



Hornsea Project Four: Preliminary Environmental Information Report (PEIR)

Volume 5, Annex 2.2: Water Framework Directive Assessment

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Glossary

Term	Definition
Ballast Water	Fresh or saltwater, sometimes containing sediments, held in tanks and cargo holds of ships to increase stability and manoeuvrability during transit.
Bathing Water	Fresh or sea waters in which bathing is either explicitly authorised or is not prohibited and is traditionally practised by a large number of bathers.
Entrainment	The entrapment of organisms in a water body.
Intertidal	An area of seashore that is covered at high tide and uncovered at low tide.
Nutrient Sensitive Water	A designation of the Environment Agency for waters that are sensitive to pollution from macronutrients (i.e. nitrates and phosphates).
Shellfish Water	Waters suitable for the cultivation of shellfish (e.g. cockles or oysters).
Subtidal	Area extending from below the low tide mark.

Acronyms

Acronym	Definition
AEol	Adverse Effect on Integrity
BW	Bathing Water
BWD	Bathing Water Directive
cBWD	Current Bathing Water Directive
DCO	Development Consent Order
EA	Environment Agency
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
EQS	Environmental Quality Standard
EQSD	Environmental Quality Standards Directive
ES	Environmental Statement
EU	European Union
HDD	Horizontal Directional Drilling
HMWB	Heavily Modified Waterbody
IE	Intestinal Enterococci
INNS	Invasive and Non-Native Species
LSE	Likely Significant Effect
MAGIC	Multi-Agency Geographic Information for the Countryside
MHWS	Mean High-Water Springs
NSIP	Nationally Significant Infrastructure Project
NSW	Nutrient Sensitive Water
O&M	Operation and Maintenance
PEIR	Preliminary Environmental Information Report
PINS	The Planning Inspectorate
RBMP	River Basin Management Plan
rBWD	Revised Bathing Water Directive
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
SFW	Shellfish Water

Acronym	Definition
SoS	Secretary of State
SPA	Special Protection Area
SSC	Suspended Sediment Concentration
WFD	Water Framework Directive
WTG	Wind Turbine Generator

Units

Unit	Definition
km	Kilometre
m	Metre
ml	Millilitre
nm	Nautical Mile
pH	Acidity

1 Introduction

1.1 Project background

1.1.1.1 Ørsted Hornsea Project Four Ltd (the Applicant) is proposing to develop the Hornsea Project Four offshore wind farm (hereafter Hornsea Four). Hornsea Four will be located approximately 65 km offshore from the East Riding of Yorkshire coast in the Southern North Sea and will be the fourth project to be developed in the former Hornsea Zone (please see [Volume 1, Chapter 1: Introduction](#) for further details on the Hornsea Zone). Hornsea Four will include both offshore and onshore infrastructure including offshore generating stations (within the wind farm), export cables to the landfall, and connection to the electricity transmission network (please see [Volume 1, Chapter 4: Project Description](#) for full details on the Project Design). The location of Hornsea Four is illustrated in [Figure 1](#). The Preliminary Environmental Information Report (PEIR) boundary combines the search areas for the onshore and offshore infrastructure.

1.2 Aims and objectives

1.2.1.1 This document has been prepared by GoBe Consultants Ltd to present the findings of the Water Framework Directive (WFD) Assessment for the potential impacts of the proposed Hornsea Four. This document details the assessment for the transitional and coastal WFD bodies. A separate WFD assessment has been included for onshore waterbodies and groundwater and is incorporated within [Volume 6, Annex 2.3: Water Framework Directive Compliance Assessment](#).

1.2.1.2 The Environment Agency (EA) is currently aiming to achieve 'good status' in at least 60% of waters by 2012 and in as many waters as possible by 2027. 'Good status' comprises two parts – the first is 'good ecological status' (or 'good ecological potential', for waterbodies classed as heavily modified or artificial), and the second is 'good chemical status'. 'Good ecological status/potential' includes biological, hydromorphological and physicochemical quality elements and specific pollutants, whereas 'good chemical status' concerns a series of priority substances (including priority hazardous substances). The WFD also requires that relevant protected area objectives are achieved (EA, 2017).

2 Policy and Legislative Context

2.1 Introduction

2.1.1.1 The following section provides information regarding the legislative context surrounding the assessment of potential effects in relation to the WFD.

2.2 Water Framework Directive

2.2.1.1 The European Union (EU) WFD (2000/60/EC) was established in the year 2000 in order to provide a single framework for the protection of surface waterbodies (including rivers, lakes, coastal waterbodies (out to 1 nm) and estuaries) and groundwater. Each waterbody has an assigned ecological status (see [Section 6.3](#)), which is assigned by considering the biological, hydromorphological and chemical environment of the waterbody. The different ecological statuses are:

- High;
- Good;

- Moderate;
- Poor; and
- Bad.

2.2.1.2 The current WFD status for each water body is set out in the 2015 River Basin Management Plans (RBMPs). There are eight RBMPs which cover watercourses and coastal waterbodies in England and Wales. The proposed development of Hornsea Four is encapsulated within the Humber River Basin District RBMP (Environment Agency, 2015) which has been reviewed to inform this assessment. This assessment aims to ensure that the proposed development complies with the requirements under the WFD and to ensure no deterioration in quality (as presented in the Humber RBMP) of the protected areas and water bodies.

2.2.1.3 Monitoring of the aquatic environment in relation to physical, chemical and biological parameters started in 2006 with a view to ensuring a 'good ecological status' of all surface waterbodies. Chemical and biological environmental quality indicators are used, and a programme of measures is implemented in order to improve surface waters that do not meet the required status.

2.2.1.4 The WFD's objective of 'good chemical status' is defined in terms of compliance with all the quality standards, within the waterbody, as established for chemical substances at a European level. The directive also provides a process for renewing these standards and establishing new ones by means of a prioritisation mechanism for hazardous chemicals. This will ensure at least a minimum chemical quality, particularly in relation to very toxic substances.

2.2.1.5 The WFD's objective of 'good ecological status' also requires certain chemical conditions. The chemical requirements include the achievement of environmental quality objectives for discharged priority substances and for any other substances liable to cause pollution and identified as being discharged in significant quantities.

