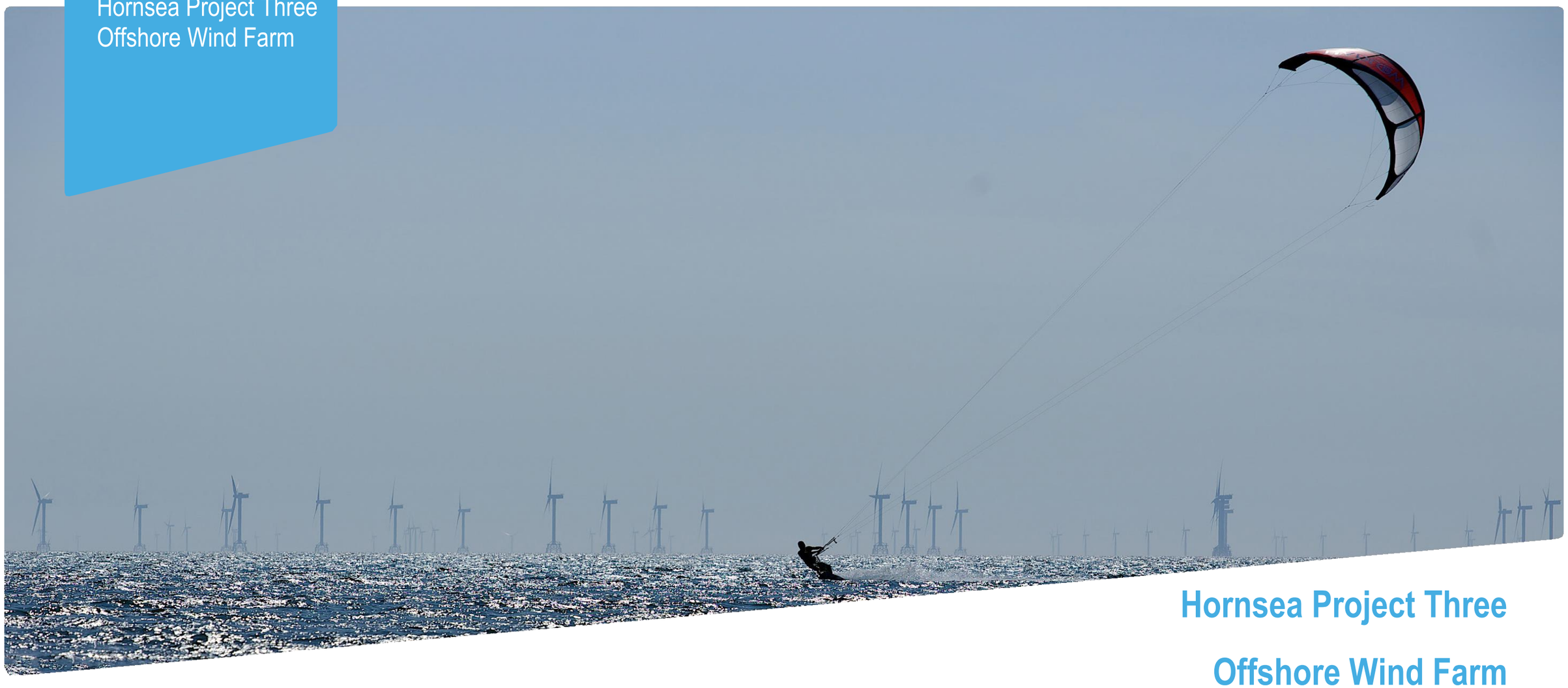
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Preliminary Environmental Information Report:

Annex 2.2 - Water Framework Directive Assessment

Date: July 2017

Hornsea 3
Offshore Wind Farm

DONG energy

Environmental Impact Assessment

Preliminary Environmental Information Report

Volume 2

Annex 2.2 – Water Framework Directive Assessment

Report Number: P6.5.2.2

Version: Final

Date: July 2017

This report is also downloadable from the Hornsea Project Three offshore wind farm website at:
www.dongenergy.co.uk/hornseaproject3

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Front cover picture: Kite surfer near one of DONG Energy's UK offshore wind farms © DONG Energy Hornsea Project Three (UK) Ltd., 2016.

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Glossary

Term	Definition
Ballast water	Fresh or salt water, 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 practiced by large numbers of bathers
Entrainment	The entrapment of organisms in a water body (e.g. cooling water)
European site	A Special Area of Conservation (SAC) or candidate SAC, a Special Protection Area (SPA) or potential SPA, a site listed as a Site of Community importance (SCI) or a Ramsar site.
Impingement	The entrapment of organisms on mesh screens used to protect cooling water intakes
Intertidal	An area of a seashore that is covered at high tide and uncovered at low tide.
Mollusc	Invertebrate animal belonging to the phylum Mollusca that includes the snails, clams, chitons, tooth shells, and octopi.
Nitrate vulnerable zones	A conservation designation of the Environment Agency for areas of land that drain into nitrate polluted waters, or waters which could become polluted by nitrates
Polychaete	A class of segmented worms often known as bristleworms.
Shellfish waters	Waters suitable for the farming of shellfish
Subtidal	Area extending from below low tide to the edge of the continental shelf.

Acronyms

Acronym	Description
DCO	Development Consent Order
EMF	Electromagnetic Field
EQSD	Environmental Quality Standards Directive
HDD	Horizontal Directional Drilling
HAT	Highest Astronomical Tide
HMWB	Highly Modified Water Body
HRA	Habitats Regulations Assessment
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
INNS	Invasive and Non Native Species
MCZ	Marine Conservation Zone
PEIR	Preliminary Environmental Information Report
PEMMP	Project Environmental Management and Monitoring Plan
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SPA	Special Protection Area
SSC	Suspended Sediment Concentration
WFD	Water Framework Directive

Units

Unit	Description
%	Percent
km	Kilometre
km^2	Square kilometre
m	Metre
m^2	Square metre
MW	Megawatt
NM	Nautical mile

1. Introduction

1.1.1.1 DONG Energy Power (UK) Ltd. (hereafter referred to as DONG Energy), on behalf of DONG Energy Hornsea Project Three (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 project within the former Hornsea Zone, and includes the associated offshore export cable route (cable) corridor and onshore infrastructure. The proposal is for a wind farm with a total generating capacity of up to 2,400 MW which will be situated within the Hornsea Three array area in the east of the former Hornsea Zone. Hornsea Three is located in the North Sea, approximately 121 km to the northeast of Tringham, Norfolk, 140 km to the east of the East Riding of Yorkshire coast and approximately 10.1 km west of the median line between UK and Netherlands waters.

