea Three were identified. These included reduction in access to or exclusion from fishing grounds, displacement leading to gear conflict and increased fishing pressure elsewhere, displacement or disruption of commercially important fish and shellfish resources, additional steaming to alternative fishing grounds, increased vessel traffic leading to interference with fishing activity and gear snagging. With the proposed mitigation measures in place (advance warning and accurate location details of construction operations and associated Safety Zones, advisory safety distances and on-going liaison with all fishing fleets), the majority of these impacts result in effects of **minor adverse** significance (not significant in EIA terms). However effects of **moderate adverse** (significant in EIA terms) significance were identified during the construction and decommissioning phases of the Hornsea Three offshore cable corridor for UK potting vessels targeting brown crab, lobster and whelk due to a reduction in access to fishing grounds and displacement leading to gear conflict. An additional measure to offset the effect on UK potting vessels, which operate across distinct areas of ground, will be that any disturbance payment will be in accordance with the procedures as outlined in the Fishing Liaison with Offshore Wind and Wet Renewables Group (FLOWW) guidance (2014 and 2015) wherever possible.

6.7.1.4 During the operational and maintenance phase, the assessment assumes that fishing will resume within the Hornsea Three array area, which will be supported by a Fisheries Liaison and Co-Existence Plan. The potential effects of localised exclusion from the Hornsea Three array area are of **minor adverse** significance (not significant in EIA terms), for UK, Dutch and Belgian demersal trawling fleets targeting flatfish, *Nephrops* and mixed demersal species and **negligible** for all other fleets. All other potential effects during operational and maintenance phase are of **minor adverse** or **negligible** significance (not significant in EIA terms) for all fleets.

6.7.1.5 Cumulative impacts from other offshore wind farm developments, existing and proposed/recommended nature conservation designations, gas fields, oil fields, pipelines and aggregate dredging were assessed. The cumulative effects of reduction in access to, or exclusion from, potential and/or established fishing grounds and displacement leading to gear conflict and increased fishing pressure on alternative grounds are considered to be **moderate adverse** for demersal trawling fleets and minor for all other fleets. These assessment take account of a high degree of uncertainty. All other cumulative effects on all other fleets are considered to be of **minor adverse** significance.

6.7.1.6 Transboundary effects with regard to commercial fisheries from Hornsea Three on the interests of other EEA States were predicted. The commercial fisheries assessment considered the potential impact of Hornsea Three on commercial fishing fleets from all EEA States. Transboundary impacts within UK waters have therefore been intrinsically considered throughout the commercial fisheries EIA process and are consistent to those presented in the impact assessment.

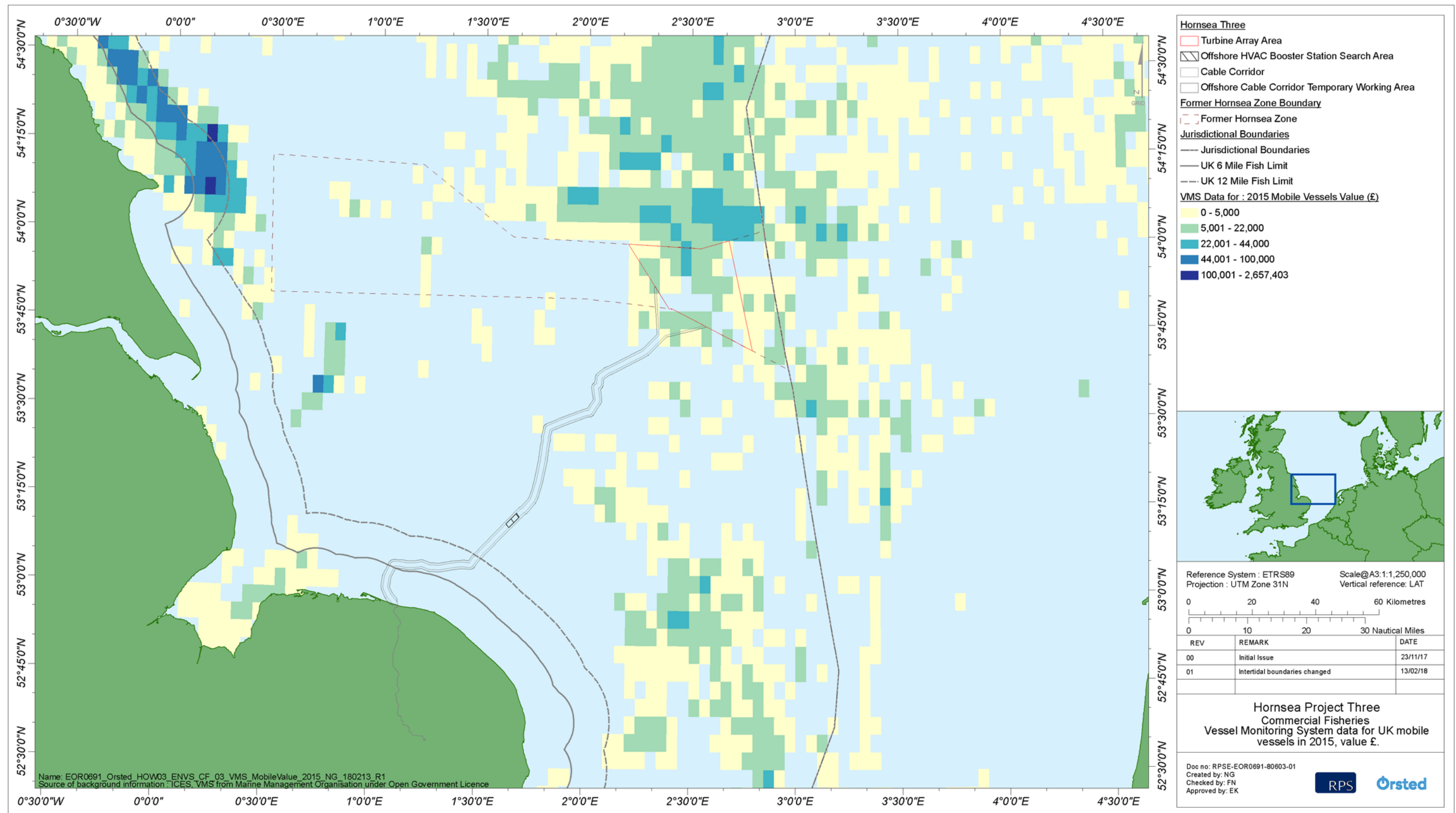


Figure 6.5: Vessel Monitoring System data for UK mobile vessels (≥ 15 m) actively fishing within regional commercial fisheries study area in 2015 indicating value of catch.

6.8 Shipping and navigation

- 6.8.1.1 Shipping and navigation considers the transport of goods or persons by sea (for commercial or recreational purposes) as well as navigational activities associated with extraction resources such as marine aggregates, oil and fish. Shipping and navigation activity within the Hornsea Three array area and offshore cable corridor has been characterised using a review of existing data and project-specific studies, including four vessel based marine traffic surveys at the Hornsea Three array area and Hornsea Three offshore HVAC booster station search area, carried out by vessel crews tasked to monitor all vessel movements within the area. It is noted that the final location of the Hornsea Three offshore HVAC booster station(s) have not yet been identified and the survey data collected has and will continue to contribute to the assessment of the search area to identify a suitable location.
- 6.8.1.2 Based on 40 days of AIS and Radar data collected over two periods at the Hornsea Three array area, the 26 days analysed in summer 2016 were considered to represent the highest traffic levels and recorded an average of 42 different vessels per day passing within the Hornsea Three array area shipping and navigation study area. All survey requirements were agreed in advance with key stakeholders and met the regulatory requirements set out in the main guidance document produced by the Maritime and Coastguard Agency (MCA) – Marine Guidance Note (MGN 543) (MCA, 2016).
- 6.8.1.3 Following a review of the baseline environment, a Navigational Risk Assessment (NRA) for Hornsea Three was undertaken. The assessment was based around the IMO Formal Safety Assessment (FSA) and MGN 543 as required by the key regulator for shipping and navigation, the MCA. The FSA assessed the marine traffic survey data alongside a combination of key stakeholder consultation, regular operator consultation, a Hazard Workshop and collision (vessel to vessel) and allision (vessel to structure) risk modelling to assess risks for all phases of the development (construction, operation and maintenance and decommissioning) as well as an assessment of cumulative effects.
- 6.8.1.4 The findings of the NRA were then used to inform the overall impact assessment for shipping and navigation and identified which risks were to be assessed within the shipping and navigation assessment. The chapter has considered impacts including route deviations, adverse weather, vessel to vessel collision risk, vessel to structure allision risk (for passing vessels and vessel transiting internally within the array), gear snagging and the effect upon emergency response including search and rescue (SAR) impacts. The impact assessments initially considered impacts for all phases of the development in isolation and then cumulatively with other developments within the southern North Sea area.
- 6.8.1.5 With measures adopted as part of Hornsea Three in place as part of the project, including (but not limited to) the promulgation of information, use of safety zones, charting of the Hornsea Three structures, array cables and export cables, implementation of guard vessels, lighting and marking of the wind farm, advisory safe passing distances, temporary aids to navigation during construction and decommissioning and marine coordination, the majority of impacts across each phase of Hornsea Three result in effects of **minor adverse** significance (not significant in EIA terms) for Hornsea Three in isolation.
- 6.8.1.6 For the construction and decommissioning phases, the assessment shows that all impacts which result from Hornsea Three will have effects of **minor adverse** significance (not significant in EIA terms) on shipping and navigation.
- 6.8.1.7 An effect of **moderate adverse** significance (significant in EIA terms) is assessed for the allision and collision risk associated with the subsea offshore HVAC booster stations during the operation and maintenance phase of Hornsea Three. However it is noted that the final location(s) for the subsea offshore HVAC booster stations have not yet been selected (a maximum design scenario was assessed) and it is recommended that they are aligned or grouped so as to be sympathetic to shipping. Additionally, further consultation shall be undertaken with the MCA and Trinity House (TH) to agree the final location(s) and under keel allision risk modelling will be undertaken for the final location(s). Moreover, further Aids to Navigation (in consultation with TH) in water depths giving less than 30 m under keel clearance may be implemented. With these additional mitigation in place, the risk should be reduced to not significant in EIA terms).
- 6.8.1.8 All cumulative impacts were deemed to be of **minor adverse** significance (not significant in EIA terms) with measures adopted as part of Hornsea Three. Consultation with Hornsea Project One and Hornsea Project Two is a key mitigation for cumulative impacts to ensure that aids to navigation for the developments are considered at a cumulative level to avoid proliferation of lights and to mitigate the effects of the proposed navigational corridor.
- 6.8.1.9 The screening of transboundary impacts identified that there was potential for transboundary effects on shipping and navigation from Hornsea Three upon the interests of other EEA states from the Hornsea Three array area having an effect upon commercial shipping routes transiting between the UK and other EEA ports. However given the minor deviations expected, the impact is assessed to be not significant following consideration of measures adopted as part of Hornsea Three.