2.2.1.6 The Environmental Quality Standards Directive (EQSD) list¹ identifies priority substances and polluting chemical which should be considered in WFD Assessments for estuarine and coastal waters. The WFD and EQSD seeks to reduce these substances entering into the marine environment, primarily from discharges and outfalls. Priority substances include benzene, nickel and lead.

2.2.1.7 A WFD Assessment of the potential for Hornsea Four to have a significant non-temporary effect on WFD parameters at a waterbody level has been undertaken using the Environment Agency (EA) 'Clearing the Waters for All' guidance (Environment Agency, 2016). This has been carried out based on information detailed in **Volume 1, Chapter 4: Project Description**.

2.2.1.8 This assessment is reliant upon identifying those effects that are non-temporary which, for the purposes of this assessment is defined as:

'A period of time that is greater than the recommended monitoring period interval as stated by the WFD (2000/60/EC).'

¹ <https://www.gov.uk/government/publications/list-of-chemicals-for-water-framework-directive-assessments/environmental-quality-standards-directive-eqsd-list-for-wfd-assessments>

2.2.1.9 Different monitoring periods are defined for different parameters under the WFD. In this assessment, the monitoring period interval is aligned with that of the RBMP, which is understood to be six years.

2.3 Shellfish Waters Directive

2.3.1.1 The WFD incorporates the Shellfish Waters Directive which aims to protect and improve water quality and support the growth of healthy shellfish and contribute to good quality edible shellfish.

2.3.1.2 The original Directive 'Council Directive 79/923/EEC of 30th October 1979 on the quality required of Shellfish Waters (SFWs) as amended by Council Directive 91/692/EEC (further amended by Council Regulation 1882/2003/EC)', known as the Shellfish Waters Directive, was designed to protect the aquatic habitats of bivalve and gastropod molluscan species of shellfish. It sets out standards for various parameters that should be monitored in designated shellfish areas. It has since been superseded by 'Directive 2006/113/EC of the European Parliament and of the Council of 12th December 2006 on the quality required of shellfish waters'.

2.3.1.3 The Directive establishes parameters applicable to designated SFWs, as well as indicative values, mandatory values, reference methods of analysis and the minimum frequency for taking samples and measurements. These parameters are set for pH, temperature, salinity and the presence or concentration of certain substances (dissolved oxygen, hydrocarbons, metals, organohalogenated substances etc.).

2.3.1.4 The competent authorities for each member state must take samples from the waters to verify their conformity with the criteria set by the Directive, with the following proportions of samples conforming to the established values:

- 100% of samples for the parameters 'organohalogenated substances' and 'metals';
- 95% of the samples for the parameters 'salinity' and 'dissolved oxygen';
- 75% of the samples for the other parameters; and
- No evidence of harm to the shellfish from organohalogenated substances.

2.3.1.5 Additionally, the Directive stipulates that a discharge should not cause an increase in suspended solids exceeding 30% above background levels, as shellfish can be adversely affected by the effects of sediment smothering.

2.3.1.6 The status of the SFWs within 2 km of Hornsea Four are presented in [Section 6.3](#) of this annex.

2.4 Bathing Water Directive

2.4.1.1 The EU's revised Bathing Water Directive (rBWD) came into force in March 2006 and replaced the 'current Bathing Water Directive (cBWD)' (76/1160/EEC). The rBWD provides more stringent standards than the cBWD and places an emphasis on providing information to the public.

2.4.1.2 The rBWD has four different classifications of performance, these are:

- Excellent – the highest, cleanest class;

- Good – generally good water quality;
- Sufficient – the water meets minimum standards; and
- Poor – the water has not met the minimum required standards.

2.4.1.3 The EA measures, monitors and reports the number of certain types of bacteria which may indicate the presence of pollution, mainly from sewage or animal faeces, these are *Escherchia coli* (*E. coli*) and intestinal enterococci (IE). An increase in the concentrations of these bacteria indicates a decrease in water quality. [Table 1](#) presents the microbiological standards for the different classifications.

2.4.1.4 The EA collect approximately 20 samples from each Bathing Water (BW) each year during the bathing season (15th May to 30th September in England). An overall classification for the BW is then determined by creating a distribution from the monitoring data for the last four years (4 years x 20 samples = distribution of 80 samples). A separate distribution is calculated for both *E. coli* and IE. The 95th and 90th percentile values from each distribution are calculated. This then enables the determination of the classification for each bacterium for the BW. Therefore, activities from Hornsea Four have the potential to affect the BW classifications for up to four bathing seasons after the proposed activities commence.

2.4.1.5 If the classification for each type of bacteria is different, then the overall compliance of the BW is the lowest classification achieved. For example, if *E. coli* were performing at 'Good' but IE was performing at 'Sufficient', then the BW would be classified as performing at 'Sufficient'.

Table 1: rBWD classifications.

Classification	E. Coli		IE	
	No. per 100 ml	Percentile*	No. per 100 ml	Percentile*
Excellent	250	95	100	95
Good	500	95	200	95
Sufficient	500	90	185	90
Poor	>500	90	>185	90

*A percentile is a measure used in statistics indicating the value below which a given percentage of observations in a group of observations fall.

2.4.1.6 The status of the BWs within 2 km of Hornsea Four are presented in [Section 6.3](#) of this annex.

2.5 Requirement to consider the WFD in the context of the Planning Act 2008

2.5.1.1 Consideration of the WFD (2000/60/EC) is required for any Development Consent Order (DCO) application. Consideration is specifically for Nationally Significant Infrastructure Projects (NSIPs) in coastal and estuarine environments which have the potential to cause deterioration in the ecological and chemical status of a waterbody or have the potential to compromise improvements which might otherwise lead to a waterbody meeting its WFD objectives.

2.5.1.2 The WFD aims to protect and enhance waterbodies within Europe and covers all estuarine and coastal waters out to 1 nautical mile (nm).

3 Consultation

3.1.1.1 A WFD Screening Assessment was submitted as Annex E to the Scoping Report (Ørsted, 2018). A formal Scoping Opinion was sought from PINS following the submission of the Scoping Report (Ørsted, 2018). No comments were received as part of the Scoping process in relation to the offshore elements of the WFD Assessment. Comments relating to the onshore elements are addressed in [Volume 6, Annex 2.3: Water Framework Directive Compliance Assessment](#).

