Hornsea Project Four

Clarification Note on Marine Processes Supplementary Work Scope of Works

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01	N/A	N/A	Document prepared and presented to Natural England and the MMO in response to Relevant Representation.

Memo

Subject	Hornsea Four Marine Processes Additional Scope of Works
To	Natural England, MMO
Copy	GoBe Consultants and Royal HaskoningDHV
From	Hornsea Four Offshore Wind Farm (Hornsea Four)
Regarding	Supplementary works associated with Marine Geology, Oceanography and Physical Processes receptors: Smithic Bank; the Holderness coast; and the Flamborough Front.

1. Introduction and Background

This document sets out the draft Scope of Works (SoW) proposed by Hornsea Four (the Applicant) to address comments from Natural England (NE) and the Marine Management Organisation (MMO) in their Relevant Representations to the Hornsea Four Development Consent Order (DCO) Application on the topic of Marine Geology, Oceanography and Physical Processes. The Applicant understands the main issues raised by NE and the MMO relate to three main Marine Geology, Oceanography and Physical Processes receptors: the Smithic Bank; the Holderness coast; and the Flamborough Front.

The works described in the following SoW are intended to increase the confidence NE and the MMO may have on the data used and as such the baseline understanding that has been presented within the ES.

2. Appreciation of the Issues Raised

2.1 Smithic Bank and The Holderness Coast

NE and the MMO consider Smithic Bank to be of high environmental value for two main reasons; it provides shelter for the Holderness coast from wave exposure, and it acts as a sediment store that feeds the wider coastal and marine systems. NE have raised concerns with the proposed cable installation activities across the Smithic Bank, stating it could adversely affect the form and function (morphology) of the bank (particularly lowering) with subsequent effects on the wave climate at the coast (particularly during storms) and, in turn, change the coastal morphology. The main designated sites of concern to NE are the Humber Estuary Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar site and Site of Special Scientific Interest (SSSI), the Holderness Inshore Marine Conservation Zone (MCZ) and Dimlington Cliffs SSSI.

NE have requested long-term impacts of cable installation activities across the Smithic Bank are addressed in terms of the risk of lowering the Bank and its

potential effect on sediment transport processes at the above designated site receptors. NE also state that the baseline assessments of Smithic Bank and the Holderness coast, to support the assessment of potential impacts, are insufficient and would like to see detailed investigation of the historic evolution of the geomorphology of the bank and the Holderness cliffs, and potential future evolution with sea-level rise.

The MMO has concerns regarding the cumulative impact of cables crossing Smithic Bank. They indicate that although a 'high level' overview has been provided by physical monitoring surveys and bathymetry surveys, the coverage and intensity of surveys around Smithic Bank and along the Holderness coast are sparce and that gaps exist. The MMO requested further information be provided for the baseline, including bathymetry and geotechnical survey data.

2.2 Flamborough Front

NE and the MMO consider Flamborough Front to have high environmental value as an area of high productivity which supports concentrations of foraging fish that in turn provides a food source for high densities of seabirds and marine mammals. NE raised concerns that the potential impacts of the project alone and in-combination with other plans and projects, on disruption (turbulent wakes) to the Flamborough Front were not adequately assessed in the ES. NE have requested an improvement in the baseline characterisation of the Flamborough Front, particularly in the vicinity of Hornsea Four, and its potential effect on the Flamborough Head SAC.

The MMO raised concerns that impacts on the Flamborough Front, especially any changes (positively and negatively) to primary productivity (and subsequently secondary productivity) have not been fully addressed.

3. Receptors

The specific receptors considered as part of this SoW build on those identified above and address the additional receptors of concern included by NE and the MMO in their relevant representations:

- Smithic Bank
- Holderness coast
- Flamborough Front
- Flamborough Head SAC
- Humber Estuary SAC/SPA/Ramsar

4. Methods Employed

This SoW is divided into five elements, to be agreed in consultation with interested parties, and provide clarification or validation of the existing baseline and assessment works concluded for Hornsea Four. These are:

1. Data review
2. Historical Trend Analysis (HTA)
3. Expert Geomorphological Assessment (EGA)
4. Source-Pathway-Receptor (S-P-R) model
5. Updates to the impact assessments

Table 1 summarises the methods that will be employed for each receptor.

Table 1: Methods of Assessment

Receptor	Data review	HTA	EGA	S-P-R	Assessment
Smithic Bank					
Holderness coast (Holderness Inshore MCZ and Dimlington Cliffs SSSI)					
Flamborough Front					
Flamborough Head SAC					
Humber Estuary SAC, SPA, Ramsar					

In each of these components of the proposed clarification works, the study will be a principally receptor-led assessment of individual and combined effects on the specific receptors. The study will provide clarification or validation of the existing baseline presented in the Environmental Statement (ES) Chapter A2.1 Marine Geology, Oceanography and Physical Processes and accompanying ES Volume A5 Annex 1.1 Marine Processes Technical Report.