1.1.1.2 RPS was commissioned to undertake a Water Framework Directive (WFD) assessment for Hornsea Three, and specifically the inshore section of the Hornsea Three offshore cable corridor. This Annex of the Preliminary Environmental Information Report (PEIR) provides a WFD screening, scoping and impact assessment for Hornsea Three.

1.1.1.3 According to guidance provided by the Overarching National Policy Statement for Energy (EN-1) (DECC, 2011) consideration of the WFD (2000/60/EC) is required for any DCO application where a project has the potential to impact on water bodies or protected areas under the Water Framework Directive and has the potential to cause deterioration in the ecological and chemical status of a water body or to compromise improvements which might otherwise lead to a water body meeting its WFD objectives. The WFD aims to protect and enhance water bodies within Europe and covers all estuarine and coastal waters out to 1 NM.

1.1.1.4 Under the WFD, coastal waters, estuaries, rivers, man-made docks and canals are divided into a series of water bodies. Within each water body, the WFD sets ecological and chemical objectives. The aim of the WFD was for all water bodies to achieve "good status" by 2015. This aim ("good status" for all water bodies by 2015) was not achieved and therefore the Environment Agency is subsequently aiming to achieve good status in at least 60% of waters by 2021 and in as many waters as possible by 2027. Under all conditions, it requires that there should be no deterioration in status.

1.1.1.5 Using the Environment Agency *Clearing the Waters for All* guidance (Environment Agency, 2016) and referring to the relevant chapters of the Hornsea Three PEIR, a WFD assessment of the potential for Hornsea Three to have a significant non-temporary effect on WFD parameters at water body level has been carried out. This has been undertaken on the basis of the Hornsea Three information detailed within volume 1 chapter 3: project description.

1.1.1.6 This document should be read alongside the following chapters of the PEIR all of which are referred to throughout this document:

- Volume 2 chapter 1: marine processes;
- Volume 2 chapter 2: benthic subtidal and intertidal ecology;
- Volume 2 chapter 3: fish and shellfish ecology; and
- Draft Report to Inform Appropriate Assessment.

1.2 Project overview

1.2.1.1 This WFD assessment focuses on those elements of Hornsea Three relevant to the offshore/coastal areas which are required to be assessed against the objectives for each WFD water body (i.e. extending out to 1 NM from MHWS, see Figure 1.1). As such, activities of relevance relate to the installation of the offshore export cable within 1 NM of the coast and at the landfall (i.e. rather than considering any of the offshore elements of the scheme seawards of 1 NM from the coast) and changes to the wave regime due to the presence of operational turbines. Assessment of inland WFD water bodies from the 2015 Anglian River Basin Management Plan (RBMP) is covered in volume 3, chapter 2 hydrology and flood risk and therefore not considered further in this assessment.

1.2.1.2 Export cables are used for the transfer of power from the offshore substations to the onshore HVAC/HVDC substation. Up to six export cables will be required for Hornsea Three. The offshore export cables shall be located within the Hornsea Three offshore cable corridor and make landfall near Weybourne Hope on the north Norfolk coast. The maximum design envelope for the Hornsea Three offshore cable corridor and the landfall area are set out in Volume 1, Chapter 3 of the PEIR (Project Description). The exact location and orientation of the Hornsea Three offshore cable corridor and landfall shall be determined during an iterative route planning process following the granting of the DCO. The offshore cables will be located wholly within the Hornsea Three offshore cable corridor shown in Figure 1.1.

1.2.1.3 Drawing on the information outlined in volume 1 chapter 3: project description, the primary effects associated with laying of the Hornsea Three export cable that are considered to be relevant to the WFD assessment are:

- Offshore cable installation (offshore export cable installation via trenching, dredging, jetting, ploughing or vertical injection); and
- Crossing the intertidal via HDD, trenching, dredging, jetting, ploughing, rock cutting or vertical injection.

1.2.1.4 The WFD assessment presented in this Annex shall be subject to revision ahead of the Environmental Statement once the baseline environment is fully established through site specific surveys and to take account of any further refinements to the Project Description. The assessment presented in this document covers the scoping and assessment stages of the WFD assessment process; identifying all potential risks to the relevant receptors associated with the proposed activity/activities; identifying those receptors which may require further assessment; receptors that can be scoped out of the WFD assessment and undertaking an assessment for those receptors where a potential risk is identified. The assessment focuses on the receptors where risks have been identified and which according to the Environment Agency (2016) guidance should be scoped into the assessment.