4 Project Overview and Parameters for Assessment

4.1.1.1 This WFD Assessment focuses on those elements of Hornsea Four of relevance to the offshore/ coastal areas designated for WFD consideration. As such, the construction activities of relevance relate to the proposed activities below Mean High Water Springs (MHWS). An assessment of inland WFD waterbodies is presented in [Volume 6, Annex 2.3: Water Framework Directive Compliance Assessment](#). Full details of the proposed offshore activities are presented in [Volume 1, Chapter 4: Project Description](#).

4.1.1.2 Hornsea Four will comprise of Wind Turbine Generators (WTGs) and all infrastructure required to transmit the power generated by the WTGs to the national grid network via the grid connection. It will also comprise any infrastructure required to operate and maintain Hornsea Four.

4.1.1.3 The minimum distance between the Hornsea Four array area and the coastline is 65 km, and so the activities associated with the array will not be undertaken in any WFD waterbodies. Therefore, the components and activities relevant to this WFD Assessment are limited to the offshore export cables which will transfer power from the offshore substations to shore and then onwards to the onshore substation at Creyke Beck. Up to six export cables will be required for Hornsea Four, located in the Export Cable Corridor (ECC), which will make landfall on the Yorkshire Coast, south of Bridlington.

4.1.1.4 The exact location and orientation of the offshore export cables will be determined during an iterative route planning process following the granting of the DCO. For the purposes of this assessment, the PEIR boundary ([Figure 1](#)) has been used for the relevant activities and components.

4.1.1.5 Drawing on the information presented in [Volume 1, Chapter 4: Project Description](#), the primary effects associated with the installation of the Hornsea Four offshore export cables that are considered to be relevant to the WFD Assessment are:

- Preparatory works including boulder clearance and sandwave clearance;
- Offshore cable installation via trenching, dredging, jetting, ploughing or vertical injection;
- The installation of the export cables at the cable landfall across the intertidal areas via Horizontal Directional Drilling (HDD) or open-cut trenching; and
- Cable rock-berm protection of a maximum width on the seabed of 10.4 m and height of 1.5 m above the seabed.

4.1.1.6 The worst-case design scenario for the relevant WFD receptors have been considered within this assessment.

5 Assessment Methodology

5.1 Assessment process

5.1.1.1 This WFD Assessment has been undertaken following the latest EA (2017) 'Clearing the Waters for All' guidance for assessing impacts in estuarine (transitional) and coastal waters for the WFD. The guidance has been followed for screening, scoping and impact assessment. Based on the EA (2017) guidelines, a WFD Assessment can have up to three stages, with the need to undertake later stages of the assessment dependent on the outcomes of the preceding stages. The three stages are:

- **Stage 1** – WFD screening – to determine if there are any activities associated with the Proposed Development that don't require further consideration, for example activities which have been ongoing since before the current RBMP plan cycle and which have thus formed part of the baseline;
- **Stage 2** – WFD scoping – to identify risks of the proposed development activities to receptors based on the relevant water bodies and their water quality elements (including information on status, objectives, and the parameters for each water body); and
- **Stage 3** – WFD impact assessment – a detailed assessment of water bodies and their quality elements that are considered likely to be affected by the proposed development, identification of any areas of non-compliance; consideration of mitigation measures, enhancements, and contributions to the RBMP objectives. Where the potential for deterioration of water bodies is identified, and it is not possible to mitigate the impacts to a level where deterioration can be avoided, the project would need to be assessed in the context of Article 4.7 of the Directive (see Section 4 of this Advice Note for further advice on derogation). Where a derogation is necessary, Applicants will need to provide the necessary information to justify their case, bearing in mind that Applicants must always seek to avoid deterioration of the water environment. It is a matter for the Secretary of State (SoS) to consider whether derogation under Article 4.7 is justified in relation to a proposed development.

5.2 Screening

5.2.1.1 According to the EA 'Clearing the Waters for All' guidance (EA, 2017), Hornsea Four is categorised as a new project (i.e. one which has started after January 2009 and not included in the relevant RBMP). As a result, Hornsea Four is not required to complete a screening stage and therefore is required to commence at the scoping stage. However, initial screening information is necessary as part of the scoping stage and therefore this stage is still often completed in practice in order to inform the WFD scoping. Additionally, screening the construction and Operations and Maintenance (O&M) activities of projects enables a high-level initial assessment of those activities that could impact on compliance parameters within WFD waterbodies.

5.2.1.2 Screening has been undertaken in this assessment to inform the scoping phase and is presented in [Section 6](#) of this document. Proposed activities for Hornsea Four are presented in [paragraph 4.1.1.5](#).

5.3 Scoping

5.3.1.1 The scoping stage identifies the receptors that are potentially at risk from the proposed activity and therefore may need impact assessment. At the scoping stage, it is necessary to

identify all potential risks to each receptor associated with the proposed activity/activities. The receptors are:

- Hydromorphology;
- Biology – habitats;
- Biology – fish;
- Water quality; and
- Protected areas.

5.3.1.2 Invasive and Non-Native Species (INNS) must also be considered during the scoping stage.

5.4 Impact assessment

5.4.1.1 Following the scoping stage, if it is determined that the impact assessment stage is required, i.e. a receptor cannot be scoped out, the EA (2017) guidance sets out that an impact assessment should be undertaken for each receptor identified as being at risk from the activity. The impact assessment should consider what (if any) pressures the activity may create on the marine environment and specifically the receptors identified. The key aim of the impact assessment is to determine whether there is potential for deterioration in the status of the waterbody receptor.

5.4.1.2 Deterioration is defined as when the status (ecological or chemical) of a quality element reduces by one class, for example, ecological quality elements move from 'good' to 'moderate' status. If a quality element is already at the lowest status (Bad), then any reduction in its condition also counts as deterioration. According to the EA (2017) guidance, temporary effects due to short-duration activities like construction and maintenance are not considered to cause deterioration if the waterbody would recover in a short time without any restoration measures. Where relevant, mitigation measures should be included to avoid or minimise risks of deterioration.

5.4.1.3 If the activity may cause deterioration, either of the quality element or supporting habitat, an explanation must be provided of how this deterioration could occur, including consideration of whether the impact is:

- Direct and immediate – it will happen at the same time and place as the activity; or
- Indirect – it will happen later or further away, including in other linked waterbodies.