6.9 Aviation, military and communication

- 6.9.1.1 Aviation, military and communication considers the impact of Hornsea Three on civil en-route operations; Ministry of Defence (MOD) Air Defence operations and training; helicopter support to offshore oil and gas operations; and aircraft using various communication systems. Information on aviation, military and communication was collected through a detailed desktop review of existing datasets and through consultation. Point-to-point Line of Sight (LOS) analysis was also undertaken for the assessment of effects on radar.
- 6.9.1.2 There are a number of aviation, military and communication related interests in the vicinity of the Hornsea Three array area and offshore cable corridor. This includes Air Traffic Services, MOD Managed Danger Areas (MDAs), Aerial Tactics Areas, an Offshore Safety Area, and submarine practice areas. In addition, one Helicopter Main Route (HMR) crosses the Hornsea Three array area, and the boundary of the Hornsea Three array area extends into the 9 NM consultation zones surrounding nine offshore gas platforms (the Schooner A, Ketch, Chiswick, ST-1, J6A, Grove, Windermere, Cutter and Carrack QA platforms). Hornsea Three is also located within the operational ranges of the NATS Claxby Primary Surveillance Radar (PSR) and the MOD's Air Surveillance and Control Systems (ASACS) Air Defence PSRs located at Staxton Wold and Trimmingham. There are networks of microwave links in the vicinity of the Hornsea Three array area; however there are no microwave links which pass through the array area.
- 6.9.1.3 A number of potential impacts on aviation, military and communication, associated with the construction, operation and maintenance, and decommissioning of Hornsea Three, were identified. These included disruption to cross-zone transit helicopter traffic and HMRs, effects on available airspace, disruption of helicopter access to offshore gas platforms, drilling rigs and subsea infrastructure, and disruption to civil and military radar coverage. With the proposed mitigation measures in place, there will be no significant effects arising from the development of Hornsea Three in isolation during the construction, operation and maintenance, or decommissioning phases on aviation, military and communication, with these impacts resulting in effects of either **negligible** or **minor adverse** significance (not significant in EIA terms).
- 6.9.1.4 Cumulative impacts from other offshore wind farm developments were assessed and these impacts were predicted to result in effects of either **negligible** or **minor adverse** significance (not significant in EIA terms).
- 6.9.1.5 The screening of transboundary impacts identified that there was potential for significant transboundary effects on aviation, military and communication from Hornsea Three upon the interests of other EEA states. Transboundary impacts relate to the aviation requirements of Sprit Energy in regard to helicopter access to the Markham group of platforms, helideck equipped drilling rigs and vessels, and cross-zone helicopter transit. These impacts were predicted to result in effects of **minor adverse** significance (not significant in EIA terms).

6.10 Marine archaeology

- 6.10.1.1 Marine archaeology considers the impact of Hornsea Three on marine archaeology seaward of MHWS. A detailed literature search was carried out to establish the baseline of information available. Recent survey data collected from the Hornsea Three array area, offshore cable corridor and intertidal area in 2016 and 2017 have been used to inform the baseline characterisation. This included an archaeological assessment of geophysical survey data collected specifically for Hornsea Three. Archaeological potential was assigned to each contact identified during the geophysical surveys and contacts assessed as having archaeological potential were then compiled into a gazetteer.
- 6.10.1.2 The desktop study and Hornsea Three field surveys have identified extensive remains. These comprise largely buried remains of palaeolandscapes, wrecks and possible aviation losses. The evidence indicates that palaeolandscapes are discreetly grouped. Seabed remains of wrecks and aviation losses are relatively easy to recognise from geophysical surveys and thus are likely to be largely avoided by Hornsea Three and therefore preserved.
- 6.10.1.3 Offshore wind farms can result in adverse and beneficial impacts on marine archaeology. For the purposes of the EIA, effects were defined based on the disturbance of prehistoric land surfaces, and on shipwrecks and aircraft wrecks. Effects were therefore defined as adverse throughout the assessment. Nevertheless, it is noted that they could, in fact, also be seen as beneficial through improved understanding of human history and prehistory.
- 6.10.1.4 Construction and decommissioning activities within the Hornsea Three array area and offshore cable corridor have the potential to result in a range of potential impact on marine archaeology. These include the removal or disturbance of sediments resulting in a potential effect on near-surface prehistoric land surfaces and deeply buried prehistoric land surfaces along with potential effects on shipwrecks, aircraft wrecks and a variety of heritage assets. With the designed-in measures adopted as part of Hornsea Three, these potential impacts have all been assessed as being of **minor adverse** significance (not significant in EIA terms).
- 6.10.1.5 Operation and maintenance activities may affect prehistoric land surfaces through the removal or disturbance of sediments and also have the potential to affect shipwrecks and aircraft wrecks. With the designed-in measures adopted as part of Hornsea Three, these impacts have also been assessed to be of **minor adverse** significance (not significant in EIA terms).
- 6.10.1.6 The cumulative impact upon marine archaeology when the construction, operation and maintenance, and decommissioning phases of Hornsea Three has been considered together with the construction and operation of other planned nearby wind farm projects, planned oil and gas operations, cables and pipelines and applications for aggregate extraction. Overall, the effect will be of **minor adverse** significance (not significant in EIA terms).

6.10.1.7 A screening of transboundary impacts has been carried out and identified that there was no potential for significant transboundary effects with regard to marine archaeology from Hornsea Three upon the interests of other EEA States.

6.11 Seascape and visual resources

6.11.1.1 The seascape and visual resources assessment describes the existing and historic character of the seascape and views gained by people within and around Hornsea Three including the Hornsea Three array area and offshore cable corridor. This also includes an assessment of the changes to the character of the seascape and views as a result of the proposed development during construction, operation and maintenance, and decommissioning.

6.11.1.2 A Zone of Theoretical Visibility (ZTV) of Hornsea Three was generated to within a 50 km radius of the Hornsea Three array area based on a maximum 325 m (above LAT) blade tip height of turbines (see Figure 6.6). A further ZTV was generated within a 25 km radius of the offshore HVAC booster stations search area, based on a maximum 70 m height (above LAT) of the offshore HVAC booster stations (see Figure 6.6).

6.11.1.3 Information on seascape and visual resources was collected through a detailed desktop review of existing studies and datasets. Present day seascape character is based on the 'Seascape Character Area Assessment for East Inshore and East Offshore Marine Plan Areas' published by the Marine Management Organisation (MMO) in October 2012. The character of the seascape in the centre of the North Sea is generally defined by consistent horizons across extensive and unchanging tracts of open water that have a remote and isolated quality. The coastal seascapes of Norfolk are defined by the extensive linear landform with open and exposed sandy beaches creating long sweeping views out to sea, busy shipping and sailing areas and offshore arrays.

6.11.1.4 There are a relatively small number of visual receptors within these seascapes due to the location of the Hornsea Three array area approximately 121 km from the nearest coastline. The majority of people are at their place of work or travelling for leisure purposes on vessels and people working on oil or gas platforms.

6.11.1.5 A Historic Seascape Characterisation (HSC) of the area from the Humber to Norfolk was published in 2013 (Aldred 2013a, b and c). The array SVIA study area lies within the HSC East Yorkshire to Norfolk Project Area 2. The characterisation includes the four marine tiers of sea surface, water column, sea floor and subsea floor. The Hornsea Three array area and offshore cable corridor extend predominantly over the 'Fishing' Broad Character Types which include drift netting and bottom trawling sub types, but also include communications and industry Broad Character Types which include telecommunications cables and gas and oil installations.

6.11.1.6 Offshore wind energy development, wherever it occurs, is usually visible in some form. Hornsea Three would have the following general attributes typical of most wind farms: engineered, large scale, simple in form, smooth texture, monochrome/muted colour and strong vertical form. Responses by people to wind farms can vary from 'beautiful' to 'offensive', with respondents perceiving wind turbines as potentially rhythmic, unusual, safe, interesting, invigorating, majestic and spiritual on the one hand and degrading, jarring, overbearing, industrial, clashing and ugly on the other. Wind energy development thus gives rise to a spectrum of responses from individuals and organisations who perceive its effects ranging from strongly adverse to strongly beneficial. For the purposes of this assessment, effects have been defined based on the scenario of an individual who may perceive the turbine array as a negative addition to the seascape or view. Effects are therefore defined as adverse throughout the assessment; but may in fact be seen as beneficial or positive by large numbers of viewers. An individual who perceives offshore wind farms as a positive addition to the seascape or view may consider the same effects to be beneficial or neutral in nature.

6.11.1.7 During the construction and decommissioning phases, temporary changes to the existing present day seascape character, HSC and views gained by people at sea, during the daytime and at night would occur. The effect is predicted to be of **negligible to moderate adverse** significance (not significant in EIA terms, when considered against the seascape and visual resources assessment methodology). During the operational and maintenance phase of Hornsea Three, the long term change to these same receptors, during the daytime and at night would result in direct or indirect effects. These effects are considered to be of **negligible to minor adverse** significance (not significant in EIA terms).

6.11.1.8 The cumulative impact upon seascape character, HSC and visual receptors during the construction, operation and maintenance, and decommissioning phases of Hornsea Three has been considered alongside the construction and operation of other planned nearby offshore wind projects, planned oil and gas operations, cables and pipelines, and applications for aggregate extraction. Cumulative impacts are predicted to result in effects of **negligible to moderate adverse** significance (not significant in EIA terms, when considered against the seascape and visual resources assessment methodology).

6.11.1.9 A screening of transboundary impacts has identified that there was no potential for significant transboundary effects with regard to seascape and visual receptors or the HSC from Hornsea Three upon the interests of other EEA States.

