



Hornsea Project Four

Applicant's comments on other submissions
received at Deadline 4

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Revision Summary

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1 Introduction

1.1.1.1 At Deadline 4 the following 16 submissions were received from 9 stakeholders:

- Historic England – Post-hearing submissions including written summaries of oral case put at any of the hearings during the weeks commencing 25 April 2022 and 2 May 2022 ([REP4-051](#));
- MMO –Post hearing submissions, Comments on any submissions received at Deadline 3, Any further information requested by the Examining Authority under Rule 17 ([REP4-052](#));
- Natural England – Cover Letter ([REP4-053](#));
- Natural England – Risk and Issues ([REP4-054](#));
- Natural England - Appendix B4 – Comments on G2.10 MRSea Baseline Sensitivity Report (Gannet) Revision 2 ([REP4-055](#));
- Natural England - Appendix C4 – Comments on G3.4 Compensation measures for Flamborough and Filey Coast (FFC) Special Protection Area (SPA) Compensation Connectivity Note Revision: 01 ([REP4-056](#));
- Natural England – Cover Letter ([REP3-053](#));
- Natural England – Risk and Issues Log ([REP3-054](#));
- RSPB - Response to Calculation Methods of Hornsea Four’s Proposed Compensation Measures for Features of the Flamborough and Filey Coast (FFC) Special Protection Area (SPA) and Hornsea Four comments on RSPB Written Representation ([REP4-057](#));
- RSPB - Annex A – Comments on the Applicant’s Bycatch reduction documents submitted at Deadlines 1 and 2 ([REP4-058](#));
- BP Exploration Operating Company Limited – Deadline 4 Submission ([REP4-059](#));
- CMS Cameron McKenna Nabarro Olswang LLP on behalf of NEO Energy (SNS) Limited ([REP4-060](#));
- Gordons LLP on behalf of Paul and Joanne Dransfield – Deadline 4 Submission ([REP4-061](#));
- Perenco UK Limited - Post-hearing submissions including written summaries of oral case put at any of the hearings during the weeks commencing 25 April 2022 and 2 May 2022 ([REP4-062](#)); and
- The Corporation of Trinity House of Deptford Strond - Comments on any submissions received at Deadline 3 on the draft Development Consent Order [REP3- 007] (“the Draft DCO” ([REP4-063](#)).
- East Riding of Yorkshire Council - Cover Letter ([REP4-064](#))
- East Riding of Yorkshire Council – Response to Issue Specific Hearing 2 (ISH2) action points ([REP4-065](#))
- East Riding of Yorkshire Council – Response to Issue Specific Hearing 3 (ISH3) action points ([REP4-066](#))

1.1.1.2 The Applicant has reviewed all Deadline 4 submissions and responded on individual stakeholders’ submissions in Section 2

1.1.1.3 The following stakeholders are dealt with in separate responses documents, due to their length and/or complexity:

- BP Exploration Operating Company Limited – Comments on legal submissions in (REP4-059) will be addressed in [G5.22 Applicant comments on bp’s legal submissions](#)
- BP Exploration Operating Company Limited – Comments on technical submissions in (REP4-059) will be addressed in [G5.21 Applicant comments on bp’s technical submissions](#)

1.1.1.4 Please see the Deadline 4 submission of [G1.1 Overarching Acronyms List \(REP3-014\)](#) and the Deadline 3 submission of [G1.45 Overarching Glossary \(REP3-027\)](#) for overarching acronym and glossary lists.