The following sections provide an overview of the methods proposed by Hornsea Four.

4.1 Data Review

Existing hydrodynamic, sedimentary and geomorphological data relating to the above receptors will be reviewed and collated. The review will clarify those datasets already identified in the Hornsea Four ES. For each identified data set, we will consider the spatial extent, temporal extent, and its applicability to the assessment. Importantly, this review will include two critical datasets of value to understanding Smithic Bank and the Holderness coast.

For Smithic Bank, bathymetry data has been collected across most of Smithic Bank in 2011 by the Channel Coastal Observatory. We are also aware of a 2016 bathymetry collected by Titan Environmental Surveys (and held by East Riding of Yorkshire Council (ERYC)). Prior to these surveys, the last known survey extending across Smithic Bank was a single-beam hydrographic survey from 1979 (now incorporated into the EMODnet bathymetry dataset).

For the Holderness coast, ERYC has monitored the retreat of the Holderness cliff through regular surveys of the cliff edge since 1951, relative to 123 measuring posts. In 2003, ERYC initiated a new system of monitoring using the Differential Global Positioning System (DGPS) every six months. Prior to 1951, dating back to

1852, ERYC estimated cliff erosion rates using historical Ordnance Survey map data.

In relation to the Flamborough Front, the study validate existing technical work carried out by Royal HaskoningDHV. Hornsea Four would welcome any additional datasets identified by NE and MMO which may be incorporated into this study.

4.2 Historical Trend Analysis (HTA)

The HTA method essentially involves the interrogation of time series data to identify directional trends and rates of processes and morphological change over varying time periods. For Smithic Bank, the digital bathymetry data from 1979 (EMODnet), 2011 and 2016 (if available) will be assessed in this way. ArcGIS will be used to create Digital Ground Models (DGMs) for each of the 1979, 2011 and 2016 bathymetry surveys to identify features including depressions/channels, sand waves and areas of outcropping bedrock. Where they overlap, the 1979, 2011 and 2016 bathymetries will be compared to identify and quantify areas of morphological change (erosion and deposition of seabed sediment) or areas of seabed that have been static (bedrock) or in equilibrium. Long-term change will be assessed by comparison of the younger data with 1979, and short-term change by comparing 2011 with 2016.

For Holderness, O.S. maps extend back to the First Edition One-inch 'Old Series' maps surveyed in the mid-19th century. These were followed by the Six-inch 'County Series' maps surveyed in the late 19th century and later years. These maps will be geo-referenced and the long-term positions of the cliff-top digitised in a GIS. The position of the cliff-top after 1951 will be derived from the ERYC monitoring data to investigate the spatial patterns of erosion change over the past 70 years (medium-term).

4.3 Expert Geomorphological Assessment (EGA)

The potential future evolution of the Smithic Bank and Holderness coast will be assessed using EGA. This method incorporates output from HTA but will also take into account information about current physical and sedimentary processes, geological constraints, sediment properties, and general relationships between processes and morphological responses. As long as due regard is taken of data origins and accuracy, predictions based on extrapolation of trends can provide a reliable estimate of the most probable evolution of the systems. However, a simple linear extrapolation into the future will not take into consideration the complex nature of the natural system, where future conditions may differ from the past. There are many reasons for this type of departure including climatic or human-induced change, or the presence of geological controls. The value of the EGA will be two-fold:

- the potential changing morphology of the Smithic Bank will be used to understand the future potential implications for physical and sedimentary processes at the coast, and any knock-on effects on erosional or accretional trends; and
- the distribution and migration patterns of any mobile bedforms and the EGA evidence will be used to map sediment transport pathways.

4.4 Source-Pathway-Receptor (S-P-R) Model

We will develop a S-P-R model providing a simple visualisation linking the receptors identified above and the associated impact pathways. The S-P-R model will combine the data review with the receptor locations and extents and map the pathways and potential receptors that could be affected by changes in the hydrodynamic and sedimentary environment because of the proposed Hornsea Four development.

4.5 Assessment Updates

The assessments presented in the EIA and RIAA relevant to the receptors and pathways identified above will be clarified where relevant based on the information gathered and interpreted through this SoW, should it be available.

5. Expert Resources

The work set out above will draw upon the EIA and any clarificatory data to provide independent validation of the pertinent aspects of the assessments presented at DCO application.

Hornsea Four propose to use Dave Brew, Lead Geomorphologist at Royal HaskoningDHV for the data review, HTA, SPR and EGA workstreams.

6. Deliverables

A report will be prepared presenting the results of the assessment described below:

1. Receptor Data Review - All five receptors
2. HTA – Smithic Bank and Holderness coastline
3. EGA – Smithic Bank and Holderness coastline
4. SPR Model – All five receptors
5. Assessment– All five receptors