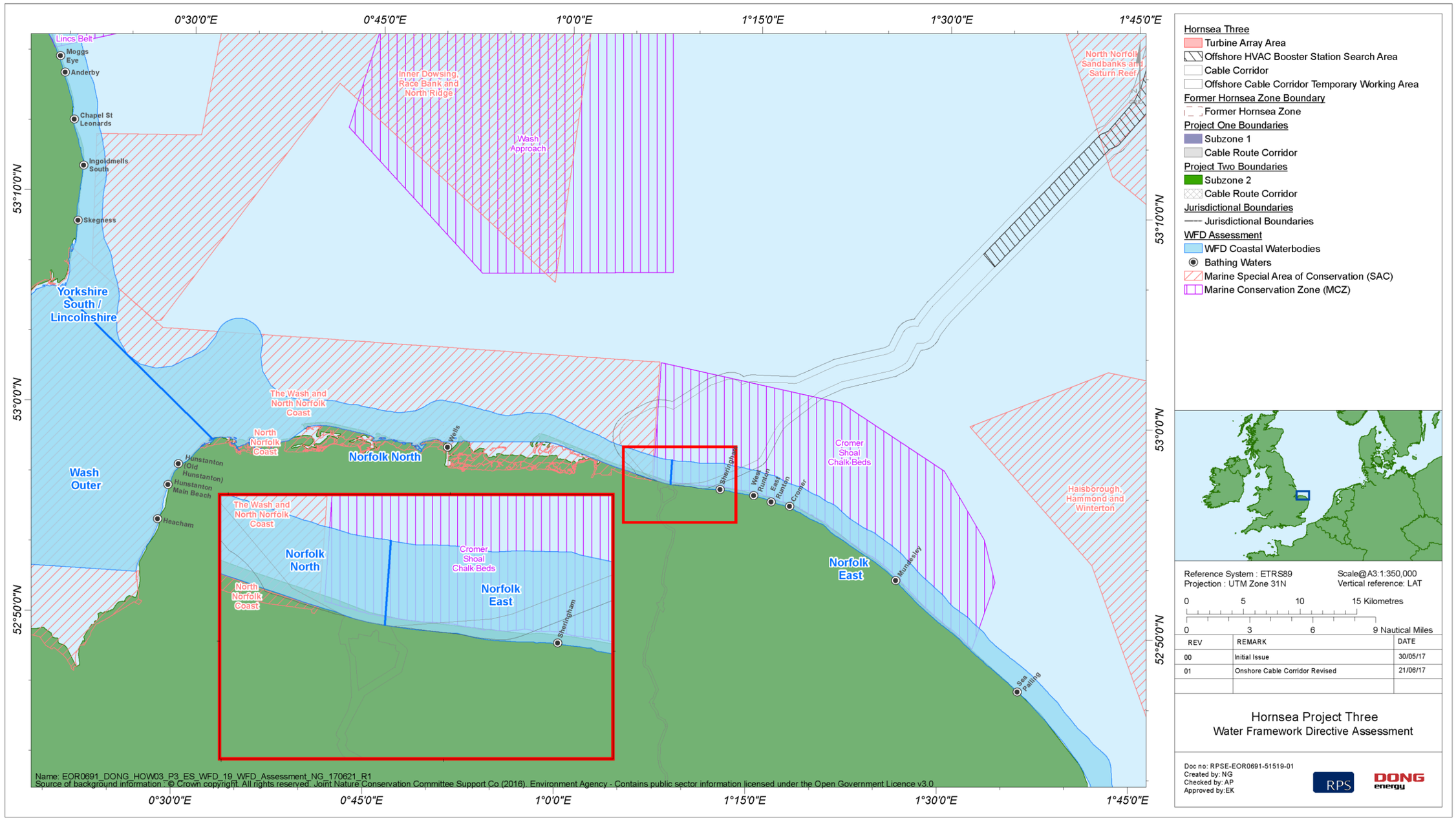

Figure 1.1: Location of Hornsea Three offshore cable corridor and landfall area (inset) in relation to WFD Coastal Water Bodies, Bathing Waters and Protected Areas.

2. Methodology

2.1.1.1 As stated in paragraph 1.1.1.4, the aim of the WFD was for all water bodies to achieve "good status" by 2015, although this was subsequently updated with the Environment Agency currently aiming to achieve good status in at least 60% of waters by 2021 and in as many waters as possible by 2027.

2.1.1.2 "Good status" comprises two parts. The first is "good ecological status" (or "good ecological potential", for water bodies classed as heavily modified or artificial). The second is "good chemical status". "Good ecological status/potential" includes biological, hydromorphological and physicochemical quality elements and specific pollutants. "Good chemical status" concerns a series of priority substances, including a number of priority hazardous substances. The WFD also requires that relevant protected area objectives (Environment Agency, 2015) are achieved. These are outlined within the Anglian RBMP (Environment Agency, 2015).

2.1.1.3 The current status of water bodies is detailed within River Basin Management Plans (RBMPs) and supporting Appendices. The first RBMPs were published in 2009 and have been superseded by the updated 2015 plans. The 2015 plans which included the work undertaken over the preceding last five years and the plans/objectives for the next six years following publication. The Hornsea Three offshore cable corridor is geographically covered by the updated 2015 Anglian RBMP (Environment Agency, 2015). This is applicable to the project and information provided within this plan has been drawn upon to provide the characterisation of the environment required for this preliminary WFD screening assessment.

2.1.1.4 The WFD Screening presented within the Hornsea Three Scoping report (DONG Energy, 2016) was undertaken based on the Environment Agency *Clearing the Waters* guidance (Environment Agency, 2012), which was superseded in late 2016 by the *Clearing the Waters for All* guidance (Environment Agency, 2016). This WFD Assessment has been undertaken following the latest Environment Agency (2016) *Clearing the Waters for All* guidance for assessing impacts in estuarine (transitional) and coastal waters for the WFD. Based on the Environment Agency (2016) guidelines, a WFD assessment can have up to 3 stages, with the need to undertake later stages of the assessment dependent on the outcomes of the preceding stages. The three stages are Screening, Scoping and Impact Assessment are described in further detail below.

2.1.1.5 Hornsea Three held a meeting with the Environment Agency on the 19th September 2016. The relevant data held by the Environment Agency and the approach to the WFD assessment were discussed at the meeting.

2.1.2 Screening

2.1.2.1 According to the Environment Agency *Clearing the Waters for All* guidance (Environment Agency, 2016), screening is required for Hornsea Three as it is not a low risk project, is not a fast-track or accelerated marine licence activity and does not fall into any of the categories of projects where screening is not required (see Environment Agency, 2016). Initial screening information is necessary as part of the scoping stage and, therefore, this stage is often completed in practice in order to inform the WFD scoping. Additionally, screening the construction and operational activities of projects enables a high level initial assessment of those activities that could impact on compliance parameters within WFD water bodies.