2 Applicant's Comments to Historic England (REP4-051)

Reference	Stakeholder's Written Representation	Applicant's Response
<i>Issue Specific Hearing 3 (26th April 2022)</i>		
3	<p>Ref: 10.2 – We accept the explanation provided to us that no amendment is to be made to Condition 13(1)(c) within the draft DCO (Ref: version as submitted at Deadline 3; EN010098-001339). We appreciate that the Applicant has highlighted provisions for marine archaeology required in a Construction Method Statement to have “regard to any mitigation scheme pursuant to subparagraph 13(1)(f).” which alludes to pre-construction surveys. However, we noted that the explanation by the Applicant that 13(1)(f) is linked to Condition 17 which also relates to pre-construction monitoring and surveys, but the text of this condition states that “The undertaker must, in discharging condition 13(1)(f), for each stage of construction submit a monitoring plan or plans for that stage in accordance with an outline marine monitoring plan.” We therefore wish to have it confirmed that in order to inform each stage of construction the conditions that provide for completion of pre-construction surveys and reporting will occur within a timeframe that supports decision-making at each stage of construction.</p>	<p>For a full response to the proposed changes to the draft DCO and DML, please see the response to the Examiner’s second written question HE.2.7 (ii) in G5.2 Applicant’s responses to ExAs Second Written Questions.</p>
4	<p>Ref: iv – We accept the confirmation stated in the Applicant’s comments on other submissions received at Deadline 2; Deadline: 3, Date: 21 April 2022; Document Reference: G3.3; Revision: 01 that a high-resolution Side Scan Sonar (SSS) survey will be undertaken as part of the pre-construction monitoring as secured through Schedules 11 and 12 (Draft DCO including Draft Deemed Marine Licences (DMLs) as submitted by the Applicant at Deadline 3). We appreciate the explanation that survey data will be used to inform further work and the identification of anomalies of archaeological interest or other sites of possible historic interest (e.g. previously unknown wreck site locations) should be afforded Archaeological Exclusion Zones (AEZs), as necessary to inform planning of the final design of the proposed project, including micrositing, so that archaeological material(s) are left in-situ and undisturbed. However, we note that the Applicant makes specific reference to SSS survey and that Draft DML Condition 17(2)(a) specifies swath–bathymetry survey. It is therefore our advice that the Applicant confirms that delivery of Draft DML Conditions 13(2) and 13(3) in Schedules 11 and 12, which secure a marine Written Scheme of archaeological Investigation, also recognises the requirement within Condition 13(2)(h) “...further site investigations, which must allow sufficient opportunity to establish a full understanding of the historic environment within the offshore Order Limits...” We therefore offer the advice that a full suite of geophysical survey techniques are employed such as Sub-Bottom Profiler (i.e. shallow seismic) and magnetometer as well as SSS and high-resolution swath-bathymetry (i.e. Multi-Beam Echo Sounder).</p>	<p>For a full response to the proposed changes to the draft DCO and DML, please see the response to the Examiner’s second written question HE.2.7 (iii) in G5.2 Applicant’s responses to ExAs Second Written Questions.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
5	<p>Ref: 2.10 – We accept the explanation provided by the Applicant regarding adaptive mitigation strategies, as detailed within the Outline Marine Written Scheme of Investigation (WSI) for the stage of construction including the production of Archaeological Method Statements (Conditions 13(2)(b) in Schedules 11 and 12). However, given that up to 110 Gravity Base Structures could be installed, we consider it necessary that at the time of producing such method statements that it details the estimate depth of seabed excavation to be required.</p>	<p>For a full response to the proposed changes to the draft DCO and DML, please see the response to the Examiner's second written question HE.2.7 (i) in G5.2 Applicant's responses to ExAs Second Written Questions.</p> <p>The Outline WSI has been updated at Deadline 5 to this effect.</p>
15	<p>Ref: 4.19 – We accept the explanation given by the Applicant that an offshore geotechnical survey will be undertaken prior to construction including geoarchaeological assessment. We understand that geo-archaeological analysis of this data, as generated by pre-commencement material operations inclusive of intrusive seabed works, should be provided through Conditions 13(2)(h) and 13(3) in Schedules 11 and 12. We also appreciate that subject to successful completion of any agreed programme of analysis that a 'positive' effect in EIA terms could be identifiable. However, it seems that as well as changes in sedimentary conditions attributable to this proposed seabed development, a relevant factor is also the physical presence of the proposed infrastructure, in conjunction with other comparable developments (in planning, under construction and built) and are relevant factors for inclusion within Cumulative Effect Assessment.</p>	<p>For a full response to the proposed changes to the draft DCO and DML, please see the response to the Examiner's second written question HE.2.4 in G5.2 Applicant's responses to ExAs Second Written Questions.</p>
18	<p>Ref: 4.25 – We welcome the statement by the Applicant that landfall geophysical and geotechnical survey data acquired in the summer of 2021 will inform the construction programme in addition to the known archaeological receptors identified. We therefore defer further comment to the relevant local planning authority and their archaeological advisory service for all works as proposed within the intertidal zone.</p>	<p>East Riding of Yorkshire Council have confirmed in a Deadline 4 response (Late Deadline 4 Submission, accepted at the discretion of the Examining Authority – Response to Issue Specific Hearing 3 (ISH3) action points (REP4-066)) that they have 'no outstanding concerns regarding the historic environment of the intertidal zone.'</p>
Action 4	<p><i>Clarify if there are any outstanding concerns regarding the historic environment of the intertidal zone and, if there are, to explain them." Action by: Historic England/East Riding of Yorkshire Council</i></p> <p>We have contacted the Humber Archaeological Partnership (the archaeological advisory service) for East Riding of Yorkshire Council, as they are best placed to advise on how the historic environment might be encountered within the intertidal zone.</p> <p>However, we noted in the Outline Marine Written Scheme of Investigation (Doc Ref: PINS Document Reference: F2.4; APFP Regulation: 5(2)(a)), which includes works as may occur within the intertidal zone, in paragraph 6.1.1.2 it states that "Curatorial responsibility for the aspects of Hornsea Four seaward of MHWS resides with Historic England". This requires amendment, and in agreement with the</p>	<p>For a full response to the proposed changes to the draft DCO and DML, please see the response to the Examiner's second written question HE.2.9 in G5.2 Applicant's responses to ExAs Second Written Questions.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
	<p>Humber Archaeological Partnership, we advise you that the East Riding of Yorkshire Council are the authority with curatorial responsibility within the intertidal zone (i.e. between the MHWS and MLWS). The responsibility for providing archaeological advice is delegated by them to the Humber Archaeology Partnership, as the historic environment planning advisors to the East Riding of Yorkshire Council. Therefore, in reference to draft DML Schedule 12 (Transmission Assets), Conditions 13(2), you may wish to ensure that in addition to the "statutory historic body" (i.e. Historic England), that the East Riding of Yorkshire Council is included, as relevant to any consultation exercise required to produce a marine WSI for any proposed works within the intertidal zone. The definition of "statutory historic body" could therefore require amendment within Part 1 of this draft DML to include the relevant local authority curatorial body.</p> <p>Furthermore, we also suggest that the draft Transmission Assets DML Schedule 12 is amended to provide for reporting to the relevant local authority and their professional archaeological advisory service (the Humber Archaeological Partnership) for any archaeological reports produced in accordance with condition 13(2)(c); such that reports are to be agreed with the MMO in consultation with the statutory historic body and, if relevant, East Riding of Yorkshire Council.</p> <p>We also offer an additional comment regarding Schedule 11 (Generation Assets) and Schedule 12 regarding Condition 13(2)(g). We are aware that the present text requires the implementation of Offshore Renewables Protocol for Reporting Archaeological Discoveries (ORPAD), as originally promoted by The Crown Estate. However, we understand that The Crown Estate no longer resources ORPAD although the guidance published by The Crown Estate in 2014 remains valid regarding the design of a protocol system for reporting discoveries and finds. We therefore offer the following text amendment for your consideration:</p> <p><i>"a reporting and recording protocol, designed in reference to the Offshore Renewables Protocol for Reporting Archaeological Discoveries as published by The Crown Estate and reporting of any wreck or wreck material during construction, operation and decommissioning of the authorised project..."</i></p> <p>We appreciate that you may wish to clarify this matter with the Applicant and the MMO regarding the text of the DML condition to be included.</p>	

3 Applicant's Comments to MMO (REP4-052)

Reference	Stakeholder's Written Representation	Applicant's Response
<i>Issue Specific Hearing 4 (ISH4)</i>		
1.7	<p>The MMO also notes the discussion had on the sampling requirement condition, and the Applicant's position that <i>"All offshore construction will be completed by 2029, so within five years from the commencement of offshore works and as such, sampling of the dredge area is unlikely to be required."</i> The MMO firstly advises that sampling is required either every 3 years, or every 5, depending on the results of the sediment sample analysis. The MMO are currently awaiting clarifications regarding the sampling before it is able to advise on the outcome of the results.</p> <p>Secondly, the MMO requests that the Applicant, in light of their position, provides clarity as to how OSPAR requirements will be adhered to, and how it would be secured, should there be a delay in the construction. We suggest that should the Applicants suggestion of <i>"dredging disposal activities will be provided in both the Construction Method Statement and the Construction Environmental Management and Monitoring Plans. And the Applicant considers that this mechanism will ensure that regulators can approve details in relation to the dredge and disposal activities"</i> be carried forward, that the OSPAR sampling requirements are clearly outlined as a matter to be included, and requiring sign off, within the DMLs.</p>	<p>For a full response to the proposed changes to the draft DCO and DML, please see the response to the Examiner's second written question MC.2.7 in G5.2 Applicant's responses to ExAs Second Written Questions.</p>
<i>Comments on any submissions received at Deadline 3 – Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction [REP2-032]</i>		
3.1.2 – 3.1.4	<p>The MMO notes, and welcomes the additional clarification set out in Section 2.2 regarding the timings of IHLS survey. The Clarification Note now acknowledges that no IHLS survey was undertaken in 2017.</p> <p>Regarding Section 2.2.1.2, in respect of 2018 IHLS survey data, it states that <i>"In 2018, the survey was undertaken for the Shetland stock only and is therefore not applicable for use within the back-calculations for the Banks stock (the stock of relevance for Hornsea Four)."</i></p> <p>The MMO notes that larval data for the Central North Sea (i.e. Banks stock) in 2018 are available. However, also notes the bold text taken from ICES 2020: <i>"Four survey areas were covered within the framework of the International Herring Larval Surveys in the North Sea during the sampling period 2018/2019. They monitored the abundance and distribution of newly hatched herring larvae in the Orkney/Shetlands area, in the Buchan area and the central North Sea (CNS) in the second half of September and in the southern North Sea (SNS) in the second half of December 2018 (figure 1.1). The German survey contribution around the Orkneys started as scheduled, but after one day of sampling the research vessel</i></p>	<p>The Applicant notes that the ICES 2020 report acknowledges the existence of 2018 IHLS data for the Banks stock. However, the Applicant confirms that this data is not publicly available via the ICES data portal. The Applicant has contacted ICES and the respective authors of the report, requesting that this data is made available and will seek to include it in a future update of G1.10 Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction, if this data becomes available to the Applicant during Examination.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
	<p>had to face severe technical problems. There was no opportunity to conduct a safe journey any further, thus the survey had to be stopped after 28 plankton hauls. (...) "As a consequence, the estimate for the Orkney/Shetland area is very low and biased due to the low area coverage, and no estimate for the Downs components is available in January 2019. The survey contribution of The Netherlands in September 2018 were as planned and covered the Buchan and the central North Sea." Please see Annex 1, Table 1 and Figure 1 of this submission for information extracted from ICES (2020).</p>	
3.1.5	<p>The MMO notes in Section 2.3 that the larval length in survey sample data (catch length) has been increased to 10mm, which we support for the purpose of undertaking a precautionary assessment.</p>	<p>The Applicant welcomes the MMO's agreement on the larval length in survey sample data (catch length).</p>
3.1.6	<p>The MMO also notes in Section 2.4.1.4 that larval length hatch sizes of 5mm (most conservative length) and 6mm (minimum length identified in meaningful numbers within the IHLS data) have now been included as a scenario for the back-calculation, which we also support as an additional conservative approach to the assessment.</p>	<p>The Applicant welcomes the MMO's agreement on the larval length hatch size scenarios and their acknowledgement that this adds further conservatism.</p>
3.1.7	<p>The MMO appreciates the presentation of the mean temperature data at sampling depths for sampling stations as shown in Figure 4 of the Clarification Note, as this provides a helpful visual depiction of sea temperatures at each sample location which can be used to determine typical durations of egg development and yolk absorption, depending on location. Whilst we recognise that the data depicted in Figure 4 shows mean temperatures at maximum sampling depth of 12°C or higher at the Flamborough Head spawning ground, we note that lower temperatures ranging from 8-12°C were recorded in the vicinity of Flamborough Head when the individual years of data are viewed in Figures 6 – 17 in Appendix C. With this in mind, the MMO maintains our previous comment that a conservative approach should be taken which considers the maximum durations for egg development and yolk absorption, i.e., the minimum temperatures recorded.</p>	<p>The Applicant notes that while temperatures lower than 12°C were identified in the vicinity of the hotspots, the lowest temperature recorded within the hotspot in any year was 11.9°C, with all other years generally much higher than the 12°C mean temperature (which includes all values from the survey area, not just the hotspot). Notwithstanding this, the Russell <i>et al.</i> (1976) paper does not provide values for yolk absorption and egg development at such a resolution to enable the use of an 11.9°C value, the 12°C temperature remains the most appropriate value to use. Specifically, this value can still be considered a precautionary temperature to determine the durations for egg development and yolk absorption as in all other years the temperature within the hotspot (i.e. the region of greatest importance) was above this value and so the durations would be faster than those used within the calculations (and it is unlikely that a 0.1°C difference in temperature would materially change the durations). . As such, the Applicant considers that to use a lower temperature than the already conservative 12°C, particularly as low as 8°C proposed by the MMO, would be excessively conservative as to be meaningless</p>

