



Hornsea Project Four

Applicant's comments on other submissions
received at Deadline 3

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Revision Summary

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1 Introduction

1.1.1.1 At Deadline 3 the following 13 submissions were received from 9 stakeholders:

- BP Exploration Operating Company Limited – Submission ([REP3-047](#));
- Corporation of Trinity House – Post-hearing submissions for Deadline 3 following Issue Specific Hearing 1 on the draft Development Consent Order on Tuesday 12 April 2022 (ISH1) ([REP3-048](#));
- East Riding of Yorkshire Council – Comments on submission received at Deadline 2 ([REP3-049](#));
- East Riding of Yorkshire Council – Post-hearing submissions including written summaries of oral case put at any of the hearings held during w/c 11 April 2022 ([REP3-050](#));
- Historic England - Regarding Issue Specific Hearing 3 (Offshore Environmental Matters) on 26th April 2022; Update on progress of Statement of Common Ground ([REP3-051](#));
- Malcolm and Jane Taylor ([REP3-059](#));
- Marine Management Organisation (MMO) Post-hearing submissions including written summaries of oral case; Comments on submissions received at Deadline 2; Progressed versions of any SoCG; further information requested by the ExA under Rule 17 ([REP3-052](#));
- Natural England – Cover Letter ([REP3-053](#));
- Natural England – Risk and Issues Log ([REP3-054](#));
- RSPB - Comments on submissions received at Deadline 2 ([REP3-055](#));
- RSPB - Cover letter related to Issue Specific Hearing 5 (marine and coastal ornithology) and 6 (Habitats Regulations Assessment) ([REP3-056](#));
- Viking Link - Relating to the Issue Specific Hearing on 26 April ([REP3-057](#)); and
- Viking Link - Relating to the Issue Specific Hearing on Offshore Environmental Matters on 26 April ([REP3-058](#)).

1.1.1.2 The Applicant has reviewed all Deadline 3 submissions and responded on individual stakeholders' submissions in Section 2 – 4.

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 submission ([REP3-047](#)) will be submitted at Deadline 5.
- Malcolm and Jane Taylor ([REP3-059](#)) will be answered in [G4.8 Signposting document of responses to Mr and Mrs Taylor Deadline 3 Submission](#) submitted at Deadline 4.

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

2 Applicant's Comments to Marine Management Organisation (MMO) (REP3-052)

Reference	Stakeholder's Written Representation	Applicant's Response
2. Comments on submissions received at Deadline 2		
2.2 Clarification Note on Marine Sediment Contaminants Revision: 1 [REP1-066]		
2.2.3	<p>The MMO has however, regarding the same comments, identified that the depth of the samples are unclear from the results template. Our review of this analysis has been carried out under the assumption that the depth provided was water depth and not sediment depth, and that all samples were taken from the seabed surface. However, this will need to be confirmed by the Applicant as a Mini-Hamon Grab is not appropriate for depth samples.</p>	<p>The Applicant confirms the depth provided is water depth.</p>
2.2.4	<p>The MMO agrees with comments made from Natural England outlined within Table 1 of this Clarification Note, that all potential impacts should be carried forward to the Cumulative Effect Assessment unless the Applicant can provide sufficient justification for not doing so.</p>	<p>In relation to certain 'not significant' project alone impacts not being taken forward into the cumulative assessment, the Applicant notes that this is the standard approach to cumulative assessments for offshore wind farms, with Hornsea Three, Norfolk Vanguard and Boreas, and East Anglia ONE North and TWO adopting similar methodology, with these methodologies agreed with Natural England through their respective SoCG processes. This approach is adopted because many of the potential impacts identified and assessed for projects alone are relatively localised and temporary in nature and therefore have limited or no potential to interact with similar changes associated with other projects (e.g. accidental release of pollutants, temporary habitat disturbance associated with maintenance activities). As such, the Applicant proposes to adopt the same, consistent approach as has been applied for recent offshore wind applications which have been previously accepted in those cases by Natural England and the MMO.</p>
2.2.5	<p>Regarding Section 3 of the Clarification Note, the MMO has major concerns, and cannot accept the results provided at present. The analysis laboratories are noted as "Gardline Limited" for the array samples and "Bibby HydroMap Limited/Benthic Solutions Limited" for the Export Cable Corridor. Neither of these are validated laboratories by the MMO for analysing marine sediments. Confirmation of the analysing laboratories is required to allow the interpretation of the results. The MMO did request this information from the Applicant on 7 April 2022, however, has been advised it may be a number of weeks before this information can be provided by the Applicant. The MMO cannot undertake a robust</p>	<p>The Applicant confirms there had been an error in the details of the laboratories provided on the MMO return forms but this has been rectified and re-submitted to the MMO and the ExA at Deadline 4. The Applicant confirms that the PAH lab certificate analysis has also been submitted at Deadline 4. This information has been provided as an update to G1.44 Hornsea Four Contaminated Sediments Clarification Note for completeness.</p>