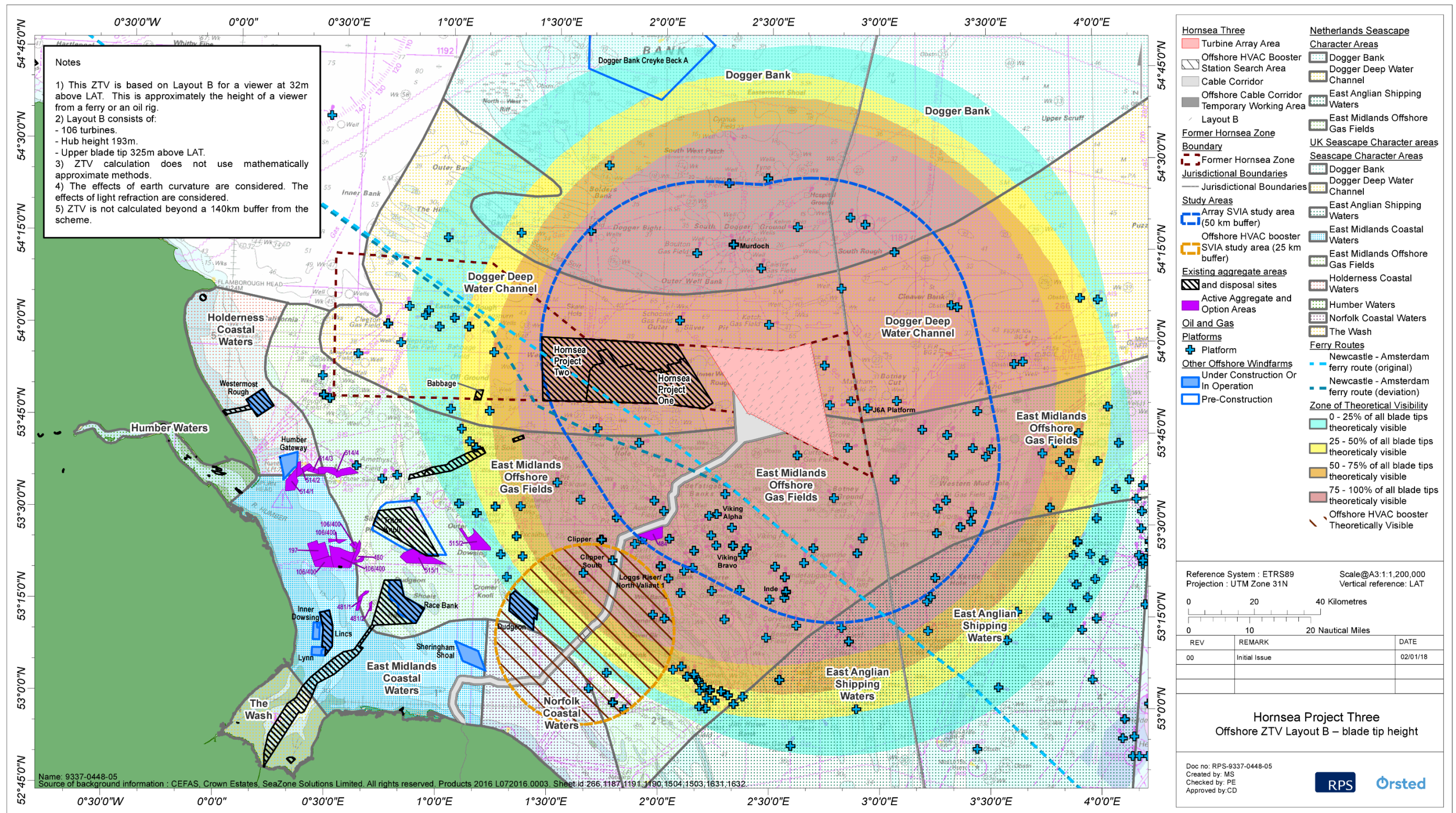


Figure 6.6: Zones of theoretical visibility within the Hornsea Three array study area.

6.12 Infrastructure and other users

6.12.1.1 Infrastructure and other users considers the impact of Hornsea Three on the following:

- Recreational sailing and motor cruising;
- Kite surfing, surfing and windsurfing;
- Sea/surf kayaking and canoeing;
- SCUBA diving;
- Recreational fishing;
- Offshore telecommunications cables;
- Carbon capture and storage and natural gas storage;
- Disposal sites;
- Aggregate extraction; and
- Oil and gas operations (including pipelines).

6.12.1.2 Information on infrastructure and other users was collected through a detailed desktop review of existing studies and datasets and through consultation. Due to the distance from the UK coast, the level of recreational activity within the Hornsea Three array area is low, and recreational fishing activity is likely to be limited. There is low to medium recreational vessel activity in the nearshore area of the Hornsea Three offshore cable corridor, a number of offshore routes, and a general boating area crossing the inshore section of the Hornsea Three offshore cable corridor. Boat angling and shore angling also takes place, particularly within 1 nm of the shoreline. Kite surfing, surfing, wind surfing, kayaking and canoeing all have the potential to occur within the nearshore and inshore sections of the offshore cable corridor and there are several SCUBA diving sites in the vicinity.

6.12.1.3 The closest offshore wind farms to the Hornsea Three array area are Hornsea Project One and Hornsea Project Two (under construction), with the closest offshore wind farms to the offshore cable corridor being Dudgeon and Sheringham Shoal (operational). There is one active telecoms cable crossing the Hornsea Three array area, and one active telecoms cable crossing the Hornsea Three offshore cable corridor. In the landfall location, the Hornsea Three offshore cable corridor also crosses the export cables for the Dudgeon and Sheringham Shoal offshore wind farms. There are 27 active pipelines which intersect the Hornsea Three offshore cable corridor. There are no aggregate extraction sites within the Hornsea Three array area or offshore cable corridor.

6.12.1.4 Licences for the exploration and extraction of oil and gas are granted for identified geographical blocks. There are currently nine licenced blocks coincident with the Hornsea Three array area operated by Spirit Energy North Sea Ltd (formerly Centrica North Sea Ltd) and Spirit Energy Resources Ltd (formerly Centrica Resources Ltd), INEOS and Shell and eight unlicensed blocks coincident with the Hornsea Three array area. There are an additional three blocks (49/1a operated by INEOS, 49/10a operated by Spirit Energy Resources Ltd and 49/10e unlicensed) within 1 km of the Hornsea Three array area. There are currently ten licenced blocks coincident with the offshore cable corridor licenced to Shell, INEOS, Independent Oil and Gas and ConocoPhillips, with one of these blocks (48/24b operated by Independent Oil and Gas) coinciding with the offshore HVAC booster station search area, and 14 unlicensed blocks, with one of these coinciding with the offshore HVAC booster station search area. There is one additional licenced block (49/16a licenced to ConocoPhillips) within 1 km of the Hornsea Three offshore cable corridor. All of the unlicensed acreage has been offered in the 30th licence round.

6.12.1.5 A number of potential impacts on infrastructure and other users, associated with the construction, operation and maintenance, and decommissioning of Hornsea Three, were identified. These included displacement of recreational craft and recreational fishing vessels, restriction of access to cables and pipelines, change in aggregate resource, and disruption to oil and gas operations (including restriction on seismic survey activity, restrictions on drilling and the placement of infrastructure, and interference with Radar Early Warning Systems (REWS) on gas platforms). With the proposed mitigation measures in place, there will be no significant effects arising from the development of Hornsea Three in isolation during the construction, operation and maintenance, or decommissioning phases on recreational users and recreational fishing; aggregate extraction, cables and pipelines; and oil and gas receptors, with these impacts resulting in effects of either **negligible** or **minor adverse** significance (not significant in EIA terms).

6.12.1.6 Cumulative impacts associated with the construction, operation and maintenance and decommissioning of Hornsea Three together with other offshore wind farm developments, cables and pipelines and aggregate extraction activities, were assessed and predicted to result in effects of either **negligible** or **minor adverse** significance (not significant in EIA terms) upon recreational users and recreational fishing; aggregate extraction, cables and pipelines; and oil and gas receptors.

6.12.1.7 Transboundary effects relate to effects of Hornsea Three in isolation on the J6A platform REWS operated by Spirit Energy and located within Dutch territorial waters. The effect is predicted to be of **minor adverse** significance (not significant in EIA terms).

6.13 Inter-related effects (offshore)

- 6.13.1.1 The EIA for Hornsea Three has also assessed the potential for inter-related effects to arise. Inter-related effects are defined as multiple effects upon the same receptor arising from Hornsea Three. These occur either where a single effect acts upon a receptor over time to produce a potential additive effect or where a number of separate effects interact to affect a single receptor, for example the combination of noise and habitat loss on marine mammals.
- 6.13.1.2 Potential inter-related effects have been identified based on the detailed assessments undertaken in the individual Environmental Statement chapters for example, habitat loss/disturbance/alteration, increased suspended sediment concentrations and associated sediment deposition on benthic ecology. However, given the temporary and small-scale nature of effects, availability of alternative habitats, and also factoring in proposed measures adopted as part of the project, the overall significance of any inter-related effects was not judged to increase the individual effects assessed in the topic-specific chapters.

7. Potential Environmental Impacts (Onshore)

7.1 Introduction

- 7.1.1.1 This section of the NTS provides a non-technical summary of the onshore assessments undertaken for Hornsea Three, whilst further detail can be found in each of the topic chapters in volume 3 of the Environmental Statement.
- 7.1.1.2 This section outlines how the EIA process has assessed the potential for the construction, operation and maintenance, and decommissioning of Hornsea Three to impact upon the onshore environment, as characterised by the review and analysis of site-specific data, peer reviewed papers, desk based studies and modelling of specific parameters. With the exception of potential visual impacts which may arise from an offshore HVAC booster station (see section 7.5), impacts upon the onshore environment occur as a result of the onshore elements of Hornsea Three (namely Hornsea Three landfall, onshore cable corridor, the onshore HVAC booster station, the onshore HVDC converter/HVAC substation and the interconnection with the Norwich Main National Grid substation), as well as where appropriate, compounds, storage areas and accesses. A description of each onshore element is provided in section 3 of the NTS.
- 7.1.1.3 The assessment of environmental impacts and their resulting effects has been informed, where relevant, by National Policy, local planning policy, legislation and guidance, as well as consultation with relevant stakeholders.

7.2 Geology and ground conditions

- 7.2.1.1 Geology is the study of the origin, history and structure of the earth and geological materials (i.e. the bedrock and other below ground materials (other than soils). The assessment of ground conditions focuses on the potential for Hornsea Three to cause disturbance of existing land contamination, for example waste disposal sites or former industrial sites, as well as the potential for impacts on groundwater.
- 7.2.1.2 The geology and ground conditions study area comprises of a 1 km buffer around the onshore elements of Hornsea Three, as well as the storage areas and compounds. The baseline information was collated from various sources, which included a desktop study of existing studies and datasets as well as the compilation of all designated sites within the geology and ground conditions study area that could be impacted by Hornsea Three.