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3.1.8	<p>In addition, whilst the mean temperatures in the vicinity of Flamborough Head are >12°C, mean temperatures in the area to the north and northeast of Flamborough Head are lower at 10-11°C, so when considering piling noise propagation, it is essential to understand how far the effects of piling noise would extend in this area. With this in mind, we request that the Applicant presents Figure 4 with the modelled noise contours overlaid, based on the maximum hammer energy for monopiling. Noise contours should be presented based on a stationary receptor, for a fish with a swim bladder involved in hearing, and for eggs and larvae, based on the thresholds described in Popper et al. (2014); Mortality and potential mortal injury, recoverable injury, and Temporary Threshold Shift (TTS). In addition, we request that the noise contour for the received levels of the 135dB single strike sound exposure level (SELs) at the herring spawning ground are also presented for consideration of behavioural responses in herring based on the findings in Hawkins et al. (2014).</p>	<p>when considering the temperature values associated with the hotspot (i.e. the primary area of spawning).</p> <p>The Applicant notes the MMO's request to present the modelled noise contours for Group 3 stationary receptors, based on the thresholds described in Popper <i>et al.</i> (2014) in Figure 4 of G1.10 Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction. In response, to this, the Applicant has overlaid the noise contours from the HVAC booster station search area (piling location closest to the IHLS hotspot) over the sampling depth temperature data (see Figure 4 of G1.10 Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction submitted at Deadline 5). The Applicant can confirm that within the noise contours, the mean sampling depth temperatures from the temporal dataset range from 12.9°C to 13.7°C, significantly higher than the 12°C mean temperature used to inform the parameters presented within the Clarification Note, ensuring that a precautionary approach has been utilised.</p> <p>As has been stated in previous submissions, the Applicant does not deem it appropriate to present the 135dB SEL threshold. This is due to the use of the 135dB SEL threshold (which is based on a study within a quiet loch) being expressly recommended by the authors of the paper (Hawkins <i>et al.</i> 2014) as not appropriate for use in determining impacts from underwater noise on fish. Notwithstanding the above, it would not be considered appropriate to use a threshold based on study from a quiet loch within a much noisier area such as the southern North Sea (which is subject to high levels of anthropogenic activity and consequently noise) as the fish within this area will be acclimated to the noise and would be expected to have a correspondingly lesser sensitivity to noise levels.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
3.1.9	<p>The Applicant should also note that in past cases where the method of determining a "peak spawning" period has been applied for the purpose of refining/reducing a piling restriction, additional work was done to look at noise spread in the context of larval size, using the modelled noise contours and IHLS data. This was undertaken to estimate a migration period for herring to reach the spawning grounds before spawning. For example, at Rampion Offshore Wind Farm this was 8 days ahead of start of estimated earliest hatch date.</p>	<p>The Applicant notes previous work undertaken by Rampion Offshore Wind Farm to estimate migration periods for herring to reach the Banks spawning ground prior to spawning. The Applicant confirms that the Banks herring stock migrate in a clockwise circuit in the North Sea, migrating from the Northeast to the Banks spawning ground, and then continuing in a northerly direction (Cushing, 2001). This migration circuit has been mapped alongside the herring larval hotspots, and the underwater noise contours for stationary receptors with a swim bladder involved in hearing (see Figure 18 of G1.10 Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction, updated at Deadline 5). As illustrated in Figure 18, the noise contours fall outside of the migration circuit, and therefore noise effects from the Hornsea Four construction works will not cause a barrier effect to herring migration. As such, there is no need to allow additional time for a migration period within the peak spawning period timing.</p>
3.1.10	<p>The MMO supports the presentation of details of the literature sources for daily growth rates in larvae shown in Table 2. However, having reviewed this information, the MMO maintains its previous comment that a calculated growth rate of 0.46 mm d⁻¹ is high and is not conservative or precautionary for the purpose of the back-calculation. As Heath (1993) acquired growth rates from the field in the North Sea, for Autumn (and spring) spawners, it can be argued that these rates are likely the most appropriate and comparable data to use to inform the back-calculation. Other growth rates listed in Table 2 are either for other stocks or are for reared herring rather than field-observed growth rates. Accordingly, we recommend that the Applicant adopts an assumed growth rate of 0.25mm d⁻¹ to ensure a precautionary approach to back-calculation of spawning.</p>	<p>The Applicant notes the MMO's request to adopt a slower growth rate in line with that proposed by Heath (1993). The Applicant however is confident that the equation presented by Oeberst <i>et al.</i> (2008) to calculate growth rates is appropriate to estimate the growth rate for the Banks herring stock. The growth rate presented by Heath (1993) is based on herring stocks distributed across the northeast Atlantic, which would equate for significant variations in temperature, with the temperatures within the more northerly stocks much lower than those within the Banks stock region. The calculation as presented in Heath (1993) does not account for temperature as a variable, whilst it is widely accepted that sea temperature affects herring larvae growth rates (Stevenson 1962; Keegen <i>et al.</i> 1986; McGurk 1984; Ottersen and Loeng 2000). It is on this basis, that the Applicant does not consider Heath (1993) to be a reliable source for the determination of growth rates. The Applicant is therefore confident that the calculation presented in</p>