5.4.1.4 Where the activity may cause deterioration, alternatives should be considered to minimise the impact, including changes to the materials or substances used, the size, scale or timing of the activity or methods of working and/or how equipment or services are used.

5.4.1.5 In addition to assessing the potential for deterioration of the current status of a waterbody, the impact assessment must consider the risk of jeopardising 'Good status'. Every waterbody has a target status that it is expected to achieve, with an expected date by when this should be achieved as set out in the RBMPs. Where the status of a waterbody or quality element is less than 'Good', the impact assessment should consider whether the activity may jeopardise the waterbody achieving 'Good status' in the future. These may include activities which reduce the effectiveness of improvement activities taking place or prevent improvement activities taking place in the future. Details of these activities or measures are set out in the RBMPs.

5.5 Assessment criteria

- 5.5.1.1 The WFD Assessment will consider each stage of activity at Hornsea Four as relevant. Those proposed activities to be considered in terms of their potential impacts on each receptor are defined in [paragraph 4.1.1.5](#) above.
- 5.5.1.2 Hydromorphology in this assessment is defined as the physical characteristics of the waterbody including the size, shape, structure and (for marine bodies) the flow and quantity of water and sediment.
- 5.5.1.3 Biological habitats (both those designated as higher or lower sensitivity habitats) will be assessed if the footprint (including sediment plumes and dredging areas) of activities is:
- 0.5 km² or greater;
 - 1% or more of the waterbody's area;
 - Within 500 m of any higher sensitivity habitat; or
 - 1% or more of any lower sensitivity habitat.
- 5.5.1.4 The impacts on fish should be assessed if:
- The activity is in an estuary and could affect the fish in the estuary;
 - The activity could delay or prevent fish from entering the estuary; or
 - The activity could affect fish migrating through the estuary to freshwater.
- 5.5.1.5 The impacts resulting from the proposed activities on water quality will be assessed in terms of:
- Whether it could affect water clarity, temperature, salinity, oxygen levels, nutrients, or microbial patterns continuously for longer than a spring/neap tidal cycle (approximately 14 days);
 - Whether it is in a waterbody/waterbodies with a phytoplankton status of moderate, poor or bad; or
 - Whether the waterbody/waterbodies have a history of harmful algae.
- 5.5.1.6 The water quality assessment will also assess the potential for the release of chemicals (on the EQSD list) and on contaminants (above Cefas Action 1²) as a result of the disturbance of sediment.
- 5.5.1.7 The impacts will also be considered on BWs, SFWs and Nutrient Sensitive Waters (NSWs) within 2 km of the activities.
- 5.5.1.8 As part of the DCO application for Hornsea Four, a Habitats Regulations Assessment (HRA) (Report to Inform Appropriate Assessment (RIAA)) is being undertaken to assess the potential impacts on Natura 2000 sites (Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites) and their associated features. The RIAA provides a detailed assessment for the potential effects on SAC and SPA sites.

² <https://www.gov.uk/guidance/marine-licensing-sediment-analysis-and-sample-plans#suitability-of-material>

5.6 Data Sources

5.6.1.1 The following data sources have been collated and used to inform the assessment:

- Site-specific data;
- EA BW Classifications³;
- Multi-Agency Geographic Information for the Countryside (MAGIC) interactive mapping tool⁴; and
- Natural England marine evidence database⁵.

6 Screening

6.1 WFD waterbodies

6.1.1.1 WFD waterbodies for both onshore and offshore have been considered in this assessment. As required under the EA (2017) guidance, waterbodies were identified based on the following criteria:

- Any WFD waterbody within 2 km of the PEIR boundary (see [Section 6.2](#)); and/or
- Any UK Biodiversity Action Plan (BAP) Priority Habitat⁶ within 500 m of the PEIR boundary.

6.1.1.2 The proposed Hornsea Four ECC crosses the Yorkshire South waterbody (GB640402491000) ([Figure 1](#)). The offshore ECC does not cross any other WFD waterbodies and there are also no Priority Habitats within 500 m of the offshore ECC.

6.2 Protected areas

6.2.1.1 As required under the EA (2017) guidance, the following WFD protected areas have been considered:

- SACs;
- SPAs;
- BWs;
- SFWs; and
- NSWs.

6.2.1.2 Since scoping, the project boundary has been refined. The following sites (as illustrated in [Figure 2](#)) described below are within 2 km of the PEIR boundary and are therefore included in the assessment:

- **Flamborough Head SAC** – primarily designated for the presence of Annex 1 habitats;
- **Flamborough Head and Bempton Cliffs SPA** – primarily designated to support populations of kittiwake and a seabird assemblage of puffin, razorbill, guillemot, herring gull and gannet;
- **Greater Wash SPA** – Primarily designated to support populations of red-throated diver, little gull, sandwich tern, common tern and little tern;
- **Wilthorpe BW**; and

³ <https://www.gov.uk/government/statistics/bathing-water-quality-statistics>

⁴ <https://magic.defra.gov.uk/magicmap.aspx>

⁵ <http://publications.naturalengland.org.uk/category/41010>

⁶ <http://jncc.defra.gov.uk/page-5718>

- **Fraisthorpe BW.**

6.2.1.3 The Southern North Sea SAC was screened out of further assessment in the WFD Assessment on the basis that it is remote from any WFD waterbodies.

6.2.1.4 At Scoping, the Bridlington South Beach and Skipsea BWs were identified in WFD Screening. For PEIR, the Hornsea Four PEIR boundary has been refined such that these sites are now at a distance of greater than 2 km from the Project Boundary and, therefore, no longer require consideration in the WFD Assessment.