2.1.2.2 The previous Screening stage presented within the Hornsea Three Scoping report (DONG Energy, 2016) has informed the scope of the assessment presented in this WFD Assessment.

2.1.3 Scoping

2.1.3.1 The Scoping stage identifies the receptors that are potentially at risk from the proposed activity and therefore may need impact assessment. Scoping is also not required if the activity was carried out during 2009 to 2014 (when evidence was collected for the 2015 RBMPs), where a WFD assessment was already completed and where there are no changes to how the activity is carried out.

2.1.3.2 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;
- Protected areas; and
- Invasive non-native species (INNS).

2.1.3.3 The Environment Agency (2016) guidance provides specific criteria for each of the receptors outlined above to determine if an impact assessment is required, and recommends the use of a scoping template as part of the WFD assessment process. These criteria are considered for each receptor in section 4 of this Annex using the recommended scoping template.

2.1.4 Impact assessment

2.1.4.1 Following the Scoping stage, if it is determined that the impact assessment stage is required, the Environment Agency (2016) 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 water body receptor.

2.1.4.2 Deterioration is when the status of a quality element reduces by one class. For example, biological quality elements move from good to moderate status. If a quality element is already at the lowest status then any reduction in its condition counts as deterioration. According to the Environment Agency (2016) guidelines, temporary effects due to short-duration activities like construction or maintenance are not considered to cause deterioration if the water body would recover in a short time without any restoration measures. Where relevant, mitigation measures should be included to avoid or minimise risks of deterioration.

2.1.4.3 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 water bodies.

2.1.4.4 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.

2.1.4.5 In addition to assessing the potential for deterioration of the current status of a water body, the impact assessment must consider the risk of jeopardising good status. Every water body has a target status that it is expected to achieve, with an expected date by when this should be achieved. Where the status of a water body or quality element is less than good, the impact assessment should consider whether the activity may jeopardise the water body achieving to 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 improvement activities, or measures, can be found in the RBMPs.

2.1.4.6 Once the baseline environment has been fully established through site specific surveys (i.e. prior to the Environmental Statement to support the DCO application), the WFD assessment will be updated, including updates to the scoping (where necessary) and the impact assessment on those receptors where scoping has identified risks, using the Environment Agency guidance detailed in this section.

2.2 Identification of relevant water bodies

2.2.1.1 With reference to the 2015 Anglian RBMP, the relevant coastal/estuarine water bodies that could be potentially affected by Hornsea Three offshore cable installation activities, due to their locations and associated proximity to the cable installation activities, are the Norfolk East coastal water body (ID GB650503520003) and the Norfolk North coastal water body (ID GB640503300000).

2.2.1.2 Assessment of inland WFD water bodies from the 2015 Anglian RBMP is covered in volume 3, chapter 2 hydrology and flood risk and therefore not considered further in this assessment.

3. Background Information on WFD Water Bodies

3.1 Norfolk East (coastal water body; ID GB650503520003)

3.1.1.1 The Norfolk East coastal water body is designated as a heavily modified water body (HMWB), with flood protection and coastal protection cited as the reasons for this classification. The WFD ecological target for HMWBs is typically good ecological potential, although the target for Norfolk East coastal water body is moderate ecological potential (Environment Agency, 2015) with the justification cited that good ecological potential would be disproportionately expensive. As with all surface water bodies, the default chemical status objective is good chemical status.

3.1.1.2 The Norfolk East WFD coastal water body is at moderate status overall, moderate ecological potential and good chemical potential. The data from the latest 2015 RBMP (Cycle 2) indicates that the water body is currently meeting its WFD objectives in respect of all biological, physico-chemical and supporting elements and specific pollutants. The latest data also indicates that the water body is currently meeting its WFD objectives for chemical quality.

3.1.1.3 In terms of the WFD habitats that are present in the Norfolk East waterbody, these include chalk reef, polychaete reef, cobbles, gravel and shingle, intertidal soft sediment, subtidal rocky reef and subtidal soft sediments.

3.1.2 Protected areas

3.1.2.1 The 2015 Anglian RBMP provides the status of Protected Areas and only lists the Great Yarmouth North Denes Special Protection Area (SPA), Outer Thames Estuary SPA and Winterton-Horsey Dunes SAC for the Norfolk East WFD water body, none of which are in the vicinity of the Hornsea Three offshore cable corridor. However, the Hornsea Three offshore cable corridor overlaps with the Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ) and Sheringham, which is designated under the Bathing Water Directive, is in the vicinity of the Hornsea Three offshore cable corridor (see Figure 1.1). The Cromer Shoal Chalk Beds MCZ is rated as being in favourable condition and based on the new Bathing Water Directive standards, Sheringham was rated as Excellent in 2014 and was not considered to be at risk of failing to comply in 2015.

3.2 Norfolk North (coastal water body; ID GB640503300000)

3.2.1.1 The Norfolk North coastal water body is also designated as a HMWB, with flood protection cited as the reason for this classification. The WFD ecological target is moderate ecological potential (Environment Agency, 2015) with the justification cited that good ecological potential would be disproportionately expensive. As with all surface water bodies, the default chemical status objective is good chemical status.

3.2.1.2 The Norfolk North coastal water body is at moderate status overall, moderate ecological potential and good chemical potential. The data from the latest 2015 RBMP (Cycle 2) indicates that the water body is currently meeting its WFD objectives in respect of its biological quality elements (angiosperms, invertebrates and phytoplankton), physico-chemical (dissolved inorganic nitrogen and dissolved oxygen) and supporting elements. The water body is also meeting its WFD objectives for specific pollutants (arsenic, copper and zinc) as well as its WFD objectives for chemical quality.

3.2.2 Protected areas

3.2.2.1 The nearest Natura 2000 sites of relevance to the Norfolk North coastal water body are the Wash and North Norfolk Coast SAC and the Norfolk Coast SAC/SPA (see Figure 1.1). The Hornsea Three offshore cable corridor is located within both of these Natura 2000 sites at the landfall area. The Hornsea Three offshore cable corridor also overlaps with the Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ) which is rated as being in favourable condition.