- 7.2.1.3 There are two geological Sites of Special Scientific Interest (SSSI) within the geology and ground conditions study area: Weybourne Cliffs and Kelling Heath. However, through refinement of the onshore cable corridor, Hornsea Three has avoided land take within the designated sites and has committed to the implementation of design measures to minimise the potential for indirect impacts during construction (see Outline CoCP document reference number A8.5) such that no significant effects are predicted. There are also several Mineral Safeguarded Areas (areas of mineral resource (sand and gravel) of sufficient economic or conservation value to warrant protection for future generations) within the geology and ground conditions study area.
- 7.2.1.4 The bedrock (i.e. the solid geology) underlying the northern and central part of the Hornsea Three geology and ground conditions study area is split between the Lewes Nodular Chalk of the White Chalk Subgroup (in the west) and the Wroxham Crag Formation (in the east). The rest of the geology and ground conditions study area, including the onshore HVDC converter/HVAC substation and HVAC booster station are underlain by Lewes Nodular Chalk of the White Chalk Subgroup. The majority of the bedrock is overlain by superficial deposits (i.e. unconsolidated sediments nearer the surface) including sand and gravel deposits.
- 7.2.1.5 The Chalk and Crag bedrock are principal aquifers (i.e. underground layers of rock that yield high volumes of groundwater). The superficial deposits are classified as secondary A and B aquifers which also contain groundwater but it is likely to be localised due to the variable nature of the deposits. There are public water supplies from the Chalk aquifer, together with several private abstractions from the Chalk elsewhere in the geology and ground conditions study area. The Environment Agency has defined Source Protection Zones around the public water supplies to identify the risk of potential contamination from surrounding land uses.
- 7.2.1.6 Land use within the geology and ground conditions study area is predominantly used for agriculture and open land. However, there are also a number of infilled ponds, infilled pits, former factories and warehouses of unknown use; cemeteries; substations; sewage treatment works and former military land which may have potentially caused localised ground contamination. However, there are no sites recorded as contaminated land under Part 11A of the Environmental Protection Act 1990 within the 500 m of the onshore elements of Hornsea Three, as well as the storage areas and compounds.
- 7.2.1.7 A Water Framework Directive assessment was undertaken for the groundwater bodies within the geology and ground conditions study area (see volume 6, annex 1.4: Water Framework Directive Groundwater Assessment). This concluded that construction, maintenance and decommissioning of the onshore elements of Hornsea Three will not result in deterioration of the groundwater bodies which underlay the areas affected by Hornsea Three.
- 7.2.1.8 During construction, Hornsea Three will directly impact on the mineral resources within the Mineral Safeguarded Areas. However, the area impacted has been minimised where possible through the refinement of the Hornsea Three onshore cable corridor, and those Mineral Safeguarded Areas which would be impacted are of variable quality and in some instances of small extent (and thus may already be limited in respect to their viability for extraction). In addition, the impact resulting from Hornsea Three would be reversible following decommissioning (the current operational life is anticipated to be 35 years), as the mineral resources would not be permanently sterilised. As such, the effects on the Mineral Safeguarded Areas is considered to be of **minor adverse** significance (not significant in EIA terms).
- 7.2.1.9 During construction, there is also potential for certain activities (e.g. piling and open cut trenching) to create pathways for water to flow into primary aquifers (including in Source Protection Zones which are highly sensitive), leading to potential disruption to groundwater flow and/or reduction in groundwater quality. Although this is a potential impact, the variable nature of the superficial deposits (both locally and regionally) indicates that the groundwater within these deposits is likely to be confined to a specific area. Taking this into consideration, in combination with the mitigation measures proposed (including the preparation of a Hydrological Risk Assessment at each HDD within a SPZ and Watercourse Crossing Method Statement) the effect of Hornsea Three on Source Protection Zones and the principal aquifer is considered to be of **minor adverse** significance (not significant in EIA terms). Effects on the secondary aquifers, which could be impacted in a similar way, are also predicted to be of **negligible** significance (not significant in EIA terms). Where the secondary aquifers are associated with surface waters, the effects are considered to be of **minor adverse** significance (not significant in EIA terms).
- 7.2.1.10 During the operational and maintenance phase, it has been assumed that oils and lubricants will be used in the maintenance of the onshore HVAC booster station and onshore HVDC converter/HVAC substation. Should an accidental spill of these chemicals occur, the water quality of secondary aquifers and principal aquifers, together with any associated surface waters, could be impacted. However, taking into consideration the mitigation measures proposed (including emergency response procedures), the effect of spills and leaks occurring and impacting underlying groundwater resources is considered to be of **negligible to minor adverse** significance (not significant in EIA terms). The thermal effect of underground cables on groundwater during the operational and maintenance phase is considered to be of **minor adverse** significance (not significant in EIA terms).
- 7.2.1.11 During the decommissioning phase, above and below ground structures at the onshore HVAC booster station and HVDC converter/HVAC substation will be removed, the onshore cable corridor will be cut and sealed, and surface features of link boxes will be removed. These activities have the potential to cause impacts similar to those during the construction phase, and as such, with the implementation of similar mitigation measures, the effects of disturbance or contamination of secondary and principal aquifers are considered to be of **negligible to minor adverse** significance (not significant in EIA terms).

- 7.2.1.12 There are a number of potential cumulative impacts which could arise as a result of Hornsea Three in combination with other planned developments related to the disturbance or contamination of aquifers and associated surface waters, impact on mineral resources within the Mineral Safeguarded Areas, and thermal effects of underground power cables. However, the significance of the cumulative effects are considered to be of **minor adverse** significance (not significant in EIA terms).
- 7.2.1.13 It was considered that there was no potential for significant transboundary effects with regard to onshore geology and ground conditions from Hornsea Three upon the interests of other EEA States.

7.3 Hydrology and flood risk

- 7.3.1.1 Hydrology assesses the movement, distribution and quality of water above ground, including the hydrological cycle and water resources. The assessment of hydrology and flood risk focuses on the potential for increased risk of flooding and surface watercourse disturbance as a result of Hornsea Three.
- 7.3.1.2 The hydrology and flood risk study area comprises a 250 m buffer around the onshore elements of Hornsea Three (including all storage areas and compounds). The hydrology and flood risk study area also comprises a 1 km buffer around the onshore HVAC booster station and HVDC converter/HVAC substation to identify any assets that may be affected in terms of flood risk. The baseline information was collated from various sources, which included a desktop study of publicly available information as well as the identification of all designated sites within the hydrology and flood risk study area that could be impacted by Hornsea Three. This information was supplemented by information requested from the EA, Norfolk Rivers Internal Drainage Board, Norfolk County Council, North Norfolk District Council, Broadlands District Council and South Norfolk Council.
- 7.3.1.3 The hydrology and flood risk study area includes a number of catchments and associated surface watercourses. These include the River Yare, River Tud, River Wensum, River Bure, River Glaven (Gunthorpe Stream), Spring Beck, Intwood Stream, Swannington Beck and Blackwater Drain. All of these watercourses are classified as having moderate water quality under the WFD, with the exception of the River Bure which is classified as poor.
- 7.3.1.4 EA mapping indicates that the majority of the onshore elements of Hornsea Three (including the onshore HVDC converter/HVAC substation and onshore HVAC booster station) are in Flood Zone 1, which has less than 0.1% chance of flooding. Small areas of the Hornsea Three onshore cable corridor areas located within Flood Zone 3 in the vicinity of Salle, Blackwater Drain, Swannington Beck, River Wensum, River Tud, River Yare, unnamed tributary of the River Yare at Little Melton and Intwood Stream. This means that there is greater than 1% chance of flood in those locations.

- 7.3.1.5 During construction, the use of open cut trenching, Horizontal Directional Drilling (HDD) and/or other construction activities has the potential to impact surface water quality by increasing turbid (murky) runoff, spillages/leaks of fuel, oil etc. or an alteration in surface water flow pathways. However, with the implementation of mitigation measures, such as those provided in the Outline CoCP (document reference A8.5) (including site inductions on pollution prevention measures and maintenance of a vegetated strip close to watercourses (where possible)), the effects are considered to be of **minor adverse** significance (not significant in EIA terms).
- 7.3.1.6 The construction of the onshore elements of Hornsea Three also has the potential to impact existing field drainage and irrigation, which may disrupt surface water runoff. However, with the implementation of specific measures (including the preparation of a Drainage Management Plan at the onshore HVAC booster station and onshore HVDC converter/HVAC substation) the effects of these impacts have been assessed to be of **minor adverse** significance (not significant in EIA terms).
- 7.3.1.7 Similarly, the open cut and HDD activities has the potential to impact existing drainage pipeline infrastructure which could impact water quality, potential flow rates and local water supply networks. Although the routing and refinement of the Hornsea Three onshore cable corridor has taken into account the location of major services utilities, the presence of local drainage infrastructure cannot be ruled out. However, if required, micro-routing or appropriate construction techniques will be employed to avoid any impact unidentified infrastructure. The effect is therefore considered to be of **minor adverse** significance.
- 7.3.1.8 Furthermore, construction of the onshore elements of Hornsea Three has the potential to impact flood risk, for example by creating a pathway for flood water at the Hornsea Three landfall, or impacting surface water runoff in localised areas. Specific mitigation measures (including maintenance of existing level of flood protection during construction and use of permeable material for the haul road) will be implemented as part of Hornsea Three, as detailed in the Outline CoCP (document reference A8.5). With the implementation of these measures, the effect on flood risk is considered to be of **minor adverse** significance (not significant in EIA terms) near the Hornsea Three landfall, and **negligible** (not significant in EIA terms) for the remainder of the Hornsea Three hydrology and flood risk study area.
- 7.3.1.9 During operation and maintenance, there is the potential for increased flood risk due to an increase in runoff rate at the onshore HVAC booster station and onshore HVDC converter/HVAC substation. However, with the inclusion of the mitigation measures adopted as part of the design (including a commitment for the onshore HVAC booster station and onshore HVDC converter/HVAC substation to achieve greenfield run off rates), the effect is considered to be **negligible** (not significant in EIA terms).
- 7.3.1.10 There is also the potential for unintentional spillage of substances, such chemicals, oils and greases, at the onshore HVAC booster station and onshore HVDC converter/HVAC substation which could impact the water quality of nearby surface watercourse. However, with the mitigation measures integrated as part of the design of Hornsea Three (such as emergency spill response procedures, clean up and remediation of contaminated water runoff), the effect is considered to be of **minor adverse** significance (not significant in EIA terms).

- 7.3.1.11 During the decommissioning phase, above and below ground structures at the onshore HVAC booster station and HVDC converter/HVAC substation will be removed (including foundations and attenuation storage), the onshore cable corridor will be cut and sealed, and surface features of link boxes will be removed. These activities have the potential to lead to changes in flood risk. However, the impacts of decommissioning of the onshore elements of Hornsea Three will be minimised through the incorporation of management measures (included in Outline CoCP (document reference A8.5)) and the natural attenuation of the sites will be restored over time. As such, the effect is considered to be of **minor adverse** significance (not significant in EIA terms).
- 7.3.1.12 For projects screened into the cumulative assessment, it is assumed that each development would be constructed in line with the requirements of the National Planning Policy Framework and Planning Policy Guidance ID7 – Flood Risk and Coastal Change (and where relevant the NPSs) requiring that new developments attenuate surface water runoff to where practicable to the greenfield runoff rate through a surface water management plan and/or drainage scheme. It is also reasonable to assume that the cumulative developments would likely have to implement similar mitigation measures to Hornsea Three (where relevant) in respect to drainage and pollution prevention. Cumulative effects on surface water quality, flood risk, drainage pipeline infrastructure, field drainage and irrigation during construction, and operation and maintenance were therefore considered to be of **negligible to minor adverse** significance (not significant in EIA terms).
- 7.3.1.13 It was considered that there was no potential for significant transboundary effects with regard to onshore hydrology and flood risk from Hornsea Three upon the interests of other EEA States.

7.4 Ecology and nature conservation

- 7.4.1.1 The assessment of impacts on ecology and nature conservation focuses on any impacts on the communities of animals and plants, and the interaction between these species and the physical environment as a result of Hornsea Three.
- 7.4.1.2 The ecology and nature conservation study area includes a buffer of up to 250 m for field data collection either side of the onshore elements of Hornsea Three; a 2 km study area for the data search and desk study for designated sites and protected species, and 5 km study area for the data search specifically for bats and ornithology. The Hornsea Three ecology and nature conservation study area used for the assessment of effects comprises the Hornsea Three onshore elements, the storage areas and compounds and the survey areas for protected species up to 250 m (where appropriate). For designated sites, the study area for assessment included all sites within 1 km of Hornsea Three and additional sites beyond that distance (up to 2 km) where an impact pathway was identified. The baseline information was collated from various sources, which included a desktop study of publicly available information, site specific surveys and the compilation of all designated sites within the ecology and nature conservation study area that could be impacted by Hornsea Three.