6.2.1.5 There are no SFWs or NSWs within 2 km of the Hornsea Four PEIR boundary.

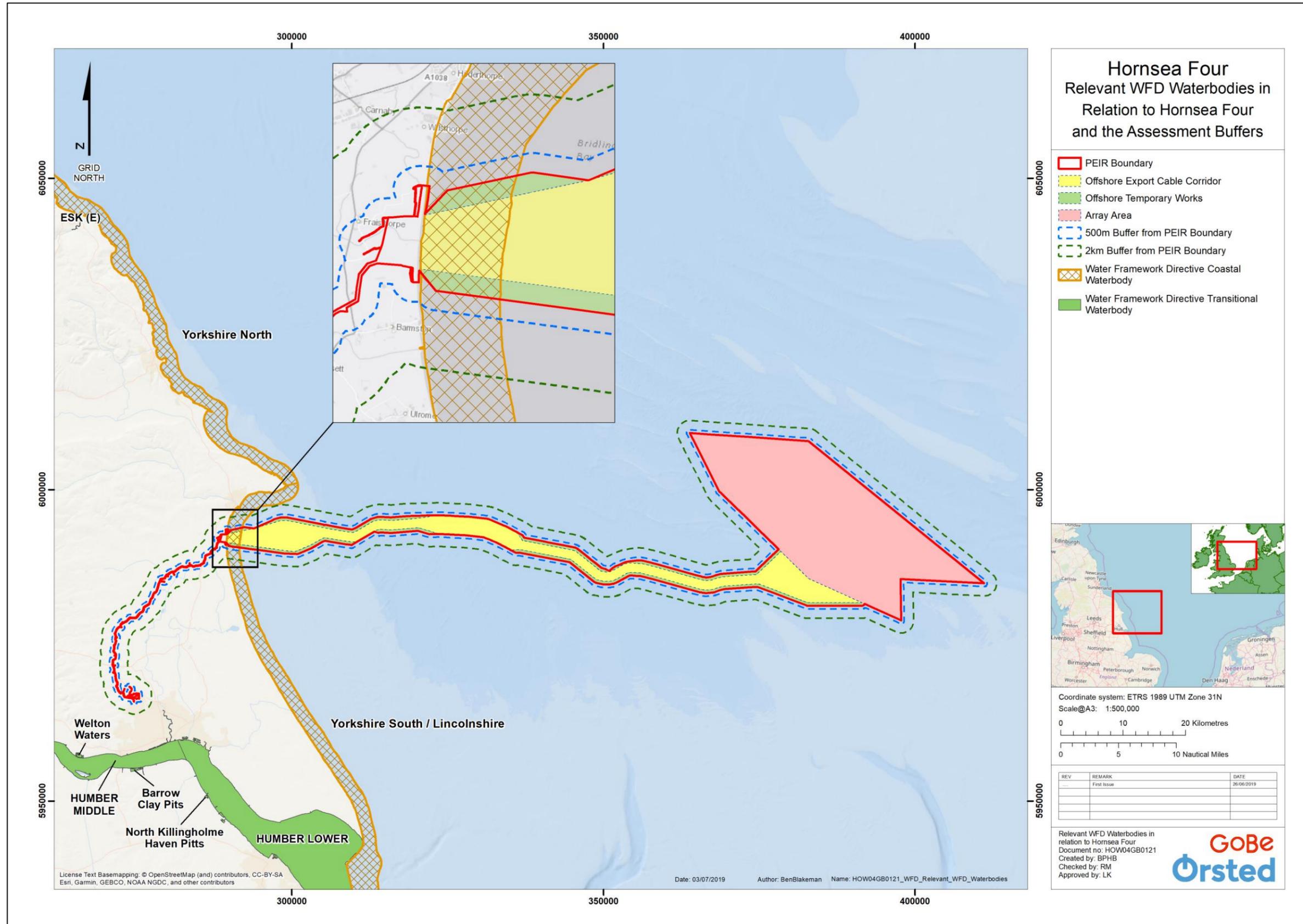


Figure 1: Relevant WFD waterbodies in relation to Hornsea Four and the assessment buffers (not to scale).