3.2.2.2 The 2015 Anglian RBMP also lists a number of Bathing Waters and designated waters under the Bathing Water Directive, all of which are located outside the Hornsea Three offshore cable corridor. Therefore, only the Wash and North Norfolk Coast SAC and the Norfolk Coast SAC/SPA and the Cromer Shoal Chalk Beds MCZ are proposed for inclusion in the scoping.

4. Scoping

4.1.1.1 The following details the findings of the Scoping stage of the WFD Assessment for Hornsea Three. This template follows guidance produced by the Environment Agency, i.e. *Clearing the Waters For All* guidance, for assessing impacts on estuarine and coastal WFD water bodies (Environment Agency, 2016).

4.1.1.2 The potential risks of the activity to each of the key receptor groups are considered in the sections below.

4.2 Hydromorphology

4.2.1.1 Table 4.1 provides the specific risk information for hydromorphology receptors.

Table 4.1: Hydromorphology risks.

Consider if your activity:	Yes	No	Hydromorphology risk issue(s)
Could impact on the hydromorphology (for example morphology or tidal patterns) of a high status water body.		No – impact assessment not required	The activities associated with Honrsea Three will not impact on the hydromorphology of a High status water body. The Norfolk North and Norfolk East water bodies are both of Moderate status.
Could significantly impact the hydromorphology of a water body at less than high status.		No – impact assessment not required	As per volume 2, chapter 1 marine processes the potential for any change during construction arises from trenching activities, the installation of cable protection measures and the excavation of HDD exit pits. During the construction phase effects are expected to be of local spatial extent, short term duration and highly reversible, resulting in effects that are of minor adverse significance. Similarly, during operation the presence of cable protection is predicted to result in effects that are of local spatial extent, continuous and reversible and of minor significance. Effects during decommissioning are predicted to be negligible. The operational presence of the Hornsea Three array area could indirectly affect the shoreline by modifying the sediment transport regime. Wave modelling found that under all scenarios there will be no measurable reduction in wave height (>2,5%) at adjacent coastlines and any changes are not predicted to have any indirect impact on hydromorphology or other processes at the coastline (see volume 2, chapter 1 marine processes). Furthermore, as the offshore HVAC booster stations are located in deep water offshore at least 25 km from the coast, they will not affect the wave climate at the shoreline.
Is in a water body that is heavily modified for the same use as your activity		No – impact assessment not required	The two water bodies are classified as heavily modified for coastal and flood protection.

4.3 Biology

4.3.1 Habitats

4.3.1.1 Table 4.2 provides a summary of the consideration of habitats with higher and lower sensitivity to human pressures for the WFD assessment. Higher sensitivity habitats have a low resistance to, and recovery rate, from human pressures whereas lower sensitivity habitats have a medium to high resistance to, and recovery rate, from human pressures.

4.3.1.2 Table 4.3 provides the specific risk information for biology habitats receptors.

Table 4.2: Habitat sensitivity to human pressures.

Higher Sensitivity Habitats	Lower sensitivity habitats
chalk reef	cobbles, gravel and shingle
clam, cockle and oyster beds	intertidal soft sediments like sand and mud
intertidal seagrass	rocky shore
maerl	subtidal boulder fields
mussel beds, including blue and horse mussel	subtidal rocky reef
polychaete reef	subtidal soft sediments like sand and mud
saltmarsh	
subtidal kelp beds	
subtidal seagrass	

Table 4.3: Biology habitats risks.

Consider if your activity:	Yes	No	Biology habitats risk issue(s)
0.5 km² or larger		No, Impact assessment not required	The maximum length of Hornsea Three offshore cable corridor that crosses either the North Norfolk or East Norfolk waterbodies is 5,332 m. Based on a 10 m wide seabed disturbance area and six cables the total area affected is 0.32 km² which includes 0.043 km² area of cable burial works in the intertidal portion of the Hornsea Three offshore cable corridor. Some limited habitat loss/disturbance may also occur within intertidal temporary working areas either side of the intertidal cable corridor due to activities such as vehicle movements, anchor placement and the purposeful grounding of the cable laying barge. Within the North Norfolk waterbody the total area affected is 0.07 km² and within the East Norfolk waterbody the total area affected is 0.16 km² (see volume 2, chapter 2 benthic subtidal and intertidal ecology). In total, the area of seabed affected within the North Norfolk waterbody is 0.39 km² and within the East Norfolk waterbody is 0.48 km².
1% or more of the water body's area		No, Impact assessment not required	***Norfolk North*** The portion of the Hornsea Three offshore cable corridor that crosses the Norfolk North water body (0.32 km²) represents 0.19% of the total area of the water body.
		No, Impact assessment not required	***Norfolk East*** The portion of the Hornsea Three offshore cable corridor that crosses the Norfolk East water body (0.32 km²) represents 0.19% of the total area of the water body.
Within 500 m of any higher sensitivity habitat	Yes		The current route of the Hornsea Three offshore cable corridor coincides with areas of subtidal chalk reef (see volume 5, annex 2.1: Benthic Subtidal and Intertidal Ecology Technical Report) within the East Norfolk waterbody. There is therefore potential for cable installation to occur in this area, with direct impacts (i.e. habitat loss) of this high sensitivity habitat. Hornsea Three is currently investigating the feasibility of avoiding this habitat and will seek to use this to mitigate these potential impacts, where possible, as the project evolves. Once the baseline environment has been fully established through further site specific surveys in the nearshore area, a full assessment of the potential to affect higher sensitivity habitats will be presented within the Environmental Statement.
1% or more of any lower sensitivity habitat[a]	Yes		***Norfolk North*** As per section 2.7 of volume 2, chapter 3, Benthic Subtidal and Intertidal Ecology the most likely lower sensitivity habitats to be present are 'cobbles, gravel and shingle' and 'subtidal soft sediments like sand and mud'. Within the Norfolk North water body the area of these habitats are 1.93 km² and 370.99 km² respectively. The portion of the Hornsea Three offshore cable corridor that crosses the Norfolk North water body (0.32 km²) represents 16.58% of the 'cobbles, gravel and shingle' habitat and 0.09% of the 'subtidal soft sediments like sand and mud'. A risk has therefore been identified for the 'cobbles, gravel and shingle' habitat of the Norfolk North water body, and therefore this receptor is scoped in based on the information currently available.
		No, Impact assessment not required	***Norfolk East*** As per section 2.7 of volume 2, chapter 3, Benthic Subtidal and Intertidal Ecology the most likely lower sensitivity habitats to be present are 'cobbles, gravel and shingle' and 'subtidal soft sediments like sand and mud'. Within the Norfolk East water body the area of these habitats are 129.72 km² and 78.40 km² respectively. The portion of the Hornsea Three offshore cable corridor that crosses the Norfolk East water body (0.32 km²) represents 0.25% of the 'cobbles, gravel and shingle' habitat and 0.41% of the 'subtidal soft sediments like sand and mud'.