- 7.4.1.3 In total, 19 statutory designated sites including SSSIs, SACs and Ramsar sites, were identified within 2 km of Hornsea Three, with 107 non-statutory designated sites also identified (e.g. County Wildlife Site and Roadside Nature Reserves). The desktop study and site specific surveys indicated the presence of protected or otherwise notable species within the ecology and nature conservation study area including bluebell, holly-leaved naiad, sandy stillball, white-clawed crayfish, whorl snail species, common lizard, great crested newt (see Figure 7.1), grass snake, slow worm, breeding birds, wintering birds, migratory birds, badger, otter, bats and water vole. Other than wintering pink-footed goose, which were observed at the landfall and the northern part of the onshore cable corridor, no species populations were considered to be of importance at higher than county level.



Figure 7.1: Great crested newts and survey sampling equipment.

- 7.4.1.4 The route selection process for the onshore cable corridor and siting of the onshore HVDC converter/HVAC substation and HVAC booster station sought to avoid ecologically sensitive areas. Hornsea Three has committed to HDD under all designated sites (statutory and non-statutory) within the onshore cable corridor. As such no direct impacts on designated sites from construction activities will occur as a result of Hornsea Three. Hornsea Three has also committed to HDD all 'main' (including the River Wensum and the River Yare) and numerous 'ordinary' watercourses, as well as large areas of woodland and several hedgerows which could not be avoided. Therefore, no areas of ancient woodland would be impacted by open cut trenching.
- 7.4.1.5 During construction, there is potential for HDD beneath watercourses and the use of associated machinery to result in damage and disturbance to designated sites associated with them. This is due to the potential for an increase in turbid runoff and spillages/leaks of fuel, oil etc. into nearby watercourses. Similarly, the Hornsea Three onshore cable corridor itself could act as a drainage channel, leading to runoff from construction affecting nearby watercourses. However, Hornsea Three has committed to implementing a number of mitigation measures outlined in the Outline CoCP (document reference A8.5) (including measures to intercept runoff and ensure that discharges from the site are controlled in quality and volume). With these measures in place the effect of HDD beneath watercourses on designated sites is considered to be of **minor adverse** significance.
- 7.4.1.6 Construction of the onshore elements of Hornsea Three also has the potential to cause a loss in or damage to habitats such as watercourses, woodland, and arable field margins. However, with the inclusion of designed in mitigation measures (most notably, the use of HDD techniques to avoid ecologically sensitive areas noted above), the effects on habitats is considered to be of **negligible to minor adverse** significance (not significant in EIA terms).
- 7.4.1.7 Although a number of hedgerows would not be directly impacted by Hornsea Three during construction due to the use of HDD, approximately 7.39 km of hedgerow will need to be removed to facilitate cable installation, which is a small proportion of the hedgerow within area survey (approximately 12%). Although hedgerows would be restored after construction, due to the potential project phasing (of up to two phases over a maximum onshore construction phase of up to 8 years), there would be a period of approximately 8-9 years from the date of first clearance before replacement hedgerow planting would mature. Based on this, the effects of Hornsea Three on hedgerows during construction are considered to be of **minor adverse** significance (not significant in EIA terms), as although impact is over a long period time it is reversible. Furthermore, it is noted that the effect would be of **minor positive** significance once the hedgerow habitat matures after construction is complete, as all hedgerows which were removed will be replanted with a species-rich native planting mix regardless of current status (i.e. species-poor or species-rich).
- 7.4.1.8 Construction activities also have the potential to impact on species including great crested newt, reptiles, breeding and wintering birds, bats, water voles, otters and badgers as a result of habitat loss and/or disturbance. However, appropriate mitigation measures adopted via the Outline CoCP (document reference A8.5) and Outline EMP (document reference A8.6) (including briefings within site inductions, buffer zones and employment of an Ecological Clerk of Works), would minimise these impacts such that effects are considered to be of **minor adverse** significance (not significant in EIA terms).
- 7.4.1.9 Depending on crop rotation/land use at the time of construction, there is potential for a significant disturbance effect on pink-footed goose at the north end of the onshore cable corridor during the construction phase, where a significant percentage of the North Norfolk Coast SPA population has been recorded. The effect would be of **moderate adverse** significance. The farms at the north end of the onshore cable corridor produce sugar beet as part of their farming activities. It is considered that the pink-footed geese may preferentially utilise the resulting sugar beet habitat during the time they are present in the vicinity of North Norfolk Coast SPA. If construction work on the sugar beet fields is likely to take place between November and January inclusive, a pink-footed goose mitigation plan will be formulated and submitted to Natural England for approval in the 12 months prior to construction. There would be two steps to the plan:
- First, pre-construction surveys and investigations will be undertaken to determine the extent of disturbance likely to occur due to construction activities. This will include a survey of the distribution and abundance of pink-footed geese and the distribution of harvested sugar beet within the areas likely to be affected during the winter season within which works will take place; and
 - Second, if required, measures to reduce disturbance or provide alternative foraging habitat will be implemented sufficient to reduce the effects of disturbance to an acceptable level. The measures proportionate to the predicted impact at the time of construction and will be in effect and agreed with Natural England prior to relevant works.
- 7.4.1.10 With the implementation of these measures, effect of Hornsea Three on the pink-footed goose would be of **minor adverse** significance.
- 7.4.1.11 During the operational and maintenance phase, routine maintenance activities associated with Hornsea Three have the potential to result in low-level visual disturbance and noise and vibration disturbance of habitats and species. There is also the potential for operational activities to result in contamination of habitats and watercourses through accidental spillage of chemicals or fuels during routine maintenance operations, and/or increased sedimentation as a result of physical disturbance of soils. Pollution and/or increased sedimentation would be controlled through the measures included in the Outline CoCP (document reference A8.5). With the implementation of outlined above, the effects are considered to be of **negligible to minor adverse** significance (not significant in EIA terms).

- 7.4.1.12 During the decommissioning phase, above and below ground structures at the onshore HVAC booster station and HVDC converter/HVAC substation will be removed (including foundations and attenuation storage), the onshore cable corridor will be cut and sealed, and surface features of link boxes will be removed. The removal and demolition activities at the onshore HVAC booster station and onshore HVDC converter/HVAC substation have the potential to cause disturbance to species and habitats. However, impacts of decommissioning will be minimised through the incorporation of management measures (included in the Outline CoCP document reference A8.5) such that the effects are considered to be of **minor adverse** significance (not significant in EIA terms).
- 7.4.1.13 There are a number of potential cumulative impacts which could arise as a result of Hornsea Three in combination with other planned developments related to the disturbance of species/habitats, habitat loss and/or severance. However, it is reasonable to assume that cumulative development would implement measures similar to those proposed for Hornsea Three, such that cumulative effects during construction, operation and maintenance, and decommissioning are considered to be of **negligible to minor adverse** significance (not significant in EIA terms).
- 7.4.1.14 It was considered that there was no potential for significant transboundary effects with regard to onshore ecology and nature conservation from Hornsea Three upon the interests of other EEA States.

7.5 Landscape and visual resources

- 7.5.1.1 Landscape and visual resources refers to the physical elements of the landscape, landscape character, areas designated for their scenic or landscape-related qualities and views from publicly accessible locations such as settlements, transport routes, and Public Rights of Way (PRoW).
- 7.5.1.2 The Hornsea Three landscape and visual resources study area includes 5 km buffer around the onshore HVAC booster station and onshore HVDC converter/HVAC substation and a 1 km buffer around the rest of the onshore elements of Hornsea Three (including the onshore cable corridor, construction compounds and storage areas). The baseline information was collated from a series of desk based and field surveys undertaken in 2017 and 2018 to create an accurate picture of baseline conditions, from which the assessment of impacts and effects was made.
- 7.5.1.3 A number of National Seascape Character Areas, National Character Areas, Local Landscape Character Areas, and designated landscapes overlap with the Hornsea Three landscape and visual resources study areas to varying extents. A number of visual resources including settlements, roads, long distance walking routes, PRoW, accessible and recreational landscapes also lie within the Hornsea Three landscape and visual resources study areas. The methods used to assess the potential impacts and significance of effects on landscape and visual receptors have had regard to national standards and guidance.

- 7.5.1.4 During the construction phase the onshore cable corridor would result in temporary short-term landscape and visual impacts which would not be significant. Impacts on landscape character would arise as a result of construction activities such as the digging of cable trenches, HDD works and the removal of short sections of hedgerow and some individual or small groups of trees. However, these impacts would be local nature, over the short term and reversible, with Hornsea Three committed to re-instating landscape features (e.g. hedgerows) following construction. However, some character areas are more sensitive than others, such that effects on landscape character are considered to range from **minor adverse** to **negligible** significance (not significant in EIA terms).
- 7.5.1.5 Although the Hornsea Three onshore cable corridor does not pass directly through any settlements, it does pass within approximately 100 m at its closest point, such that there is a potential for construction activities to impact visual receptors. Impacts would arise from construction activities like excavations, temporary work lighting, individual tree felling, limited hedgerow removal, etc. However, construction activities would occur at one location for no more than three months. Therefore, impacts would be temporary in nature and reversible. Therefore, effects on visual receptors are considered to range from **moderate adverse** to **negligible** significance (not significant to significant in EIA terms).
- 7.5.1.6 Impacts due to the onshore HVAC booster station and onshore HVDC converter/HVAC substation are summarised for the operational phase, when they would be greatest. During the construction phase, the impacts would be short to medium term and temporary, and would not be as great.
- 7.5.1.7 During the operational phase the onshore cable corridor would be buried and thus would not result in any landscape or visual impacts.
- 7.5.1.8 During the operational and maintenance phase, impacts on landscape character within the onshore HVAC booster station site itself would be of **major adverse** significance (significant in EIA terms). Overall effects on the two local landscape character areas which would be affected by the onshore HVAC booster station would be of **minor adverse** to **negligible** significance (not significant in EIA terms). The implementation of mitigation measures designed in to Hornsea Three, such as strategic landscape planting around the perimeter of the HVAC booster station, seeks to minimise impacts such that visual effects due to the onshore HVAC booster station are considered to range from **minor adverse** to **neutral** significance (not significant in EIA terms). See Figure 7.2 for a photomontage showing indicative images of the proposed onshore HVAC booster station at year 1 and year 15.