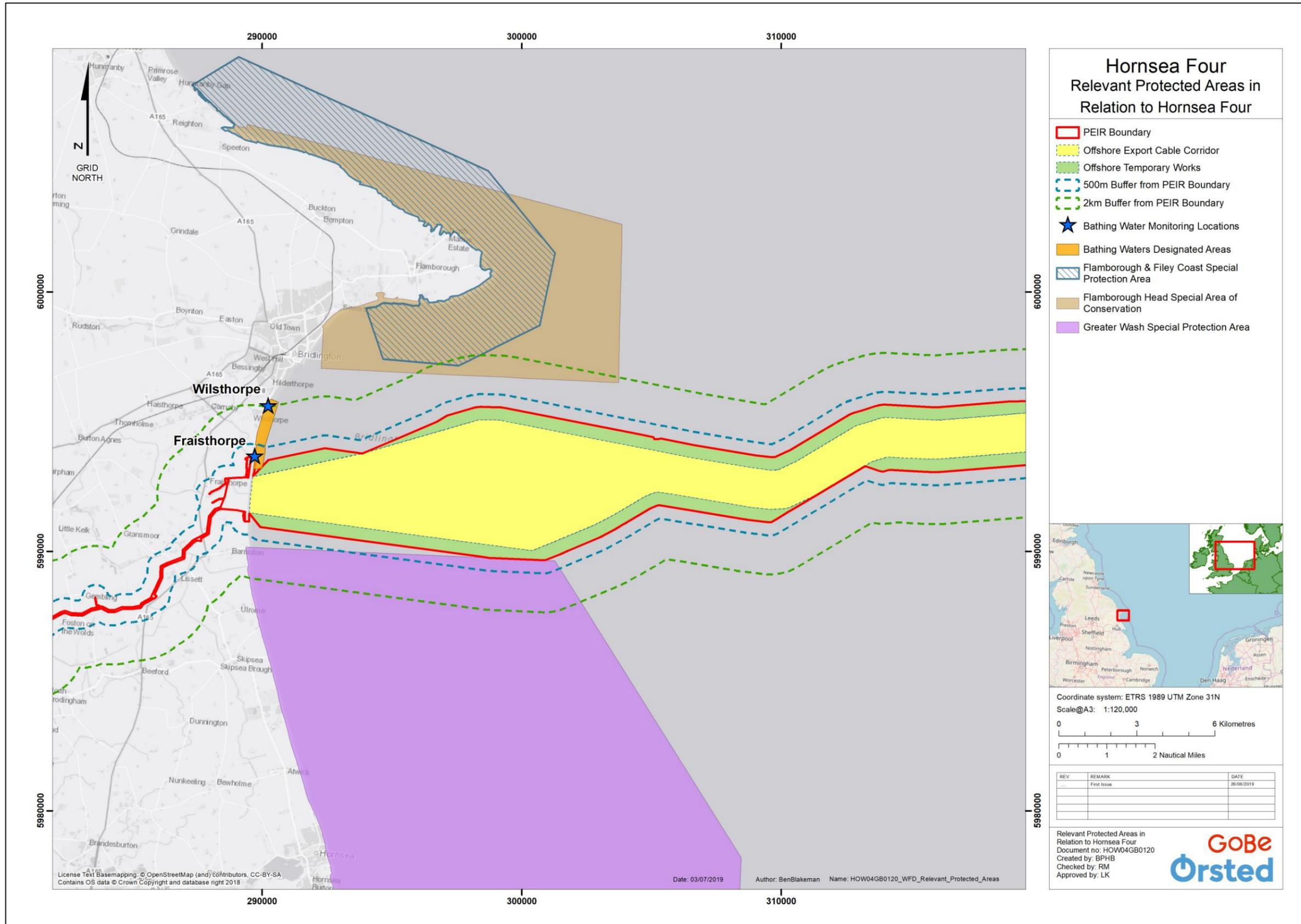


Figure 2: Relevant protected areas in relation to Hornsea Four (not to scale).

6.3 Status of Relevant Waterbodies and Protected Areas

6.3.1.1 The current status of all of the screened-in WFD waterbodies and protected areas (BWs, SACs and SPAs) identified in [Section 6.1](#) and [Section 6.2](#) above are presented in [Table 2](#), [Table 3](#) and [Table 4](#) respectively. The named SACs and SPAs are further considered in the RIAA. The higher and lower sensitivity biological habitat status for the screened-in WFD waterbodies are presented in [Table 5](#).

Table 2: Current status of the identified waterbodies (Yorkshire South).

ID	GB640402491000
Type	Coastal
Distance from Hornsea Four PEIR boundary (km)	0 (PEIR boundary overlaps with waterbody)
Waterbody area (ha)	15,836.87
Overall current status	Moderate
Current status (ecological)	Moderate
Current status (chemical)	Good
Target status by 2027	Good
Is the waterbody heavily modified (HMWB)?	Yes
Reasons for HMWB	Coastal protection; flood protection; navigation; ports and harbours
Hydromorphology status	Supports good
WFD phytoplankton classification	High
History of harmful algae?	Not monitored

Table 3: Current status of the identified BWs.

Waterbody	Wilsthorpe	Fraisthorpe
ID	uke1200-08200	uke1200-08300
Type	BW	BW
Distance from Hornsea Four PEIR boundary (km)	0.48	0.0 (overlapping)
Classification (2018)	Good	Good
Classification (2017)	Good	Good
Classification (2016)	Good	Good
Classification (2015)	Good	Good
Classification (2014)	Good	Good

Table 4: Designated feature(s) of the identified SACs and SPAs.

Site	Designated feature(s)
Flamborough Head SAC	Reefs; and Submerged and partially submerged caves.
Flamborough and Filey Coast SPA	Gannet; Herring gull; Kittiwake;

Site	Designated feature(s)
	Guillemot; Razorbill; Puffin
Greater Wash SPA	Red-throated diver; and Common scoter.

6.3.1.2 Although there two some higher sensitivity habitats present within the Yorkshire South waterbody as a whole (**Table 5**), an analysis of the area using the MAGIC⁷ mapping tool has indicated that none are present within 500 m of the Hornsea Four PEIR boundary and therefore, further consideration of these habitats is screened out.

6.3.1.3 Five lower sensitivity habitats fall within the area of the offshore ECC that overlaps with the Yorkshire South waterbody. Only those lower sensitivity habitats that have the potential to be affected by 1% or more in terms of their area within the Yorkshire South waterbody are scoped in for further assessment. The footprint of the proposed activity will not affect 1% or more of these three lower sensitivity habitats so these habitats have been scoped out as detailed in **Table 5**.

Table 5: Higher and lower sensitivity habitats screened-in for assessment within the Yorkshire South waterbody.

Characterisation	Habitat	Within 500 m?	Area in Waterbody (ha)	Area potentially affected (ha) (%)	Scoped into impact assessment?
Higher sensitivity	Mussel beds, including blue and horse mussel	No	0.29	N/A	No
Higher sensitivity	Subtidal kelp beds	No	349.12	N/A	No
Lower sensitivity	Cobbles, gravel and shingle	N/A	299.38	0 (0%)	No
Lower sensitivity	Intertidal soft sediment	N/A	680.83	0.624 (0.09%)	No
Lower sensitivity	Rocky shore	N/A	7.59	0 (0%)	No
Lower sensitivity	Subtidal rocky reef	N/A	860.94	0.94 (0.11%)	No
Lower sensitivity	Subtidal soft sediments	N/A	20,779.33	11.56 (0.06%)	No

6.3.1.4 The total footprint of infrastructure (cable installation footprint) falling within that part of the offshore ECC that lies within the Yorkshire South waterbody is approximately 0.17 km² (17 ha) total, and therefore falls below the 0.5 km² threshold; it is less than 1% of the Yorkshire South waterbody's area, and represents less than 1% of the lower sensitivity habitats affected.

6.4 Proposed Activities and Associated Impacts

6.4.1.1 The proposed activities throughout the lifetime of Hornsea Four which may impact WFD waterbodies are outlined in detail in **Volume 1, Chapter 4: Project Description**. The potential impacts associated with the proposed activities are presented in **Table 6**. There is no

⁷ <https://magic.defra.gov.uk/magicmap.aspx>

intention to knowingly release any chemicals into the environment during construction, operation or decommissioning of Hornsea Four.

6.4.1.2 The earliest construction start date would be in August 2023, with total construction lasting up to 4 years, 6 months.

Table 6: Potential impacts from Hornsea Four.