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		<p>Oeberst <i>et al.</i> (2008), which accounts for temperature as a variable, is appropriate to determine the growth rate of the Banks stock herring.</p> <p>The Applicant also draws the MMO's attention to Figure 4 of G1.10 Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction (updated at Deadline 5), where the noise contours from piling at the HVAC booster station search area (the piling location closest to the herring spawning grounds) have been overlaid on the temperature data. Within the noise contours, the sampling depth temperatures range from 12.9°C to 13.7°C. These values are significantly higher than the 12°C mean temperature used to inform the calculation of the growth rate. The Applicant has utilised a lower temperature to inform the growth rate calculation, which results in a slower growth rate and as such, is therefore confident that a precautionary approach has been utilised.</p>
3.1.11	<p>The Applicant maintains that a peak spawning period of 1st September – 16th October is appropriate to avoid population impacts on herring, however the proposal to have a seasonal piling restriction based on these dates cannot be supported as it does not allow for any period of time prior to the 'peak' of spawning for herring to migrate to the spawning grounds before spawning takes place. Hence the need for underwater noise modelling, as outlined in points 3.1.8 and 3.1.9. Upon review of the additional information requested, there will be greater confidence to determine a more appropriate restriction period.</p>	<p>The Applicant directs the Examining Authority to the Applicant's response to point 3.1.9 above. The Applicant welcomes the MMO's review of the additional information presented as part of this response.</p>
3.1.12	<p>The MMO appreciates the actioning of our previous comments and the provision of data we have requested. Whilst we are pleased to note that some of our recommendations for a precautionary approach to back-calculation have been incorporated into the revised Clarification Note, we do still have concerns regarding some of the values and data selected for use in the back-calculation and have requested some further evidence as specified below:</p> <ul style="list-style-type: none"> • The Applicant should revisit IHLS data for 2018 – see points 3.1.3 and 3.1.4. • The Applicant should present modelled noise contours as described in points 3.1.8 and 3.1.9. 	<p>The Applicant directs the Examining Authority to the evidence presented as response to points 3.1.2 to 3.1.10 above, and welcomes the MMOs review of the responses provided.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
	<ul style="list-style-type: none"> The MMO strongly believe that a calculated larval growth rate of 0.46mm d⁻¹ is not conservative or precautionary and recommend that the Applicant adopts an assumed growth rate of 0.25mm d⁻¹ to ensure a precautionary approach to back-calculation of spawning. 	
3.1.13	Once the MMO have had sight of the additional information, we will be in a better position to consider a refinement to a seasonal piling restriction.	The Applicant notes this, and welcomes the MMO's further consideration of a refinement to a seasonal piling restriction.
<p><i>Comments on any submissions received at Deadline 3 – Clarification note: marine processes supplementary work update [REP3-038]</i></p>		
3.2.3	<p>Whilst the MMO support the use of Expert Geomorphological Assessment (EGA) to assess the potential impacts on Smithic Bank, we understand there are no Guidance/Best Practice documents for this. EGA varies in quality depending on the detailed scope of work (which has not yet been not supplied), the time available and the expert group assembled. As this stage, the quality and outcomes can't be assessed.</p>	<p>The Applicant agrees there is no guidance or best practice on the use of Historic Trends Analysis (HTA) / Expert Geomorphological Assessment (EGA) as it is typically bespoke to the particular issue being addressed. In the case of Smithic Bank, the HTA involved comparison of historic bathymetries, whilst the EGA utilised information that indicated how the development of the sandbank has been controlled by physical drivers, and how these drivers would modify the bank morphology into the future, and how changes to the bank morphology would change the physical drivers. In the case of the Holderness coast, the HTA utilised erosion data collected by East Riding of Yorkshire Council (ERYC) over the past 150 years and the EGA explored how this could be translated into a future erosion rate using climate change/sea-level rise data. An Evidence Plan Technical Panel meeting was held on 10 June 2022 with the Applicant, the MMO (including its scientific advisor Cefas) and Natural England (including their marine processes expert) in relation to G4.9 Marine Processes Supplementary Report (REP3-038). The MMO and Natural England will submit a response to the report at Deadline 5, after which the Applicant will work to address outstanding issues and respond to that advice at Deadline 5a.</p>
3.2.4	Regarding the Flamborough front, it is surprising to see that Historic Trends Analysis is not available, as historic satellite images are available in various archives, for example in ESA Sentinel 3 imagery for Infra-red parameters (section 2.1.1.1), we advise that this will be a useful resource.	The Applicant clarifies that a HTA for the Flamborough Front was carried out at a high level by using three data sources for the position of the Front over time (see interpretation of 30,000 satellite images taken between 1999 and 2008 in Miller and Christodolou (2014). These positions were compiled to create a

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		<p>figure that showed a potential northerly position and a potential southerly position based on those three data sources, to create a zone within which the Flamborough Front may occupy in any one year. It can be observed that Hornsea Four is located within this indicative zone (see Figure 30 in REP3-038). Whilst a HTA based on historic satellite images may provide more detail, in terms of where the Front has sat historically over shorter timescales, it is the Applicant's position that the Flamborough Front would likely sit at all times between the two indicative lines created from the three data sources and presented in G4.9 Marine Processes Supplementary Report (REP3-038). In addition, even if analysis of the historical satellite imagery showed that the Flamborough Front moved beyond these indicative bounds, it would make no difference to the overall conclusion of the assessment, as the Flamborough Front will only interact with Hornsea Four when it is inside the indicative zone.</p>