- 7.5.1.9 Similarly, during the operation phase, impacts on landscape character within the onshore HVDC converter/HVAC substation site itself would be of **major adverse** significance (significant in EIA terms). Overall effects on the two local landscape character areas which would be affected by the onshore HVDC converter/HVAC substation would be of **minor adverse** significance (not significant in EIA terms). The implementation of mitigation measures designed in to Hornsea Three, such as strategic landscape planting around the perimeter of the HVDC converter/HVAC substation, seeks to minimise impacts such that visual effects due to the onshore HVDC converter/HVAC substation would range from **major-moderate adverse** to **neutral** significance (significant to not significant in EIA terms). See Figure 7.3 for a photomontage showing indicative images of the proposed onshore HVDC converter/HVAC substation, including the proposed landscape planting at year 1 and year 15 from a single viewpoint. The only significant visual effects would occur to users of a local PRoW located to the south of the site on completion of development, but these would reduce and not be significant following implementation and maturation of proposed planting (year 15 onwards).
- 7.5.1.10 During operation, the onshore HVAC booster station is not visible from any designated landscapes, whilst the onshore HVDC converter/HVAC substation is only theoretically visible from a very small portion of the Broads National Park. Given the nature of potential impacts of short-term construction activity followed by landscape reinstatement along the Hornsea Three onshore cable corridor, significant effects on designated landscapes are therefore not anticipated.
- 7.5.1.11 During the decommissioning phase, there is the potential for Hornsea Three to cause landscape and visual impacts at the onshore HVDC converter/HVAC substation and HVAC booster station. Landscape impacts would be limited to the onshore HVDC converter/HVAC substation and HVAC booster station sites themselves as the above and below ground structures are removed and the site re-instated. Hornsea Three may cause visual impacts at houses near to the onshore HVDC converter/HVAC substation and HVAC booster station. These would be similar in scale to those during construction but shorter-term resulting in effects of lower significance. The presence of vehicles, plant and machinery on site would give rise to landscape and visual impacts, but these would be restricted to localised and short to medium term, temporary views of demolition and restoration activity, which would not give rise to notable landscape character or visual effects over and above those of the operational site.
- 7.5.1.12 Furthermore, no residential properties would be affected during the construction, operational and maintenance, or decommissioning phases to the extent that Hornsea Three would be sufficiently “oppressive” or “overbearing” that the property would be rendered an unattractive place in which to live.
- 7.5.1.13 The offshore components of Hornsea Three (e.g., the offshore HVAC booster station which is the closest to shore) are located sufficiently distant from the coast that they would not cause any significant landscape or visual effects on land based receptors.
- 7.5.1.14 Cumulative impacts from projects screened into the assessment have been assessed using a tiered approach. No cumulative impacts due to Hornsea Three have been identified.
- 7.5.1.15 It was considered that there was no potential for significant transboundary effects with regard to onshore Landscape and Visual Resources from Hornsea Three upon the interests of other EEA States.



Photomontage view year 1



Photomontage view year 15

Ref: 6117_BS_VP_05


<p>LD Å DESIGN  Hornsea Project Three</p>	<p>Distance to Onshore HVAC booster station: 0.6km OS reference: 610563, 332886</p>	<p>Bearing to Onshore HVAC booster station: 59° Viewpoint height: 62m AOD</p>	<p>Horizontal field of view: Approx. 75° Viewing distance: 300mm @ A3</p>	<p>The Photomontage allows for screening effects of vegetation and buildings. The three dimensional model of Hornsea Three is indicative and is not based on an accurate design.</p>	<p>Onshore HVAC booster station photomontage: Viewpoint BS5 - B1149</p>
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Figure 7.2: Onshore HVAC Booster Station photomontage: Viewpoint BS5 – B1149.



Photomontage view year 1



Photomontage view year 15

Ref: 6117_SS_VP_06

		Hornsea Project Three	Distance to Onshore HVDC converter/HVAC substation: 0.2km OS reference: 621227, 303085	Bearing to Onshore HVDC converter/HVAC substation: 335° Viewpoint height: 40m AOD	Horizontal field of view: Approx. 75° Viewing distance: 300mm @ A3	The Photomontage allows for screening effects of vegetation and buildings. The three dimensional model of Hornsea Three is indicative and is not based on an accurate design.	Onshore HVDC converter/HVAC substation photomontage: Viewpoint SS9 - Mangreen Lane
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Figure 7.3: Onshore HVDC converter/HVAC substation photomontage: Viewpoint SS9 – Mangreen Lane.

7.6 Historic environment

7.6.1.1 The historic environment assessment focuses on impact on buried archaeological remains together with impacts on nearby heritage assets and the historic landscapes.

7.6.1.2 The historic environment study area covers an area of up to 1 km around the onshore elements of Hornsea Three, together with storage areas, compounds and accesses, with a focus on a core study area of 250 m around the onshore elements of Hornsea Three. The baseline information was collated through a desk top review of historic and geological mapping, existing studies and datasets, site visits and walkover surveys. Designated sites were identified through consultation with stakeholders, in particular Historic England and the local planning authorities.

7.6.1.3 Although none of the designated sites are located within the footprint which will be occupied by the onshore elements of Hornsea Three, within historic environment study area:

- 9 scheduled monuments;
- 159 listed buildings. Of these, 5 are listed at Grade I, 25 at Grade II* and 129 at Grade II;
- 4 Registered Parks and Gardens. Three of which are the Grade II* listed:
 - Heydon Hall located approximately 570 m from the storage area north of Heydon Road;
 - Intwood Hall, the grounds of which abuts the onshore cable corridor; and
 - Voewood, located 245 m from the construction access road off bridge road; and
 - Salle Park, located approximately 16 m from the storage area adjacent to Cawston Road, is registered at Grade II.
- 6 Conservation Areas, which are: Weybourne, Kelling, Hempstead, Heydon, Baconsthorpe (Figure 7.4) Blickling and Reepham. These conservation areas contain many of the listed buildings in the area.

7.6.1.4 Construction activities at the Hornsea Three landfall area and along the onshore cable corridor (including storage areas, compounds and accesses) have the potential to result in temporary impacts on the settings of heritage assets by changing the views experienced from SMs, listed buildings, Conservation Areas and registered parks and gardens. However, Hornsea Three would implement a number of mitigation measures included in the Outline CoCP (document reference A8.5) to minimise impacts such that effects were considered to range from negligible to minor adverse significance (not significant in EIA terms).

7.6.1.5 Similarly, construction works at the onshore HVAC booster station and onshore HVDC converter/HVAC substation have the potential to result in temporary impacts on the settings of heritage assets by changing the views experienced from SMs, listed buildings, Conservation Areas and registered parks and gardens. However, Hornsea Three would implement a number of mitigation measures included in the Outline CoCP (document reference A8.5) to minimise impacts such that effects are considered to range from **negligible** to **moderate adverse** significance. Of these, the potentially significant effects of Hornsea Three on the Roman town Venta Icenorum, Gowthorpe Manor House, Mangreen Hall and Church of St Edmund are considered to be **moderate adverse** (significant in EIA terms).



Source: English Heritage, <http://www.english-heritage.org.uk/visit/places/baconsthorpe-castle/>

Figure 7.4: Exterior view of Baconsthorpe Castle.

7.6.1.6 Furthermore, onshore construction activities of Hornsea Three has the potential to result in permanent loss of or damage to, buried archaeological remains. Hornsea Three has sought to avoid archaeological assets which have been identified through desk assessment and fieldwork through route refinement, although other assets may be discovered during construction. With the implementation of a chance find procedure (see Outline CoCP, document reference A8.5) the effect on these assets is considered to be of **minor adverse** significance (not significant in EIA terms).

7.6.1.7 During both construction and operational and maintenance phases the overall effect on the historic landscape, considered to be of **minor adverse** significance (not significant in EIA terms).

7.6.1.8 During operation and maintenance, the onshore HVAC booster station and onshore HVDC converter/HVAC substation has the potential to result in long-term but reversible impacts on the settings of the heritage assets by changing the views experienced from SMs, listed buildings, Conservation Areas and registered parks and gardens. Although during operation, the restoration of hedgerows and landscape planting will have been completed, the effects would be similar to those outlined above for the construction of onshore HVAC booster station and onshore HVDC converter/HVAC substation which is considered to be of **moderate adverse** significance (significant in EIA terms).

- 7.6.1.9 The onshore cable corridor will be buried underground and there are no routine operation and maintenance activities that would cause an impact to the setting of heritage assets or the overall historic landscape.
- 7.6.1.10 During decommissioning, the potential effects from the onshore elements of Hornsea Three in relation to heritage assets including SMs, listed buildings, Conservation Areas and registered parks and gardens is considered to be **negligible** to **minor adverse**, whilst effects on the overall historic landscape are considered to be **negligible** (not significant in EIA terms).
- 7.6.1.11 There are a number of potential cumulative impacts which could arise as a result of Hornsea Three in combination with other planned developments related to the permanent loss of buried archaeological remains during the construction phase, and on the settings of heritage assets during the operational and maintenance phase. Cumulative effects are considered to be of **minor** to **moderate adverse** significance (not significant to significant in EIA).
- 7.6.1.12 Screening of potential transboundary impacts has identified that there was no potential for significant transboundary effects with regard to the historic environment.

7.7 Land use and recreation

- 7.7.1.1 The land use and recreation assessment considers impacts on other land user groups that may be affected, including farmers and recreational users.
- 7.7.1.2 The land use and recreation study area comprises the onshore elements of Hornsea Three, as well as storage areas and compounds, plus a 1 km buffer, together with land and recreational resources immediate proximate to, or linking to these onshore elements, plus a 1 km buffer. The study area for farm holdings considers those farm holdings which may be affected by Hornsea Three and therefore is based on the known ownership boundaries of those farms with land that falls within the onshore elements of Hornsea Three, plus the storage areas and compounds.
- 7.7.1.3 The baseline conditions were collated through a detailed desktop review of existing studies and datasets to identify the known soil types and patterns, agricultural land quality, farm holdings, designated sites, and recreational resources including PRoW (i.e. public footpaths, bridleways and restricted byways). A walkover survey and consultation with the relevant local authorities has also been undertaken to confirm the existing PRoW network.

- 7.7.1.4 The Hornsea Three onshore elements of Hornsea Three cover four landscape regions of Norfolk: the Coastal Plain; Cromer Ridge and Sand-Loam Uplands; the Boulder Clay Plateau; and the river valleys of the Glaven, Bure, Wensum and Yare and their main tributaries. The four landscape regions contain different soils that may be graded using Agricultural Land Classification. This places land into one of five grades, with Grade 1 being the best and Grade 5 the worst, according to the degree to which its physical characteristics impose long term limitations on its agricultural use. Grade 1 land has no or very minor limitations to agricultural use. Whereas, Grade 5 land exhibits very severe limitations which mainly restrict use to permanent pasture or rough grazing.
- 7.7.1.5 The Coastal Plain landscape region is underlain by Marly Drift and the soils are generally graded as 3a. Similarly, in the Cromer Ridge and Sand-Loam Uplands landscape region areas where soil developed in glaciofluvial sands and gravels they are generally graded 3a/4. However, in areas where glaciofluvial sands and gravels are overlain by aeolian drift higher grades of 2/3a occur. In the vicinity of Boulder Clay Plateau landscape region substantial areas of Grade 2 and Subgrade 3a with only minor amounts of Subgrade 3b are prevalent. Lastly, in landscape region of the river valleys of the Glaven, Bure, Wensum and Yare, and their main tributaries, land is generally no better than Grade 4. In terms of farming, the Local Authority areas within which the Hornsea Three onshore elements are situated, are characterised as mainly cereal cropping (60% to 68%).
- 7.7.1.6 A variety of recreation resources are present within the land use and recreation study area. The shingle beach at Weybourne can be accessed by anglers and other visitors from a beach side car park (Figure 7.5), whilst the rivers Wensum and Yare are also popular with anglers, as well as for other water based activities. The land use and recreation study area also encompasses a camping site west of Weybourne, as well as Kelling Heath Holiday Park. Kelling Heath SSSI and Booton Common SSSI and other recreational resources such as Baconsthorpe Castle (Figure 7.4), Salle Park, North Norfolk Railway and the Muckleburgh Military Collection. The land use and recreation study area also crosses, or runs close to, two National Trails, a number of PRoW, a National Cycle Network Route, other cycle routes and informal paths.
- 7.7.1.7 Construction of the onshore elements of Hornsea Three will temporarily impact approximately 44 farm holdings. The construction of the onshore element of Hornsea Three has the potential to cause temporary disruption to farming management, including changes to farm access within individual fields and along local roads, as well as temporary effects on field drainage and irrigation systems. Following construction, the restoration of soils along the Hornsea Three onshore cable corridor would enable the land to be returned to its former agricultural use and returned to the farm holdings of which it forms part. However, there would still be permanent loss of land predominantly from three large arable based farm holdings (those which overlap HVAC booster station and HVDC converter/HVAC substation areas) which is considered to have an effect of **minor adverse** significance (not significant in EIA terms) on farm holdings during operation.