Potential Impact	Description
<i>Construction</i>	
Effects on sediments and sedimentary structures	Construction would not alter the geology of the site, particularly the strata which are below the level at which construction activity will occur (for cable installation this would be limited to a few metres below the current seabed level). There could be localised scour effects in the immediate vicinity of any cable protection required in terms of bed formations.
Accidental pollution	There is a risk of pollutants being accidentally released from vessels and machinery used in Hornsea Four, including construction and installation vessels and from the construction process itself. Such pollution could affect the water and sediment quality, with potential secondary implications for the benthos.
Effects on suspended sediment concentration (SSC) and sediment transport	There would be short-term increases in SSC as a result of seabed preparation and cable installation. The methods used for installation would affect the amount of sediment which is displaced, but it is considered that the effects would be localised and would not disperse at high concentrations outside the footprint of the PEIR boundary.
Re-suspension of EQS substances (including bacteria) from sediments	There would be short-term increases in SSC, with potential for the release of EQSD list substances (if present in sediments) as a result of seabed preparation and cable installation.
Short-term impacts on low priority habitats	Depending on the selected method of cable installation, there may be short-term impacts on low-priority habitats in the area. Specifically, these are intertidal soft sediment, subtidal soft sediment and subtidal rocky reef.
<i>Operation and Maintenance</i>	
Accidental pollution	There is a risk of pollutants being accidentally release from vessels and machinery used for Hornsea Four during O&M activities. Such pollutants could affect the water and sediment quality, with potential secondary implications for the benthos.
Re-suspension of EQS substances (including bacteria) from sediments	Should scour occur within the ECC around cable protection, this could result in an increase in SSC in the water column, which may release EQSD list substances present within the sediments (should they be present). Scour effects are only considered in the O&M phase; however, the degree of sediment disturbance will be limited when compared to that which may occur during the construction phase.
Effects to hydrodynamic regime (waves and tidal currents)	Structures in the WFD waterbody such as cable crossings and cable protection may affect the hydrodynamic regime.
Potential artificial reef creation	It is likely that the structures placed on the seabed, such as cable crossings and cable protection, will be colonised by a range of marine species. These structures have the potential to act as artificial reefs but may also facilitate the spread of INNS.

Potential Impact	Description
<i>Decommissioning</i>	Impacts during the decommissioning phase are expected to be similar, or less in magnitude to the impacts during the construction phase.

7 Scoping

7.1.1.1 **Table 7** details the scoping assessment, whilst **Table 8** provides a summary of the results of scoping for consideration in the impact assessment.

Table 7: Scoping assessment.

Consideration of the Activity	Key Risk Issues and Justification	Scoped into assessment?
<i>Hydromorphology</i>		
Could impact on the Hydromorphology (for example morphology or tidal patterns) of a waterbody at high status	The only project infrastructure that could result in effects on Hydromorphology (i.e. wind turbine or substation/HVAC foundations) are outside the 2 km screening distance for inclusion within the WFD Assessment.	No
Could significantly impact the Hydromorphology of any waterbody	N/A – as above.	No
Waterbody is heavily modified for the same use as the proposed activity	The Yorkshire South waterbody is classed as heavily modified in terms of coastal protection, flood protection, navigation and ports and harbours. It is not modified for the purpose of renewable energy and therefore no further consideration of the potential impacts associated with Hornsea Four is required.	No
<i>Biology - Habitats</i>		
0.5 km ² or greater	The footprint of the works within the Yorkshire South waterbody, including a factor of 1.5 times the footprint in terms of dredging (cable trenching) is approximately 0.17 km ² and is therefore below the 0.5 km ² threshold and does not require further consideration in the WFD Assessment.	No
1% or more of the waterbody's area	The footprint of the works, including a factor of 1.5 times the footprint of the dredged area, totals approximately 0.19 % of the waterbody area and therefore falls below the 1% threshold.	No
Within 500 m of any higher sensitivity habitat	The Hornsea Four PEIR boundary is located greater than 500 m from any higher sensitivity habitat.	No
1% or more of any lower sensitivity habitat	The Hornsea Four export cables will cross areas of subtidal soft sediment and intertidal soft sediment and may cross areas of subtidal rocky reef. Assuming a worst-case design scenario, the interaction falls below the 1% threshold for all three features (approximately 0.08%, 0.14% and 0.16%, respectively).	No
<i>Biology - Fish</i>		
Is in an estuary and could affect fish in the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	The activities associated with the export cables for Hornsea Four are not located in an estuary.	No
Could impact on normal fish behaviour like movement, migration or spawning (for example by creating	There will be no physical barrier placed within the Yorkshire South waterbody as a result of the activities from Hornsea Four. The presence of the export cables buried in the seabed will not affect current speeds and will as a worst-case result in a minor depth reduction at cable crossings and where cable protection is used. Therefore,	No

Consideration of the Activity	Key Risk Issues and Justification	Scoped into assessment?
a physical barrier, noise, chemical change of a change in depth or flow)	<p>changes to water depth and currents are not considered to be significant. No significant underwater noise impacts are predicted from piling within the waterbody.</p> <p>No change in chemical water quality is anticipated which could affect fish – see water quality section below.</p> <p>No significant impacts are predicted on Fish and Shellfish Ecology resources (Volume 2, Chapter 3).</p>	
Could cause entrainment or impingement of fish	N/A	No
<i>Water Quality</i>		
Could affect water clarity, temperature, salinity, oxygen levels nutrients or microbial patterns continuously for longer than a spring-neap tidal cycle (approximately 14 days).	<p>There would be short-term increases in SSC as a result of construction activities such as seabed preparation and cable installation. The methods used for installation would affect the amount of sediment displaced, but it is considered that the impacts would be localised and high levels of SSC would not disperse to a significant level outside the footprint of the PEIR boundary and therefore would not have an impact on morphological conditions. It is not anticipated that the temperature or salinity would be affected as a result of export cable installation activities and therefore these parameters have not been taken forward to the impact assessment. There are not anticipated to be any significant changes to dissolved oxygen concentrations, nutrient concentrations or microbial patterns.</p> <p>Sediments are mainly composed of subtidal sands and coarser mixed sediments, and Volume 2, Chapter 1: Physical Processes predicts that any effects are likely to be of local spatial extent, short-term duration and highly reversible, resulting in effects that are not significant in EIA terms. Effects during O&M and decommissioning are expected to be negligible.</p>	No
Is in a waterbody with a phytoplankton status of moderate, poor or bad	The Yorkshire South waterbody is currently classified as being of high phytoplankton status, and therefore this has not been taken forward for the impact assessment.	No
Is in a waterbody with a history of harmful algae	This has not been monitored for the Yorkshire South waterbody and has therefore not been taken forward for impact assessment.	No
Release or use of chemicals which are on the EQSD list	The proposed activities do not include the use of direct discharge of any chemicals listed under the EQSD list. The installation of the export cables (in the construction phase) and potential for scour around the cable protection (O&M phase), would result in the release of suspended sediments into the water column, which could release any EQSD list substances already present within the sediment. However, the sediments present do not	No