4 Applicant's Comments to Natural England (REP4-053 - Deadline 4 Submission - Cover Letter)

Reference	Stakeholder's Written Representation	Applicant's Response
<p><i>2. G3.5 Clarification Note on the Installation of Two Monopile Foundations Sequentially - Revision: 01</i></p>		
N/A	<p>Whilst this document relates to impacts to marine mammals, it is our understanding that it has been provided in response to concerns raised by MMO rather than Natural England. We will therefore defer to MMO (as advised by Cefas) on this document, unless specifically requested to comment by the Examining Authority.</p>	<p>The Applicant notes Natural England's deferment to the MMO but highlights that this document relates to fish and shellfish ecology as well as marine mammals.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
3. Submissions of New and Updated Material – Implications for the Examination		
N/A	<p>Natural England have been in communication with the Applicant over the expected Marine Processes supplementary reports we had expected to be submitted at Deadline 3. These reports have been delayed and are now expected to be submitted at Deadline 4. Natural England wish to flag that the above clarification note will only be received late into the Examination, and highlight the risk that it may still not provide sufficient evidence to address our concerns. If this proves to be the case we advise that discussions on mitigation and/or post-construction monitoring are likely to be required.</p>	<p>The Applicant would like to stress that in the response to Relevant Representations (G1.9 Applicant's comments on Relevant Representations (REP1-038)), it was stated that <i>"an update on this workstream [marine processes supplementary report] is expected to be submitted into Examination by Deadline 3"</i>. Whilst G1.43 Examination Deliverables Summary (REP1-065) did state that the report would be submitted at Deadline 3 and the Applicant considered this achievable, helpful but significant feedback received from both the MMO and Natural England on G1.46 Clarification Note on Marine Processes Supplementary Work Scope of Works (REP1-068) (REP2-077 and REP2-084, respectively) meant that additional time was required to incorporate that feedback into the final report in a meaningful way.</p> <p>The Applicant considers that submitting the report at Deadline 4 (which was less than three weeks after Deadline 3) represented only a short delay and provides adequate time to resolve marine processes issues, with over three months remaining in the Examination process. An Evidence Plan Technical Panel meeting was held on 10 June 2022 with the Applicant, the MMO (including its advisor Cefas) and Natural England in relation to G4.9 Marine Processes Supplementary Report (REP3-038). The MMO and Natural England will submit a response to the report at Deadline 5, after which the Applicant will work to address outstanding issues and respond to that advice at Deadline 5a.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
<i>Annex 1: Natural England's Response to Action Points from ISH 2, 4, 5 and 6</i>		
ISH4: Action 5	<p>Natural England to comment further on Applicant's ISH4 explanation that no draft Development Consent Order (dDCO) Requirement would be necessary to control the number and duration of cofferdams at the HDD exit pits.</p> <p><i>Natural England has reviewed the ISH transcript in relation to this issue. On the basis that we felt we needed to seek clarification on the number and duration of the placement of cofferdams, we disagree that this is clear within the ES and therefore consider that this could be open to interpretation at the time of condition discharge. We also note that a number of other projects are considering landfall in a similar location. Therefore, ensuring clarity on this matter will also be important in the context of future assessment. Accordingly, we continue to advise that the number and duration of the cofferdams is secured in the DCO/dMLs.</i></p>	<p>The Applicant maintains its position as stated at Issue Specific Hearing 4 and summarised in relation to agenda item 2.3 of its Written Summary of the Applicant's Oral Case at Issue Specific Hearing 4.</p> <p>Insofar as there was any contended ambiguity the number and duration of placement of cofferdams has been clarified both verbally and in writing as a matter of public record and as such the Applicant does not consider that this matter could be open to interpretation at the time of condition discharge.</p>

5 Applicant's Comments to Natural England (REP4-054 - Deadline 4 Submission – Risks & Issues Log)

Reference	Stakeholder's Written Representation	Applicant's Response
<i>Summary Tab – Marine Processes</i>		
Marine Processes: WCS	<p>Natural England have reviewed the document REP3-035 G3.6 Clarification Note: Justification of Offshore Maximum Design Scenarios - Revision: 01. We welcome the amendments which have been made.</p> <p>However there is no adjustment to sandwave clearance area and this is still calculated for the full length of cable route therefore this concern remains.</p> <p>The paper does also not address the MDS around the 110 GBS.</p>	<p>The Applicant confirms that as stated in paragraph 3.5.1.1 of G3.6 Clarification Note: Justification of Offshore Maximum Design Scenarios (REP3-035), it is necessary to remove existing bedforms and mobile sediment across the entire cable route before cables are installed. This is done for two reasons. Firstly, many of the cable installation tools require a relatively flat seabed surface in order to work properly as it may not be possible to install the cable up or down a slope over a certain angle, nor where the installation tool is working on a camber. Secondly, the cable must be buried to a depth where it may be expected to stay buried. Sandwaves are generally mobile in nature therefore the cable must be buried beneath the level where natural sandwave movement would uncover it. Sometimes this can only be done by removing the mobile sediments before installation takes place. As such, no reduction to the clearance areas is proposed.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
		<p>The paper did not revisit the justification for 110 GBS foundations, because detailed site-specific survey data was previously analysed to delineate areas within the array area with sedimentary and bathymetric conditions which are not considered suitable for monopile or piled jacket foundations. Based on the extent of this delineated area (equating to approximately 61% of the Hornsea Four array area), it was calculated that the maximum number of GBS foundations that may be required within the envelope could be up to 110 GBS.</p>
<p><i>Summary Tab – Benthic & Intertidal</i></p>		
<p>Benthic & Intertidal: WCS</p>	<p>Natural England have reviewed the document REP3-035 G3.6 Clarification Note: Justification of Offshore Maximum Design Scenarios - Revision: 01. We welcome the amendments which have been made to volume of clearance material and rock protection over Smithic bank. However there is no adjustment to sandwave clearance area and this is still calculated for the full length of cable route therefore this concern remains.</p>	<p>The Applicant welcomes Natural England's comments in relation to sandwave clearance volumes and Smithic Bank rock protection.</p> <p>Please see the Applicant response to 'Marine Processes: WCS' above in relation to sandwave clearance areas.</p>
<p><i>Summary Tab – Fish & Shellfish</i></p>		
<p>Fish & Shellfish: WCS</p>	<p>Natural England have reviewed the document REP3-035 G3.6 Clarification Note: Justification of Offshore Maximum Design Scenarios - Revision: 01. However there is no adjustment to sandwave clearance area and this is still calculated for the full length of cable route therefore this concern remains.</p>	<p>Please see the Applicant response to 'Marine Processes: WCS' above in relation to sandwave clearance areas.</p>
<p>Fish & Shellfish: Data Gaps</p>	<p>Natural England cannot support the Applicants position on 'peak herring spawning' (G1.10) as there are limitations with the use of IHLS survey data underpinning the calculation of 'peak' herring spawning. With this in mind Natural England's position remains unchanged, more precaution needs to be included within the 'peak herring spawning' calculation and / or agreement to expand the no piling period of Co190 beyond the current 6 weeks.</p>	<p>The Applicant notes that dialogue continues with the MMO in relation to G1.10 Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction with a further revision submitted at Deadline 5. Applicant responses to the MMO's Deadline 4 comments on this matter are presented in Section 0 of this document.</p> <p>It remains the Applicant's position that it is appropriate to conclude that the proposed seasonal restriction for Hornsea Four (1st September – 16th October – secured by Condition 23 of Schedule 12 of C1.1: Draft DCO including DML (REP4-050)) acts to</p>