Figure 7.5: Shingle beach near the Hornsea Three landfall area.

7.7.1.8 The loss of the land required for the onshore HVAC booster station and HVDC converter/HVAC substation may also affect the workability of individual holdings, as well as resulting in the permanent loss of the “best and most versatile” land along the Hornsea Three onshore cable corridor. In addition, the construction of the onshore element of Hornsea Three has the potential to impact the Agricultural Land Classification by reducing the soil quality. However, during construction, a Soil Management Strategy (see Outline CoCP, document reference A8.5) would be implemented and temporarily affected land would be restored to its former agricultural use, as far as possible, following the completion of the construction phase. Therefore, the permanent loss of Agricultural Land Classification is considered to be of **moderate adverse** significance (significant in EIA terms).

- 7.7.1.9 During construction of the Hornsea Three landfall area, there would be a temporary impact relating to partially restricted access to the beach at Weybourne. However, with the implementation of a PRoW Management Plan (see Outline CoCP, document reference A8.5), which will include specific beach access management measures, effects are considered to be of **negligible** significance (not significant in EIA terms) on the recreational use of the coast. In respect to impacts on other recreational resources, such as potential route diversions and management measures at local PRoWs, cycle ways and recreational route; use of roads and tracks to the Muckleburgh Military Collection and Foxhills camping site at Weybourne and Kelling Heath; and access land at Bodham, effects are considered to be of **minor adverse** (not significant in EIA terms).
- 7.7.1.10 The only exception to the above is at the Hornsea Three landfall area, where effects of construction works are considered to be of **moderate adverse** significance (significant in EIA terms) on a section of the Peddars Way and Norfolk Coast Path National Trail at Weybourne. Although Hornsea Three has committed to keep these routes open during the construction works, a diversion in the region of up to 600 m may be required, as outlined in PRoW Management Plan (see Outline CoCP, document reference A8.5).
- 7.7.1.11 Following the completion of the construction works all areas of access land, recreational resources, PRoWs and other linear routes affected by the onshore works would be re-instated to their current condition and/or along their current alignments. As such, there would be no physical effects on these resources arising from the operation or maintenance of Hornsea Three.
- 7.7.1.12 During the operation and maintenance phase, the effects of the impacts due to the permanent loss of the best and most versatile land and on farm holdings associated with the onshore HVAC booster station and HVDC converter/HVAC substation is considered to be **minor adverse** and **negligible** to **minor adverse** significance respectively (not significant in EIA terms). The effects of the onshore cable corridor during the operation and maintenance phase is considered to be **minor adverse** significance (not significant in EIA terms).
- 7.7.1.13 During the decommissioning phase, above and below ground structures at the onshore HVAC booster station and HVDC converter/HVAC substation will be removed (including foundations and attenuation storage), the onshore cable corridor will be cut and sealed, and surface features of link boxes will be removed. These activities would not result in any impacts on recreational resources within the Hornsea Three land use and recreation study area although where appropriate, traffic management measures would be implemented (similar to those identified for construction) should access to the onshore HVAC booster station and HVDC converter/HVAC substation sites need to cross any PRoWs or other linear recreational routes. In respect to land use, the effects during decommissioning on farm holdings and Agricultural Land Classification are considered to be of **minor adverse** significance (not significant in EIA terms).

- 7.7.1.14 There are a number of potential cumulative impacts which could arise as a result of Hornsea Three in combination with other planned developments related to the Agricultural Land Classification and the workability of farm holdings. The cumulative effect on Agricultural Land Classification is considered to be of **moderate adverse** significance (significant in EIA terms), while the cumulative effect on farm holdings is of **minor adverse** significance (not significant in EIA terms). The cumulative effects on access land, recreational resources, PRoW and other linear routes is considered to be of **minor adverse** significance (not significant in EIA terms).
- 7.7.1.15 It was considered that there was no potential for significant transboundary effects with regard to onshore land use and recreation from Hornsea Three upon the interests of other EEA States.

7.8 Traffic and transport

- 7.8.1.1 The traffic and transport assessment relates to the traffic movements associated with the project, these being the movement of construction workers, equipment, materials, abnormal loads and traffic movements associated with operation, maintenance and decommissioning of the onshore infrastructure. The temporary impacts of these vehicles on driver delay, severance of routes, pedestrian delay, pedestrian amenity, accidents and road safety, and hazardous, dangerous and abnormal loads during construction works have been assessed in line with IEMA guidance.
- 7.8.1.2 The traffic and transport study area in relation to transport includes all highways, PRoW, private accesses and railways in the vicinity of the onshore elements of Hornsea Three that are anticipated to be used by construction, operation and maintenance, and decommissioning traffic. The traffic and transport study area also includes parts of the wider transport networks which provide links onshore elements of Hornsea Three (including the compounds, storage areas, construction accesses) and the strategic transport networks, rail terminals and port facilities.
- 7.8.1.3 Baseline traffic flows were identified using manual and automatic traffic counts and have been established within a study area that extends from the A148 at Fakenham to the A149 at Cromer, following the A1067 and A140 to the south to the Norwich ring road. Observations indicate that there are no existing highway capacity problems in this area under annual average conditions. Access to the onshore elements of Hornsea Three has been assumed to be via the A148 west, A1065, A11, A140, A146 and A47 west. and A140/B1145 four-arm roundabout at Aylsham. In addition, sustainable mode of travel which could be impacted by Hornsea Three have also been identified. Finally, PIA data obtained from Norfolk County Council has been used to consider the road safety record of the Traffic and Transport study area. The baseline has also been informed by consultation and the baseline information used in the assessment has been agreed with the Local Highways Authority (Norfolk County Council).

- 7.8.1.4 During the construction phase, the percentage change in daily two-way traffic flows were calculated based upon the numbers of total vehicles and heavy goods vehicles predicted as a result of Hornsea Three. The impact of these changes upon driver delay, severance of routes, pedestrian delay, accidents and road safety, and hazardous, dangerous and abnormal loads during construction works is considered to be of **negligible** and the effects of pedestrian amenity would be **minor adverse** significance (not significant in EIA terms).
- 7.8.1.5 The level of vehicles generated during the operation and maintenance phase will be very low and irregular, with only a few vehicle movements anticipated per week (typically in the order of 1 a week). Therefore, there will be no significant effects resulting from the traffic generated during the operational and maintenance phase.
- 7.8.1.6 During the decommissioning phase, it is considered that the impacts of Hornsea Three on traffic and transport will not result in any effects with a greater significance than those of the construction phase. Therefore, the assessment of the decommissioning phase has been undertaken on precautionary basis. The effect of Hornsea Three on driver delay, severance of routes, accidents and road safety, and hazardous, dangerous and abnormal indivisible loads will be of **negligible** significance, which is not significant in EIA terms. For pedestrian amenity, the effect will be of **minor adverse** significance, which is not significant in EIA terms.
- 7.8.1.7 There are a number of potential cumulative impacts which could arise as a result of Hornsea Three in combination with planned developments related to traffic flows on the road network. Based on a review of estimated traffic generation from the cumulative developments (taken from their respective transport document submissions), in combination with the Hornsea Three construction traffic flows, the resultant cumulative percentage impacts were calculated. The cumulative effects were considered to be of **negligible to minor adverse** significance (not significant in EIA terms).
- 7.8.1.8 It was considered that there was no potential for significant transboundary effects with regard to onshore traffic and transport from Hornsea Three upon the interests of other EEA States.

7.9 Noise and vibration

- 7.9.1.1 Noise and vibration considers the potential effects from noise and vibration generated during the construction, operation and decommissioning of the onshore elements of Hornsea Three, together with storage areas, compounds and accesses.
- 7.9.1.2 For the construction and decommissioning phase, the Hornsea Three noise and vibration study area considers noise and vibration sensitive receptors (including PRoW) within approximately 1 km of the onshore elements of Hornsea Three, together with storage areas, compounds and accesses. For the operational phase, the noise and vibration study area considered receptors within approximately 1 km from the onshore HVDC converter/HVAC substation and HVAC booster station.

7.9.1.3 The baseline information was collated from site specific surveys were used to establish the baseline sound levels (see volume 6, annex 8.1: Baseline Noise Survey) at locations representative of the noise sensitive receptors potentially most affected by the proposed onshore HVAC booster station and the HVDC converter/HVAC substation (see Figure 7.6 for typical monitoring equipment).



Figure 7.6: Noise monitoring equipment.

7.9.1.4 There are no international, national or local designations specifically related to noise and vibration. It should be noted, however, that low noise levels within rural areas (such as the noise and vibration study area) and areas of specific natural interest (such as public access woodland) are often key features of the environment and as such, should be considered in the determination of significance of noise impacts on receptors within these areas.

7.9.1.5 During construction, Hornsea Three will generate noise which has the potential to disturb noise sensitive receptors. However, Hornsea Three has committed to implement mitigation measures set out in an Outline CoCP (document reference A8.5), including consideration of selection of quieter plant and equipment, acoustic barriers around noisy equipment, and management of core working hours), which will be further defined in consultation with the relevant stakeholders. With the implementation of mitigation measures, the noise and vibration effects from the construction of Hornsea Three is considered to be of **negligible to minor adverse** significance (not significant in EIA terms).

7.9.1.6 During the operation and maintenance phase, the onshore HVAC booster station and HVDC converter/HVAC substation will generate noise from the functioning of the equipment which also has the potential to impact noise sensitive receptors. However, Hornsea Three has committed to mitigation included in the design of the onshore HVDC converter/HVAC substation and HVAC booster station to achieve a noise rating level such that no significant noise impact would occur at NSRs. With these mitigation measures in place, the effect of the onshore HVAC booster station and HVDC converter/HVAC substation during operation was considered to be of **minor adverse** significance (not significant in EIA terms).

7.9.1.7 During decommissioning, the equipment and activities used are likely to be broadly similar to those used during construction with the exception of the cable which would be left in place, with the ends cut and sealed. Therefore, the effect of the temporary impacts of decommissioning the onshore HVDC converter/HVAC substation and HVAC booster station is considered to be of **negligible to minor adverse** significance (not significant in EIA terms).