Consideration of the Activity	Key Risk Issues and Justification	Scoped into assessment?
	<p>contain significant levels of fine material, being composed mainly of sands. Therefore, it is unlikely that notable levels of contaminants, as per the EQSD list, will be present in sediments. Furthermore, no known sources of contamination have been identified within 2km of the proposed activities within the waterbody or have been raised by stakeholders. Therefore, this has not been taken forwards for impact assessment.</p>	
<p>Disturbance of sediment with contaminants above Cefas Action Level 1</p>	<p>As noted above, given the composition and grain size present within the ECC and the lack of sources of contamination it is considered highly unlikely that any sediments disturbed would have contamination levels greater than Cefas Action Level 1. Therefore, this has not been taken forwards for impact assessment.</p>	No
<p><i>WFD Protected Areas</i></p>		
<p>Within 2 km of any WFD protected area</p>	<p>Natura 2000 sites:</p> <ul style="list-style-type: none"> - Flamborough Head SAC; - Flamborough and Filey Coast SPA; and - Greater Wash SPA. <p>Bathing Waters:</p> <ul style="list-style-type: none"> - Fraisthorpe BW; and - Wilsthorpe BW. 	Yes
<p><i>INNS</i></p>		
<p>Potential to introduce or spread INNS</p>	<p>It is likely that any manmade structures placed on the seabed will be colonised by a range of marine species. These structures have the potential to act as artificial reefs, however they may also facilitate the spread of non-native species if these species are already present (i.e. they will not act as a vector for INNS in and of themselves). The vast majority of these structures will be located within the Hornsea Four array area and so are not relevant to this assessment; however cable protection may be installed within the Yorkshire South waterbody. If required, it is likely to be limited to small areas of the cable route.</p> <p>Both construction and O&M vessels have the potential to introduce or spread INNS through the discharge of ballast water within the Yorkshire South waterbody. This potential impact will be mitigated through designed-in measures such as a biosecurity plan, as well as vessels complying with International Maritime Organisation (IMO) ballast water management guidelines, ensuring that risks associated with INNS are minimised. There is currently little evidence from other offshore wind farms in the North Sea to suggest adverse effects on key species and habitats from INNS. Materials and vessels are highly likely to be from within European and/or UK waters and it is therefore expected that impacts will not be significant and as such have been scoped out of the impact assessment.</p>	No

Table 8: Summary of receptors and impacts scoped into the impact assessment.

Receptor	Potential risk to receptor?	Waterbodies/protected areas	Risk issues for impact assessment
Hydromorphology	No	N/A	N/A
Biology – habitats	No	N/A	N/A
Biology – fish	No	N/A	N/A
Water quality	No	N/A	N/A
Protected areas	Yes	Natura 2000 sites: <ul style="list-style-type: none"> - Flamborough Head SAC; - Flamborough and Filey Coast SPA; and - Greater Wash SPA. Bathing Waters: <ul style="list-style-type: none"> - Fraisthorpe BW; and - Wilsthorpe BW. 	All within 2 km of the proposed development.

8 Impact Assessment

8.1 Protected Areas

8.1.1.1 The Hornsea Four PEIR boundary coincides with, or is within 2 km of, the following sites and therefore has the potential to affect the interest features of these sites:

- Flamborough Head SAC;
- Flamborough Head and Filey Coast SPA;
- Greater Wash SPA;
- Fraisthorpe BW; and
- Wilsthorpe BW.

8.1.2 Natura 2000 Sites

8.1.2.1 The Hornsea Four HRA Screening Report submitted at Scoping has considered Likely Significant Effects (LSE) on Natura 2000 sites (SACs and SPAs). **Table 9** presents where no LSE cannot be ruled out at the HRA screening stage for the relevant sites within 2 km of the Hornsea Four PEIR boundary. The implications of no LSE and whether there are any Adverse Effects on Integrity (AEol) for the relevant sites will be considered in the Report to Inform Appropriate Assessment (RIAA). The results of the RIAA will be used to update this WFD Assessment submitted alongside the final Environmental Statement in support of the DCO application.

Table 9: Conclusions of the HRA Screening Report on Natura 2000 sites within 2 km of the Hornsea Four PEIR boundary.

Site	Relevant feature(s)	Potential for LSE?
Flamborough Head SAC	Reefs; and Submerged and partially submerged caves.	<u>Construction</u> Temporary habitat loss/ disturbance; Temporary increases in suspended sediments/smothering; Accidental pollution; and Invasive non-native species. <u>Operation and Maintenance</u> Temporary habitat loss; Temporary increases in suspended sediments/smothering; Accidental pollution; Changes to physical processes; Long-term physical loss of habitat; and EMF.
Flamborough and Filey Coast SPA	Gannet; Herring gull; Kittiwake; Guillemot; Razorbill; Puffin	<u>Construction</u> Disturbance and displacement (Guillemot, Razorbill, Puffin). <u>Operation and Maintenance</u> Risk of collision (Gannet, Herring gull, Kittiwake); and Disturbance and displacement (Guillemot, Razorbill, Puffin).

Site	Relevant feature(s)	Potential for LSE?
Greater Wash SPA	Red-throated diver; and Common scoter.	<u>Construction</u> Disturbance and displacement. <u>Operation and Maintenance</u> Disturbance and displacement.

8.1.3 Bathing Waters

- 8.1.3.1 Resuspension of sediment as result of activities within the Hornsea Four ECC could result in higher bacterial concentrations in the water column and could therefore affect the performance of local BWs. However, this impact has been scoped out in terms of impacts to water quality and is expected to be negligible at BWs.
- 8.1.3.2 Given the predicted levels of dilution and dispersion from tidal currents ([Volume 2, Chapter 1: Marine Geology, Oceanography and Physical Processes](#)), it is expected that any increases in bacteria in the water column resulting from the disturbance of sediments would be temporary. Furthermore, the increased levels of ultra-violet light in the water column (compared to the levels in the sediment prior to disturbance) will result in higher bacterial mortality rates once released into the water column. Therefore, it is predicted that any increases to bacterial concentrations at the screened-in BWs will be negligible.

9 References

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