Reference	Stakeholder's Written Representation	Applicant's Response
		<p>effectively mitigate impacts to the "peak" spawning season, with additional conservatism incorporated into the proposed dates beyond that required based on the back-calculations as informed by available literature (and as requested by the MMO), and as a result provides a robust mitigation of the potential effects of piling at the HVAC booster station search area on herring spawning.</p> <p>The Applicant continues to engage with the MMO on this matter through the Statement of Common Ground (SoCG) process.</p>
Fish & Shellfish: Identified Impacts	<p>The Applicant has confirmed that further consideration is being given to the impact of drill arisings and settled sediment plumes with a clarification note due to be submitted into Examination at Deadline 5.</p> <p>As a pathway has been identified for EMF impacts, this should be fully assessed and evidence provided within the ES to confirm no significant effect as a result of the project alone and cumulatively.</p>	<p>The Applicant notes that consideration of drilling arisings and settled sediment plumes is presented in G5.5: Drilling Mounds & Areas of Settled Disposal submitted into Examination at Deadline 5.</p> <p>With regard to the point raised in relation to EMF, in line with the information requirements for an ES as set out in Regulation 14 (specifically 14(2)(b)) of the Infrastructure Planning (EIA) Regulations 2017 (the EIA Regulations), only likely significant effects of the development are required to be set out within the ES. As such, and as agreed with the Planning Inspectorate at the Scoping stage of Hornsea Four, the impacts of EMF on fish and shellfish ecology are scoped out of the ES (PINS Scoping Opinion, November 2018, ID: 4.4.8). The justification for scoping out this impact remains unchanged (i.e. <i>the spatial extent of EMFs will be limited to the immediate vicinity of the cable, and where possible cable burial will be the preferred option for cable protection (Co83)</i>) irrespective of the publication of the Scott et al. (2021) paper.</p> <p>Please see the Applicant response to 'G1' below for further detail on the consideration of EMF.</p>
Fish & Shellfish: EIA Conclusions	<p>Natural England consider 'minor' magnitude is an appropriate assessment of effect on herring spawning ground (FSC-C-1 & FSC-C-2) due to the small proportion of the spawning area which</p>	<p>Please see the Applicant response to 'Fish & Shellfish: Data Gaps' above in relation to the herring seasonal piling restriction.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
	overlaps with the ECC in certain years. However we have outstanding concerns with the Peak herring spawning period document (G1.10) and don't feel that commitment Co190 covers a sufficient period.	
<i>D – Marine Mammals</i>		
D10	An illustrative assessment of vessel collision risk will be provided at Deadline 5.	The Applicant submitted G4.11 Clarification Note on Marine Mammals (REP4-045) at Deadline 4 containing information relating to marine mammals collision risk.
D12	<p>The Applicant has requested an updated position from Natural England on the inclusion of seismic surveys in the RIAA, owing to concerns that the methodological options available would present unreasonable results.</p> <p>Natural England maintains that a nominal seismic survey should be included in the RIAA in-combination assessment to ensure that this potential avenue for impact is accounted for. Whilst the Applicant has confirmed that airgun seismic surveys will not occur, surveys using sub-bottom profilers may be required. In addition, the oil and gas industry may carry out seismic surveys in or around the area and these typically have a very short lead in time. We therefore consider it reasonable to expect there to be at least one seismic survey that overlaps with Hornsea Four, and this should be accounted for in the assessment.</p> <p>The Applicant has currently investigated the use of two examples of seismic survey inclusion, which we agree would provide an unreasonable prediction of impact. However, this is due to the examples selected to be extreme. We suggest the Applicant could look at the JNCC Marine Noise Registry records for the previous 12 months for an indication of average noise levels to include. Alternatively, HRAs conducted by BEIS for seismic surveys for the oil and gas industry could also provide a representative value to use.</p> <p>We highlight that the inclusion of a nominal seismic survey is not without precedent. The cumulative impact assessment for EA1N and EA2 included a worst case scenario of two seismic surveys (based on two locations, one in each seasonal area and maximum overlap with the seasonal area) using a distance of 10km.</p> <p>We do not consider it appropriate for this to only be considered in the SIP due to our previously outlined concerns. In addition, there is precedent for SIPs not being subject to Appropriate</p>	<p>The Applicant has considered different theoretical/illustrative scenarios and assessed the in-combination implications of these scenarios. These include the illustrative scenario figures provided for East Anglia One North and East Anglia Two offshore wind farms, the examples presented by Natural England in their comments. The Applicant can confirm that the RIAA conclusions remain the same regardless of the different illustrative scenarios considered.</p> <p>However, there are apparent risks to the 20% threshold when other projects are screened in for assessment in-combination – on the assumption that all projects would in fact undertake such activity on the same day. Such risks need to be placed in context, to determine where risk may actually exist and what measures are available to help mitigate that risk. Key to the process is the requirement on all projects assessed here to be implementing a Site Integrity Plan, which will ensure on a case by case basis that the thresholds will not be exceeded (alone and in-combination).</p> <p>The Applicant will provide this additional information to support the RIAA conclusions at Deadline 5a, in the form of a clarification note.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
	Assessment and it therefore cannot be guaranteed that an updated in-combination assessment will be performed.	
D16	We welcome the Applicant's confirmation that seismic airgun surveys will not be used on the Project, making use of the 5km EDR appropriate. We request that the Project description is updated to reflect that whilst seismic surveys (e.g. sub-bottom profilers) may be required, seismic airgun surveys will not be required. This is to make it clear what has been assessed. We will then consider this concern addressed.	The Applicant can confirm that A1.4 Project Description has been updated and submitted at Deadline 5 to incorporate this requested change.
D18	An updated figure [to accompany Table 32 of RIAA] and/or information will be provided at Deadline 5.	The Applicant can confirm that the RIAA will be updated accordingly to include this updated figure, and this updated RIAA will be submitted at Deadline 5.
D22	We consider that the advice provided in D12 in relation to seismic surveys also applies to UXO clearance. We request that 1 nominal high-order detonation is included in the RIAA in-combination assessment. We acknowledge that there is a move towards low-order methods of UXO clearance, however we consider it likely that high order clearance would be retained as a contingency option and should therefore be assessed.	Please see the Applicant response to 'D12' above in relation to the seismic survey clarification note at Deadline 5a. The illustrative/theoretical scenario assessments presented in the clarification note will include UXO clearance activities (high order detonations).
<i>E – Marine Processes</i>		
E2	We welcome the Applicant's efforts to reduce volumes of bedform clearance (for cable installation) within the array (REP3-035), however, our position remains unchanged since sandwave clearance is still proposed for the entire length of the Export Cable Corridor, (ECC) despite the recent gathering of high-res geophysical data in 2021. We would welcome further justification on the rationale for not reducing sandwave clearance along the ECC.	Please see the Applicant response to 'Marine Processes: WCS' above in relation to sandwave clearance areas. It is important to note that sandwave clearance areas are not related to survey coverage - it is necessary to remove existing bedforms and mobile sediment across the entire cable route before cables are installed. However, the full survey coverage has been used to reduce the sandwave clearance volumes accordingly, as requested and described in G3.6 Clarification Note: Justification of Offshore Maximum Design Scenarios (REP3-035) .
E3	Natural England welcomes the explanation provided by the Applicant (REP3-035) regarding the requirement for up to 8 HDD Exit Pits. However, we are unclear why such a high failure rate is anticipated and would welcome further discussion as to whether this can be better managed through more detailed site investigations prior to construction.	As set out in G3.6 Clarification Note: Justification of Offshore Maximum Design Scenarios (REP3-035) , the requirement for eight exit pits is to accommodate the four pairs of HVDC circuits. For a HVDC system, each offshore export cable (circuit) consists of a bundle containing two power cables (positive and negative conductors). Where these offshore export cables (four in total for a HVDC system) approach the HDD exit pits, these bundles are