a as defined by Environment Agency (2016).

4.3.2 Fish

4.3.2.1 Table 4.4 provides the specific risk information for fish receptors.

Table 4.4: Fish risks.

Consider if your activity:	Yes	No	Biology fish risk issue(s)
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary		No, Impact assessment not required	The activity will not take place near or within an estuary and is highly unlikely to or prevent fish entering or affect fish migrating through any estuary. In addition,in volume 2, chapter 3 Fish Ecology effects were predicted that would be of negligible to minor significance on populations of fish as a result of Hornsea Three construction, operations and maintenance and decommissioning phases. This included effects from temporary and long term habitat loss, increased suspended sediment concentrations (SSC), underwater noise, EMF, accidental pollution and introduction of hard substrate. No significant impacts on fish populations (including migratory fish populations) were predicted.
Could prevent normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)		No, Impact assessment not required	Within volume 2, chapter 3 Fish Ecology effects were predicted that would be of negligible to minor significance on populations of fish as a result of Hornsea Three construction, operation and decommissioning. This included effects from temporary and long term habitat loss, increased SSC, underwater noise, EMF, accidental pollution and introduction of hard substrate. No significant impacts on fish populations were predicted.
Could cause entrainment or impingement of fish		No, Impact assessment not required	No entrainment or impingement will occur as a result of Hornsea Three.

4.4 Water quality

4.4.1.1 Table 4.5 provides the specific risk information for water quality receptors. Table 4.6 provides the specific risk information for water quality receptors in relation to the release of chemicals. Table 4.7 provides the specific risk information for water quality receptors in relation to mixing zones.

Table 4.5: Water quality risks.

Consider if your activity:	Yes	No	Water quality risk issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring-neap tidal cycle (about 14 days)?		No – impact assessment not required	Water clarity is likely to be affected following trenching during cable installation and due to the excavation of HDD exit pits. Sediments are mainly composed of coarse gravel and sand and chalk. Volume 2 chapter 1 marine processes demonstrates that any effects from trenching through chalk and coarse gravel and sand are expected to be of local spatial extent, short term duration (i.e. plume effects lasting seconds to minutes in any one location) and highly reversible, resulting in effects that are of minor adverse significance and therefore not significant. Effects during decommissioning are predicted to be negligible.
Is in a water body with a phytoplankton status of moderate, poor or bad		No – impact assessment not required	The two water bodies are classified as having a phytoplankton status of good.
Is in a water body with a history of significant and persistent algal blooms or toxic algal blooms		No – impact assessment not required	The two water bodies do not have a history of significant and persistent algal blooms or toxic algal blooms. However, the history of harmful algal blooms is not monitored for both water bodies.

Table 4.6: Water quality risks in relation to the use or release of chemicals.

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Yes	No	Water quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list		No – impact assessment not required	Bentonite is the main chemical that will be used during HDD activity. Bentonite and its constituent components are not listed on the EQSD list. Any potential risk of accidental release of contaminants will be minimised through the implementation of a Code of Construction Practice (CoCP) during the construction phase and a Project Environmental Management and Monitoring Plan (PEMMP) during the operational phase.
It disturbs sediment with contaminants above Cefas Action Level 1		To be confirmed	Sediment quality (and therefore potential to disturb contaminated sediments) is to be confirmed site specific surveys in the nearshore area prior to the Environmental Statement. The sediments present are unlikely to contain significant levels of fine material, being composed of coarse gravel and sand. Therefore it is unlikely that significant amounts of contaminants will be present in sediments. Sampling during the site specific environmental surveys will confirm whether or not there are contaminants in the nearshore environment (both within and adjacent to the WFD waterbodies). One of the sampling locations is within 1 NM and within the WFD waterbodies. If fine sediments are recorded in the grab sample then a sediment chemistry sample will be taken and the analysis results used to inform this assessment in the Environmental Statement.

Table 4.7: Water quality risks in relation to mixing zones.

If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	Yes	No	Water quality risk issue(s)
It will release Environmental Quality Directive (EQSD) listed chemicals.		No – impact assessment not required	Hornsea Three does not include a discharge pipeline or outfall.

4.5 WFD protected areas

4.5.1.1 The WFD assessment also considers if WFD protected areas are at risk from the proposed activity. These include:

- special areas of conservation (SAC);
- special protection areas (SPA);
- shellfish waters;
- bathing waters;
- nutrient sensitive areas – polluted or eutrophic; and
- nitrate vulnerable zones (NVZ) – polluted or sensitive.

4.5.1.2 Marine Conservation Zones (MCZs) are not listed in the Environment Agency (2016) guidance. However, as a protected area at risk from the proposed activities the Cromer Shoal Chalk Beds MCZ has been included in the assessment.