7.9.1.8 There are a number of potential cumulative impacts which could arise as a result of Hornsea Three in combination with planned developments related to noise. However, with standard mitigation measures implemented, the cumulative effects are considered to be of **negligible to minor adverse** significance (not significant in EIA terms).

7.9.1.9 It was considered that there was no potential for significant transboundary effects with regard to onshore noise and vibration from Hornsea Three upon the interests of other EEA States.

7.10 Air quality

- 7.10.1.1 The air quality assessment considers the potential changes in air quality as a result of the project, in relation to exhaust emissions and dust. Dust is considered in respect to both the suspended particulate matter (PM₁₀) fraction in the air that can be breathed, and the deposited dust that has fallen out of the air onto surfaces and which can potentially cause temporary annoyance effects. Exhaust emissions from traffic are considered in respect to the main pollutants with potential for local air quality impacts, which are nitrogen oxides (NO_x) and particulate matter (PM₁₀).
- 7.10.1.2 There are two study areas used within the Hornsea Three air quality assessment. The study area for the Hornsea Three air quality (construction dust) assessment comprises a 350 m buffer around the onshore elements of Hornsea Three, whilst the Hornsea Three air quality (traffic emissions) study area comprises a 500 m buffer along the main road network to be used during the construction of Hornsea Three. In addition air quality (traffic emissions) study area includes any roads where it has been predicted that there would be 100 or more daily HGV movements as a result of Hornsea Three.
- 7.10.1.3 The baseline information was collated from a detailed desk top study, including reference to local monitoring studies or from national or government sources, including Defra's national pollution maps. The concentrations of exhaust emissions, larger dust particles and smaller dust particles were found to be well below the objectives set by the National Air Quality Strategy to protect health. A risk based assessment approach has been used for impacts on air quality caused by Hornsea Three.
- 7.10.1.4 There is potential for construction activities to temporarily impact receptors sensitive to dust (human and ecological), in terms of dust soiling and impact on human health and ecological receptors. However, Hornsea Three has committed to implementing the Institute of Air Quality Management (IAQM) recommended dust control. This includes fully enclosing site or specific operations where there is a high potential for dust production and the site is active for an extended period; covering, seeding or fencing stockpiles to prevent wind whipping; and avoiding bonfires and burning of waste materials. Therefore, the construction effects on dust sensitive receptors is **not significant**.
- 7.10.1.5 Construction traffic generated during the construction phase may also affect human and ecological receptors. However, it is anticipated that the predicted increase in traffic will likely result in negligible air quality impacts at any given receptor along the affected roads, as the pollutants produced will likely not exceed Air Quality Strategy objectives. The effect of construction traffic on human and ecological receptors is therefore considered to be **negligible** (not significant in EIA terms).
- 7.10.1.6 During operation, Hornsea Three is not expected to generate any air emissions during normal operational activities. Although a small number of staff trips associated with occasional maintenance vehicle movements may be required, the number of vehicle movements generated would be considerably smaller than those for the construction phase and well below the IAQM indicative thresholds which indicate when a more detailed air quality assessment is required. Therefore, there will be no significant effects relating to air quality during the operational and maintenance phase and a more detailed assessment was scoped out of the EIA.

- 7.10.1.7 During decommissioning, there is also the potential for activities to temporarily impact receptors sensitive to dust. With the application of controls similar to that implemented during construction, the risk of impacts would be expected to be reduced such that the effect is **not significant**.
- 7.10.1.8 There are a number of potential cumulative impacts which could arise as a result of Hornsea Three in combination with planned developments related to air quality impacts affecting receptors sensitive to dust. The greatest issue in relation to local air quality effects is likely to be temporary disturbance caused by the deposition of dust during the construction phase. However, it is reasonable to assume that the cumulative developments would implement the recommended IAQM dust controls, such that the cumulative effect is **not significant**.
- 7.10.1.9 Given that air quality impacts on onshore receptors arising from Hornsea Three will be confined to a localised area within, or in close proximity to (less than 350 m), the project, there is no pathway by which impacts arising from Hornsea Three could cause a significant effect on onshore receptors of another member state. Thus, it was considered that there was no potential for significant transboundary effects with regard to air quality from Hornsea Three upon the interests of other EEA States.

7.11 Socio-economics

- 7.11.1.1 The socio-economic assessment presents the considerations for the assessment of socio-economic impacts, drawing on an economic model which quantifies the additional economic activity and employment which could arise across the UK and in areas local to the development as a result of the construction, operation and decommissioning activity. This will be achieved by considering the effect of the Hornsea Three development on the following socio-economic indicators against current baseline conditions: economic activity as measured through gross value added; employment creation; business sectors affected by the construction, operation and maintenance, and decommissioning of the wind farm (i.e. the supply chain); the volume and value of tourism activity; and measures of community vitality and viability (e.g. changes in demand for local housing, accommodation and services). The assessment considers the impact of both the onshore and offshore elements of Hornsea Three.
- 7.11.1.2 A selection of a port for construction and operation will only be made post-consent and therefore the Hornsea Three socio-economic assessment includes two separate impact areas for employment and Gross Value Added (GVA) related effects. The socio-economics study area includes the New Anglia Local Enterprise Partnership (LEP), a relatively large impact area covering 14 separate local authority districts in Norfolk and Suffolk, and Humber LEP area which includes Hull, East Riding, North Lincolnshire and North East Lincolnshire. The baselines in the study areas were assessed through a desktop study of various data sources, in particular the Office of National Statistics. LEPs are partnerships set up between local authorities and businesses, in order to help drive and encourage collaborative working between business and Government, to deliver economic priorities and lead economic growth and job creation.

- 7.11.1.3 The New Anglia LEP area has a historic energy presence, with the offshore gas production and the emerging renewables sector. Of the New Anglia population, 60% is of working age which is slightly lower than the national level of 63%. However, of the population that is of working age, 80% are economically active and 77% are employed, which is higher than the national figures of 78% and 74% respectively. This is reflected by the fact that 3.5% of the population are unemployed with 1.3% claiming out of work benefits, which is lower than the national averages of 5% and 1.9% respectively. These employment figures for the New Anglia LEP area are above the national average, but on average residents and workers generally earn less than is typically the case nationally. This is echoed by a lower number of level 4 qualifications, a higher number of people with no qualifications, and that lower skill professions are overrepresented. Some local areas like Great Yarmouth and North Norfolk consistently underperform, illustrating a lack of opportunity in these areas. However, some of these areas, particularly Great Yarmouth, have the greatest potential to benefit from Hornsea Three given their supply chain capacity and capability. For example, the LEP area has seen a series of planned investments in the offshore wind locally: Statoil's Operations Centre for Dudgeon Offshore Wind Farm in Great Yarmouth, Lowestoft will be used as the construction base for Galloper Wind Farm, and Siemens have set up a base in Great Yarmouth. New Anglia is also home to one of six Centres for Offshore Renewables Engineering in Great Yarmouth and Lowestoft which are designed to attract investment in wind farm assembly and manufacturing.
- 7.11.1.4 Humber LEP area is a built-up area with an industrial heritage. Historically, it suffers from socio-economic challenges but with a strong and growing renewable energy sector and significant investments in recent years to develop its offshore wind sector and which has enhanced its potential to benefit from Hornsea Three. All of the labour market indicators for Humber LEP area are lower than the national averages despite 62% of the population being working age, only slightly lower than the national level of 63%. This is exemplified by the low employment density of 651 jobs per 1,000 working age residents, which is 61 jobs per 1,000 residents lower than the national average. The unemployment rate of 6.3% is slightly above the national average of 5.0%, although there are parts of the LEP area where the rate is higher.
- 7.11.1.5 Residents and workers in the Humber LEP area earn less than the UK average, which reflects the focus of the employment base on activities which generate lower levels of value added and wealth. However, Humber LEP area has benefitted from several offshore wind developments in recent years, building on its existing industry strengths and further capabilities. These include: Siemens and its blade manufacturing facility in Hull; REDS Maritime providing cable remediation and support services; GEV Wind Power – a turbine maintenance company, and other key energy players such as Sprit Energy, Total and BP. In addition, pre-existing sectors within the Humber LEP (e.g. manufacturing) could benefit from construction, and operation and management of Hornsea Three.
- 7.11.1.6 During the construction phase of the Hornsea Three onshore elements, there would be potential for impacts in the Humber Local Study Area in relation to employment, GVA, access to employment among local residents, and the performance of the renewable energy sector, of **minor to major beneficial** significance (not significant to significant in EIA terms), dependant of the impact scenario accounted for.
- 7.11.1.7 During the operation and maintenance phase, there is potential for both Local Study Areas to experience impacts of **major beneficial** significance (significant in EIA terms) in relation to employment creation and access to employment among local residents, under the high impact scenario.
- 7.11.1.8 Potential adverse impact has been identified on the demand for housing, accommodation and local services during construction and operation and maintenance caused by influx of workers from outside of the local. However, in general, capacity exists for increased demand for temporary accommodation. These effects are expected to be **negligible** (not significant in EIA terms).
- 7.11.1.9 In addition, potential adverse impacts have been identified on offshore and coastal tourism and recreation, and local tourism and recreational resources, and PRoW. Disruption caused by construction of Hornsea Three has the potential to displace offshore and coastal tourism and recreation activity to areas which are not affected by the construction of Hornsea Three. However, with mitigation measures outlined the relevant subject areas (volume 6, chapter 4: Landscape and Visual Resources, chapter 6: Land Use and Recreation), for example the PRoW Management Plan (see Outline CoCP, document reference A8.5, the effect is considered to be of **minor adverse** significance (not significant in EIA terms).
- 7.11.1.10 Given the uncertainty that exists in relation to the decommissioning activity, the assessment of the effects associated with this phase have been assessed in a qualitative manner. It is anticipated that the nature of the socio-economic impact would be similar to that occurring during the construction phase, although the magnitude of impact and significance of effects are likely to be more limited.
- 7.11.1.11 The cumulative effects of other developments which are expected to be constructed and operated in a similar period to Hornsea Three could result in beneficial effects across a number of receptors. There is however a great deal of uncertainty associated with the effects highlighted under the cumulative assessment, which should be taken into account when interpreting this.
- 7.11.1.12 The chapter provides the assessment of effects of Hornsea Three on tourism volume and value, which will not be dependent on the UK content evidence. The assessment identified potential adverse impacts on tourism activity, however, these impacts are not expected to be significant in EIA terms.

7.12 Inter-related effects (onshore)

- 7.12.1.1 The EIA for Hornsea Three has also assessed the potential for inter-related effects to arise. Inter-related effects are defined as multiple effects upon the same receptor arising from Hornsea Three. These occur either where a single effect acts upon a receptor over time to produce a potential additive effect or where a number of separate effects interact to affect a single receptor, for example noise and vibration, visual effects and traffic related impacts for people living in dwellings within 350 m of the Hornsea Three offshore cable corridor during the construction phase.
- 7.12.1.2 Potential inter-related effects have been identified based on the detailed assessments undertaken in the individual Environmental Statement chapters, for example, disruption, visual effects and noise on PRoW users. However, given the temporary and small scale nature of effects, and also factoring in proposed measures adopted as part of the project, the overall significance of any inter-related effects was not judged to increase the individual effects assessed in the topic-specific chapters.

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