Reference	Stakeholder's Written Representation	Applicant's Response
	<p>We welcome the justification to support the MDS for up to 10% of Hornsea Four cables requiring protection, however, we remained concerned that some, or all of the 10%, may be located within nearshore shallow areas as this could lead to morphological change.</p> <p>We welcome the detailed explanation for a MDS for drilling up to 10% of all pile installations.</p> <p>Whilst we welcome the reduction in MDS bedform clearance volume for array and interconnector cables, the area remains unchanged. Moreover, there has been no reduction in the MDS for bedform clearance along the export cable corridor. If full survey coverage of the Hornsea Four Offshore Order Limits is available, can it be explained why the MDS for bedform clearance along the ECC is not possible?</p>	<p>separated into the separate power cables (eight cables in total for a HVDC system) which each requiring an individual HDD duct. As such, eight HDD export pits are required.</p> <p>The Applicant welcomes Natural England's comments in relation to cable protection reductions and drilling requirements. Please see the Applicant's response to 'E2' above in relation to sandwave clearance areas. A reduction in the MDS for bedform clearance (volumes) along the export cable corridor utilising the full survey coverage has been undertaken.</p> <p>In relation to Natural England's concerns that some or all of the 10% of cabling that could require protection may be located within the nearshore shallow areas, the Applicant highlights the commitment made (Co188 - A4.5.2 Commitments Register (REP4-007)) that 'no cable protection will be employed within 350 m seaward of MLWS'. Furthermore, the Applicant has also committed within G3.6 Clarification Note: Justification of Offshore Maximum Design Scenarios (REP3-035) to limit cable protection to a maximum of 5% of the cable lengths that cross Smithic Bank, compared to the 10% requirement stated at DCO Application. The Applicant highlights that the 10% of cabling that could require protection relates to the entire cable length and hence that allowance will likely be required at discrete sections along the export cable corridor and it is highly unlikely and unrealistic that all of the cable protection allowance would all be required in the nearshore area.</p>
E7	<p>In the recent Clarification Note: Justification of Offshore MDSs (REP3-035), Section 3.1.1.2 Table 1 presents the MDS for bedform clearance (at DCO application) as 834,000m³. Table 3 states that the bedform clearance width is 40m. The discrepancy with these figures in the ES documents, as noted in our earlier comments, has not been addressed (Where sometimes for the calculations of sandwave clearance areas and volumes, an average corridor width of 30 m has been used.). We</p>	<p>The Applicant can confirm that Table 3 of G3.6 Clarification Note: Justification of Offshore Maximum Design Scenarios (REP3-035) correctly states a maximum bedform clearance width of 40m and a boulder clearance width of 30m. The latest version of A1.4 Project Description (see Table 4.25) at Deadline 5 has been</p>

Reference	Stakeholder's Written Representation	Applicant's Response
	<p>would welcome clarification from the Applicant that these latest figures are the correct MDS parameters going forward.</p>	<p>updated to make this clearer, noting that the detail presented in previous versions was accurate and the updates are purely presentational. Similarly, the latest version of A4.4.8 Pro Rata Annex (REP4-006) also correctly states the 30m (boulder clearance) and 40m (bedform clearance) widths.</p> <p>The Applicant notes that as previously detailed in Applicant responses, and set out in a footnote of Table 4.30 of A1.4 Project Description, for the calculation of bedform clearance area and volume MDS, an average corridor width of 30m is used. This is a conservative and realistic estimation of the total bedform clearance volume.</p> <p>As such, the Applicant considers that the latest figures presented in G3.6 Clarification Note: Justification of Offshore Maximum Design Scenarios (REP3-035) fully comply with the figures presented in the ES documents, namely the latest versions of A1.4 Project Description (submitted at Deadline 5) and A4.4.8 Pro Rata Annex (REP4-006).</p>
E26	<p>Natural England have reviewed G3.8 Chart depicting the Dogger Bank A and B export cable crossing rock protection. We note that the MMO have discharged Dogger Bank A export cable documents and therefore a more precise location for Dogger Bank A export cables is available through the MMO public register and this chart could be refined further.</p> <p>Equally further assessments or evidence should be provided to provide better understanding of cable protection at crossings on smithic bank and the nearshore zone.</p>	<p>The Applicant has checked the publicly available information on the MMO's marine licensing register, noting that pre-construction plans for Nationally Significant Infrastructure Projects are not available in this register. The Applicant notes that efforts are being made to obtain more precise data from the developers of Dogger Bank A and B.</p> <p>This request was discussed at the Evidence Plan Technical Panel meeting held on 10 June 2022 with the Applicant, the MMO (including its advisor Cefas) and Natural England in relation to G4.9 Marine Processes Supplementary Report (REP3-038). The MMO and Natural England will submit a response to the report at</p>

Reference	Stakeholder's Written Representation	Applicant's Response
		Deadline 5, after which the Applicant will work to address outstanding issues and respond to that advice at Deadline 5a.
E37	Based on the information provided by the Applicant in Document REP3-035, we are content that 10% drilling requirements is a realistic worst-case scenario.	The Applicant welcomes Natural England's comments in relation to drilling requirements.
E49	<p>Natural England request further evidence to show the impact that large GBS structures might have on nearby receptors such as The Hills or Outer Silver pit. This could be in the form of modelling or examples from other windfarms but should include impact of scouring around foundations and changes to hydrodynamics and sediment transport in the vicinity of the array.</p> <p>If either of these features are not considered receptors, then justification should be provided to support the exclusion from further consideration.</p>	<p>The Applicant notes that The Hills and Outer Silver Pit are identified as seabed features in the environmental baseline (Figure 1.11 of A2.1: Marine Geology, Oceanography and Physical Processes (APP-013)) but are not considered as marine process receptors since neither feature relates to any environmental designation nor are they considered to be connected via any marine processes pathway to a source of effect that would lead to an impact.</p> <p>Outer Silver Pit is a geological tunnel valley formed during the last glaciation, rather than being a feature that was developed or is being maintained by any contemporary marine process. This feature partly bounds the north-eastern extent of the array area. Tidal flows are orientated along this pit (Figure 1.15 of A2.1: Marine Geology, Oceanography and Physical Processes (APP-013)) and through the array area in a largely north-west (ebb) to south-east (flood) direction. There is no flow pathway that exchanges any effects between the array and the pit. Any localised interruption to flows due to a large GBS structure would be along this same axis as the tide. Any scouring around the structure would be mitigated by scour protection.</p> <p>The Hills are an aggregation of linear sand ridges to the north-west of array area and down-drift of the net sediment pathway to the north-west. A large GBS structure would not change flows in the far-field or affect the regional sediment pathways. Any effects on flows or sediment transport would remain localised around the structure (i.e. limited to near-field influences).</p>

Reference	Stakeholder's Written Representation	Applicant's Response
		<p>Figure 41 of A5.1.1: Marine Processes Technical Report (APP-067) provides details of scour monitoring around an equivalent large box-shaped GBS (F3 in the southern North Sea) which shows an unprotected structure would typically develop edge scour around corners where local flow accelerations occur. All effects remain localised to the structure.</p> <p>As such, the Applicant does not consider The Hills and the Outer Silver Pit features to be receptors related to Hornsea Four and as such, further consideration of these features is not merited.</p>
E51	<p>Natural England wish to see evidence of predicted scour extent of all GBS and foundations (but particularly the larger GBS which have not been used before in UK waters) and calculations to show the separation distance is sufficient to avoid any group scour impacts.</p>	<p>The Applicant notes that predicted extents of any foundation scour are inherent to the design of scour protection and provisions outlined in Section 4.8 of A1.4 Project Description (REP4-004). The extent of scour protection is further summarised in Table 1.18 of A2.1: Marine Geology, Oceanography and Physical Processes (APP-013) with calculations made based on a conservative design basis.</p> <p>The extent of scour at F3 would appear to be contained within 25 m of the structure whereas provisions for the large GBS are 50 m extents of scour protection.</p>
E52	<p>Natural England welcomes the Applicants comments that pre and post construction surveys will be used to collect data on changes in seabed topography. However we require that this is adequately captured in the OMMP so it is clear that these post construction geophysical surveys are being used to validate assessments made within the Environmental Statement. This is important when the MMO is signing these documents off.</p> <p>Natural England also wish to see predicted maximum scour footprints for each foundation type.</p>	<p>The Applicant can confirm that marine processes monitoring was a topic of discussion at the Evidence Plan Technical Panel meeting held on 10 June 2022 with the Applicant, the MMO (including its advisor Cefas) and Natural England in relation to G4.9 Marine Processes Supplementary Report (REP3-038). The MMO and Natural England will submit a response to the report at Deadline 5, after which the Applicant will work to address outstanding issues and respond to that advice at Deadline 5a.</p>
<i>F – Benthic & Intertidal</i>		
F6	<p>The applicant has confirmed that examples of medium or high stony reef will be micro-sited around as per Co48 & Co84. To alleviate Natural England's concerns moving forward with regards to our</p>	<p>The Applicant can confirm that Natural England will be consulted on the design of the pre-construction survey by means of Condition</p>