4.5.1.3 The Wash and North Norfolk Coast SAC, North Norfolk Coast SAC/SPA, Cromer Shoal Chalk Beds MCZ and bathing waters at Sheringham coincide with the Hornsea Three offshore cable corridor and landfall area are within the MMO 'environmental sensitivity supplement' 2 km Screening trigger and have been taken forward into the scoping assessment in Table 4.8.

4.5.1.4 Table 4.8 outlines the protected area risks for Hornsea Three.

Table 4.8: Protected area risks.

Consider if your activity:	Yes	No	Protected areas risk issue(s)
Within 2 km of any WFD protected area		No – impact assessment not required	The activity is within 2km of the Wash and North Norfolk Coast SAC and North Norfolk Coast SAC/SPA. The Wash and North Norfolk Coast SAC and North Norfolk Coast SAC are both designated for a number of terrestrial features (e.g. coastal lagoons landward of highest astronomical tide (HAT), dunes etc.) and therefore there is no connectivity between the Hornsea Three activity in the subtidal and intertidal areas and these features. In addition the North Norfolk Coast SPA is designated for a number of over wintering and breeding bird species. The Hornsea Three Drat Report to Inform Appropriate Assessment demonstrates no Likely Significant Effects on the SPA from the Hornsea Three cable installation activity in subtidal and intertidal areas.
	Yes		The Hornsea Three offshore cable corridor coincides with the Cromer Shoal Chalk Bed MCZ. Impacts on the Cromer Shoal Chalk Beds MCZ and its features of interest are considered in volume 5, annex 2.3: Marine Conservation Zone Assessment.
		No – impact assessment not required	Bathing waters at Sheringham have the potential to be affected by changes in water quality and increased SSC. As outlined in volume 2 chapter 1 marine processes any effects are expected to be of local spatial extent, short term duration (i.e. plume effects lasting seconds to minutes in any one location) and highly reversible, resulting in effects that are of minor adverse significance and therefore not significant. Sheringham is 0.5 km from the Hornsea Three offshore cable corridor. However, based on the results of dispersion modelling in volume 2, chapter 1 marine processes it is likely that any SSC and changes in water quality will have returned to background levels before reaching Sheringham and therefore there is unlikely to be any impact.

4.6 Invasive and non-native species

4.6.1.1 Table 4.9 outlines the INNS risks for Hornsea Three.

Table 4.9: INNS risks.

Consider if your activity:	Yes	No	INNS risk issue(s)
Introduce or spread INNS		No – impact assessment not required	As discussed, volume 2, chapter 2 benthic subtidal and intertidal ecology, new hard substrate habitat (foundations, cable protection and scour protection) will be introduced to the marine environment, the vast majority of which will be located in the Hornsea Three array area, over 100 km to the north of the relevant WFD water bodies considered here. If cable protection is to be used within the Norfolk East or Norfolk North water bodies this is likely to be limited to small areas of cable protection (e.g. concrete mattressing). This introduced hard substrate has the potential to provide new habitat for the potential colonisation by INNS. In addition, during the operation and maintenance phase, there will be up to 11,566 vessel movements during the construction phase and 2,832 round trips to port by operational and maintenance vessels, which will contribute to the risk of introduction or spread of INNS in ballast water. However, these vessel movements are also likely to be around the Hornsea Three array area, well outside the boundaries of the Norfolk East and Norfolk North water bodies. Designed-in measures including a biosecurity plan, a PEMMP and vessels complying with the International Maritime Organization (IMO) ballast water management guidelines will ensure that the risk of potential introduction and spread of INNS will be minimised. There is little evidence from other offshore wind farm developments within the North Sea of non-indigenous species having any adverse effects on key species and habitats. Materials and vessels will be from within European and / or UK waters. As a result of these measures any impacts are expected to be of minor adverse significance and as a result not significant.

4.7 Summary

4.7.1.1 The results of the WFD scoping are summarised in Table 4.10.

Table 4.10: WFD scoping summary.

Receptor	Potential risk to receptor	Notes [risk issues for impact assessment]
Hydromorphology	No	N/A
Biology: habitats	Yes	The portion of the Hornsea Three offshore cable that crosses the Norfolk North water body represents 16.58% of the 'cobbles, gravel and shingle' low sensitivity habitat.
Biology: fish	No	N/A
Water quality	No	N/A
Protected areas	Yes	Impacts on the Cromer Shoal Chalk Beds MCZ and its features are considered in volume 5, annex 2.3: Marine Conservation Zones Assessment.
Invasive non-native species	No	N/A

5. Impact Assessment

5.1 Biology: Habitats

5.1.1 Coarse sediment habitats: Norfolk North waterbody

5.1.1.1 As detailed in volume 2, chapter 2: benthic ecology above, cable installation will result in temporary habitat loss of up to 16.58% of subtidal coarse sediment habitats within the Norfolk North waterbody (i.e. 'cobbles, gravel and shingle') during the construction phase.

5.1.1.2 While the proportion of this habitat affected within the Norfolk North waterbody is proportionally large (i.e. total 'cobbles, gravel and shingle' in the Norfolk North waterbody is estimated at 193 ha according to the Environment Agency Catchment Data Explorer; http://environment.data.gov.uk/catchment-planning), this estimate is precautionary, as this assumes all temporary habitat loss/disturbance due to cable installation occurring entirely within this habitat, due to uncertainties regarding the nature of the habitats in the inshore area of the Hornsea Three offshore cable corridor. The final WFD assessment (to be submitted with the Environmental Statement) will provide a more detailed breakdown of the predicted habitat loss during cable installation based on the habitats recorded in the area during a survey of the inshore cable route to be undertaken in 2017 and to take account of any further data which may be available ahead of the final application. However, despite this data gap, further detail on sensitivity and recovery potential of this habitat is provided below, allowing for a conclusion to be made with regard to deterioration of this receptor (paragraph 5.1.1.4).

5.1.1.3 The sensitivity of the communities associated with coarse, gravelly sediments is discussed in detail in of volume 2, chapter 2: benthic ecology with a summary provided here. These communities, if present, were concluded to have a typically low sensitivity to impacts resulting from physical disturbance/abrasion and displacement (Durkin, 2008; Rayment 2008b; Tillin, 2016c; Tillin, 2016d; De-Bastos and Marshall, 2016) and are likely to experience minor localised declines in species richness in characteristic fauna including polychaetes and venerid bivalves. Most the infauna will be expected to rebury following displacement with only a small degree of mortality resulting from predation. Although some permanently attached species such as epifaunal hydroids and bryozoans will suffer mortality when removed from the substratum during construction activities, other epifaunal species which remain attached to their substrate will likely to survive any physical damage and repair themselves (Silén, 1981). The documented evidence indicates high recoverability of the component species of this habitat following this impact with damaged or reduced populations recovering numbers and percentage cover within months, with full recovery within five years (Rayment, 2008b). This is also supported by some data from the aggregates industry which has shown that following the cessation of dredging activities, sand and gravel communities typically recover in two to three years (Newell et al., 1998), although it should be noted that the complete removal of sediment associated with aggregate extraction is quite different to that associated with the construction of Hornsea Three which will only disturb sediment during cable burial, rather than remove it entirely. Furthermore, gravel sediments have been reported as recovering from cable burial activities within one year (Andrulewicz et al., 2003 in Foden et al., 2011).

5.1.1.4 Due to the short term and reversible nature of temporary habitat loss impacts on 'cobbles, gravel and shingle' habitats, there is no potential for deterioration of the status of this quality element. This is in line with the Environment Agency (2016) guidelines which state, as detailed in paragraph 2.1.4.2, temporary effects due to short-duration activities like construction or maintenance are not considered to cause deterioration if the water body would recover in a short time without any restoration measures. Further, there is also no potential for jeopardising the potential of this quality element achieving good status in the future.

5.1.2 Chalk reef

5.1.2.1 As detailed in volume 2, chapter 2: benthic ecology and volume 5, annex 2.3: MCZ Assessment, cable installation has the potential to affect subtidal chalk reefs. In areas of chalk reef, where export cables are installed (e.g. via trenching) this would lead to loss of a proportion of this habitat, with no potential for recovery. In these areas, the cable trench would be expected to be infilled by surface sediments (e.g. coarse, mixed and sandy sediments) from surrounding areas, leading to a change in the substrate type from subtidal chalk, to a sediment habitat. In areas where anchors are placed, it is expected that the substrates would be left intact, although with some damage to the physical structure of the chalk reef depending on the structural complexity (e.g. presence of pinnacles, ridges, overhangs and gullies). Hornsea Three is currently investigating the feasibility of avoiding these features and will seek to use this to mitigate these potential impacts, where possible, as the project evolves. This WFD impact assessment on the effects on chalk reef will therefore be revisited prior to submission of the Environment Statement. Effects on subtidal chalk features of the Cromer Shoal Chalk Beds MCZ are considered further in volume 5, annex 2.3: MCZ Assessment of the PEIR.

5.2 Protected areas

5.2.1.1 As detailed in section 4.5, the Hornsea Three offshore cable corridor coincides with the Cromer Shoal Chalk Beds MCZ and therefore has the potential to affect the interest features of this site. Effects on this site are considered within volume 5, annex 2.3: MCZ Assessment which accompanies the PEIR. The MCZ assessment has concluded no significant effects on the features of the Cromer Shoal Chalk Beds MCZ, notwithstanding the potential for effects on subtidal chalk features of the MCZ (see section 5.1.2).

5.2.1.2 Due to the conclusions of no significant effects on the Cromer Shoal Chalk Beds MCZ (i.e. WFD Protected Area), there is no potential for deterioration of the status of this quality element of the Norfolk East coastal water body, nor is there potential for jeopardising the potential of this quality element achieving good status in the future.

6. Conclusion and Next Steps

6.1 Conclusion

6.1.1.1 Based on the scoping presented in section 4 and the impact assessment in section 5, there is no potential for deterioration of the status of the Norfolk North and Norfolk East water bodies. In most instances the relevant activities for the construction and installation of the Hornsea Three offshore cable corridor do not require assessment as they are below the thresholds set by the Environment Agency (2016) guidance. With respect to Biology: the criteria which determine whether an impact assessment is required were met for the area of a low sensitivity habitat affected. This was also the case for protected areas, as the Cromer Shoal Chalk Beds MCZ is within 2 km of the project and may potentially be impacted by the activities.

6.1.1.2 Based on the low sensitivity of habitats to cable installation activities and the high recoverability of the component species of this habitat, recovery is expected to occur within months, with full recovery within five years (Rayment, 2008b). Given the low sensitivity and high recoverability and due to the short term and reversible nature of temporary habitat loss, there is no potential for deterioration of the status of this quality element.

6.1.1.3 Effects of cable installation on chalk reef habitats would be permanent and irreversible, if these were to occur, although Hornsea Three is currently investigating the feasibility of avoiding these features and will seek to use this to mitigate these potential impacts, where possible, as the project evolves.

6.1.1.4 In relation to Protected Areas, volume 5, annex 2.3: MCZ Assessment concludes no significant effects on the features of the Cromer Shoal Chalk Beds MCZ. Therefore, there is no potential for deterioration of the status of this quality element of the Norfolk East coastal water body, nor is there potential for jeopardising the potential of this quality element achieving good status in the future.

6.2 Next steps

6.2.1.1 Once the habitats present within the Hornsea Three offshore cable route corridor and landfall area are confirmed through future site specific survey (i.e. prior to the Environmental Statement) this WFD assessment will be updated to include an updated scoping (where necessary) and an impact assessment on those receptors where scoping has identified risks, using the Environment Agency guidance detailed in section 2.1.4. The assessment will be revisited to provide more detailed habitat loss calculations and update the assessment of potential risks to protected features of the Cromer Shoal Chalk Beds MCZ, including the high sensitivity habitat, chalk reef.

7. References

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