Reference	Stakeholder's Written Representation	Applicant's Response
F7	<p>confidence in the classification of stony reef, we request that Natural England be consulted on survey design of pre construction benthic surveys to ensure most up to date guidance is being followed when identifying examples of stony reef and that this specific point is captured appropriately within the DCO/dML and/or relevant certified documents.</p> <p>Natural England have concerns with regards to our confidence in the classification of stony reef by the applicant. To alleviate Natural England's concerns moving forward with regards to our confidence in the classification of stony reef, we request that Natural England be consulted on survey design of pre construction benthic surveys to ensure most up to date guidance is being followed when identifying examples of stony reef and that this specific point is captured appropriately within the DCO/dML and/or relevant certified documents.</p> <p>Goulding et al, 2020, Refining the criteria for defining areas with a 'low resemblance' to Annex I stony reef, JNCC Report 656</p>	<p>17 (Pre-construction monitoring and surveys) of Schedules 11 and 12 (REP4-050) which states that (emphasis added by the Applicant): <i>'The undertaker must in discharging condition 13(1)(f) [details of surveys] for each stage of construction submit a monitoring plan or plans for that stage in accordance with an outline marine monitoring plan for written approval by the MMO <u>in consultation with the relevant statutory bodies, which must contain details of proposed surveys, including methodologies and timings, and a proposed format and content for a pre-construction baseline report.'</u></i></p>
F9	<p>Natural England welcome the submission of paper G3.6 Justification of Maximum Design Scenarios. However, we note the area subject to bedform clearance (sandwaves and boulders) remains unchanged. This means there has been no change in the extent of temporary habitat disturbance which Natural England do not agree can be defined as 'minor'.</p>	<p>Please see the Applicant response to 'Marine Processes: WCS' above in relation to sandwave clearance areas.</p>
F10	<p>The review of MDS has not resulted in a reduction to sandwave clearance area and therefore the total maximum area of temporary loss / disturbance remains unchanged.</p> <p>Natural England do not believe 75km² can be considered a minority of the receptor.</p>	
F22	<p>The Applicant has confirm that further consideration is being given to the impact of drill arisings and settled sediment plumes with a clarification note due to be submitted into Examination at Deadline 5. Natural England will review this in due course.</p>	<p>The Applicant notes that consideration of drilling arisings and settled sediment plumes is presented in G5.5: Drilling Mounds & Areas of Settled Disposal.</p>
F25	<p>The applicant has noted our comment with regards to re-use of sediment spoil. We would welcome the inclusion of a commitment to give ongoing consideration to this matter within the Commitments Register to prompt further consideration.</p> <p>The Applicant has suggested that they will provide further comment on this matter at Deadline 5.</p>	<p>The Applicant notes Natural England's request to keep alternative options open in relation to dredged material, should a project come along in relevant timescales that could effectively use the spoil material. As stated in A4.4.4 Dredging and Disposal Site Characterisation (APP-042), at the time of writing, no projects have been identified that could accept the type and volume of spoil material that might be generated during the construction of Hornsea Four.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
		<p>However, as described in A4.4.4 Dredging and Disposal Site Characterisation (APP-042), nearer to the time in the pre-construction phase, further consideration will be given to other projects which may make use of the spoil material and the viability of such options.</p> <p>The Applicant notes that the construction project environmental management and monitoring plan will provide details of '(iv) <i>waste management and disposal arrangements</i>'.</p> <p>The construction project environmental management and monitoring plan is a condition in the DMLs (Condition 13(1)(d) of Schedules 11 and 12 (REP4-050)) and will be submitted to, and approved in writing by the MMO and as such, should provide comfort that the MMO will have an opportunity to ensure that the plan gives due consideration to disposal arrangements.</p>
F27	<p>Natural England have concerns with regards to our confidence in the classification of stony reef by the applicant. To alleviate Natural England's concerns moving forward with regards to our confidence in the classification of stony reef, we request that Natural England be consulted on survey design of pre construction benthic surveys to ensure most up to date guidance is being followed when identifying examples of stony reef and that this specific point is captured appropriately within the DCO/dML and/or relevant certified documents.</p>	<p>Please see the Applicant response to 'F6' above in relation to bedform clearance areas.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
<i>G – Fish & Shellfish</i>		
G1	<p>Natural England have reviewed the projects predicted EMF levels and note that the levels appear lower than those within Scott et al (2021) where impacts were reported however it is unclear why these levels are so different to those considered representative of Offshore Windfarms in the study. Notwithstanding this, as a pathway has been identified the impact should be fully assessed and evidence provided within the Environmental Statement chapter for fish and shellfish to confirm no significant effect alone or on a cumulative basis. In this assessment it should be demonstrated why EMF levels for Hornsea 4 cables are predicted to be so much lower than those in Scott et al (2021) report, and we recommend monitoring this to validate predictions following construction.</p>	<p>Please see the Applicant response to 'Fish & Shellfish: Identified Impacts' above in relation to consideration of the impact of EMF.</p> <p>The Hornsea Four MDS envelope considers two subsea cable design options; a High Voltage Alternating Current (HVAC) and a High Voltage Direct Current (HVDC) option. The AC and DC cable designs are anticipated to have EMF strengths of approximately 16.7 uT and 40 uT respectively. These values are those at the seabed directly above the cable, with the EMF rapidly attenuating horizontally and vertically away from the source to negligible levels within approximately 10 m.</p> <p>The Scott <i>et al.</i> (2021) paper references EMF levels predicted in previous studies ranging from 65 – 8,000 µT, rather than calculating values within the paper. The range of up to 8,000 µT is based on a paper (Cada <i>et al.</i>, 2011) which presents the EMF levels calculated at the surface of a cable (using an undefined methodology, with the 8,000 µT value being a significant outlier compared to the other values presented), rather than at 1 m above the cable which is the standard value presented by various offshore wind farms (i.e. the values of EMF presented "at the seabed" is based on the assumption of a cable buried at 1 m below seabed depth). The values presented within the references used by Scott <i>et al.</i> (2021) all attenuate to approximately 20 µT – 40 µT by 1 m (from the centre of the cable) with these values all comparable to those presented by offshore wind farms and the value calculated by the Applicant for Hornsea Four. As the cable will in all instances be either buried or protected (if surface laid), determination of the EMF at 1 m from the centre of the cable is more appropriate to consider rather than using the surface of the cable value. For the impacts contained within the Scott <i>et al.</i></p>

Reference	Stakeholder's Written Representation	Applicant's Response
		<p>(2021) paper to be environmentally relevant, cables would have to be surface laid, with eggs/larvae laid on the cables for the entirety of their development. Whilst it is possible that an individual crab could overwinter on top of a cable, this could not feasibly lead to a population-level impact or a significant impact in EIA terms. As such, the Applicant is confident that any post-consent assessment of attenuation of EMF strengths, shielding and cable burial depth will not identify significant effects and due to this lack of effects predicted, post-construction monitoring would not be proportionate nor appropriate.</p>

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