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	review of the analysis results with the outstanding matters mentioned within 2.2.5 and 2.2.6 of this response. As such the MMO will provide a further response on the contaminants at a later Deadline when the information is provided.	
<i>2.3 Comments Outline Fisheries Coexistence and Liaison Plan [REP1-033]</i>		
2.3.1	The MMO requests it is made clear within the document that "the MMO will not act as arbitrator and will not be involved in discussions on the need for, or amount of, compensation being issued". The MMO believes this should be made clear at this stage to ensure all parties are aware that the MMO will not be part of this process.	The Applicant will not be updating F2.9: Outline Fisheries Coexistence and Liaison Plan at this time.
<i>2.6 Responses to Examiners Questions 1 deferred from Deadline 2 [REP2-077]</i>		
1.22	<p>Applicant Mitigation for effects on marine mammal qualifying features and monitoring</p> <p>The MMO has reviewed Natural England's response to this question and concurs with their comments on the following:</p> <ul style="list-style-type: none"> • Operational WTC noise monitoring • Monitoring bottlenose dolphin 	<p>Operational WTC noise monitoring</p> <p>The Applicant notes that due to the low levels of underwater noise produced by operational WTCs, and the absence of any significant impacts predicted in relation to operational noise, the need for operational noise monitoring is considered to be disproportionate. That said, strategic monitoring approaches within the Hornsea zone will be identified and adopted where appropriate nearer the time alongside site specific monitoring campaigns.</p> <p>Monitoring bottlenose dolphin</p> <p>Strategic monitoring approaches within the Hornsea zone will be identified and adopted where appropriate nearer the time alongside site specific monitoring campaigns.</p>
1.14	<p>Location of the Flamborough Front</p> <p>The MMO has broken the response to this question into 3 parts:</p> <p>1. If the location of the Front is not fixed, to what extent does it vary and over what time frame?</p> <p>Flamborough Front is a highly dynamic feature that is not fixed, it moves/changes in a variety of manners. These include:</p> <p>a. Changes in the intensity of the stratification due either to colder than normal deep water to the North or additional heating to the south. This can be caused by the increase of cloudless and windless days that allow stratification to build from the surface. The magnitude, size and frequency of the meanders of the Front can change due to changes in wind strength/direction and those factors described above.</p>	<p>The Applicant offers a response to each of the three parts of MMO's response:</p> <p>(1) The Applicant welcomes the MMO's acknowledgment that the location of the dynamic and seasonal Flamborough Front varies temporally and spatially. To provide further understanding on the form and function of this feature, the Applicant has commissioned an independent study, as discussed with Natural England and the MMO, which aims to satisfy concerns with respect to the position of Flamborough Front and the potential impacts of Hornsea Four upon this seasonal feature, both in isolation and in-combination with other</p>

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	<p>b(i). The dynamics of the Flamborough Front have been acknowledged for nearly 30 years. In Hill et al. (1993), it shows the Front as "zig-zag" lines (see figure 1). Along with northern and southern trajectories North and South of Dogger Bank. More modern numerical models are starting to capture the variability but not on an instantaneous level i.e. direct comparison between the observations and model predictions. [Figure 1- 1993 map of Flamborough front expressed as "zig-zag lines" (Hill, A.E. et al, 1993)]</p> <p>b(ii). Huthnance et al. (2016) reviewed the changes within the North Sea over the last 30 years. In terms of temperature the strongest increases are in the South, which is mirrored by similar increases in salinity, probably caused by flows between in the Faroe-Shetland channel from more oceanic sources mitigating wider temperature increases. Therefore, there are both inter-annual variability in the position of the front and long-term (30 years+) changes.</p> <p>2. What implications does this have for turbulent wakes and their effects?</p> <p>It should be acknowledged that the creation of the Flamborough Front only occurs in summer when the stratified waters of the Southern North Sea interact with those well mixed in the north. Therefore, any effects and hence impacts will also be seasonal. It should be noted that the period of stratification is predicted to be one week earlier by 2100 and last 5-10 days longer. No changes in intensity are predicted.</p> <p>The introduction of any structures into these waters with thermal stratification will then act as "mixing rods" and mix surface water downward on the front face of the monopile and resuspend material from the seabed on the downstream side (see figure 2). [Figure 2- Flow dynamics around a simple cylinder (Melville and Colman, 2000)]</p> <p>This is the mechanism that creates surface suspended sediment plumes behind monopiles at certain locations e.g. Thanet Offshore Wind Farm in the southern North Sea. Here, a benthic boundary layer of high suspended sediment concentrations is advected to the surface and slowly the material falls out of suspension depositing back on the seabed. These can be seen from both aerial images as well as satellite based remote sensing. At present, the impact on the benthic community of this additional suspended sediment depositing in a "hallow area" around each monopile/wind farm has not yet been investigated.</p> <p>In a similar mode to suspended sediment, it is hypothesised that temperature effects will be similar. For instance, that the cold water will be brought to the surface on the down stream side of the monopile. The scale, intensity and duration of these "cold water surface plumes" is currently unknown. However,</p>	<p>developments. The Applicant submits Marine Processes Supplementary Report (G4.9) at Deadline 4.</p> <p>(2) Observational evidence is available which shows that turbulent wake effects are dependant upon the amount of stratification within the water body (Shultze et al., 2020). This evidence shows that where stratification is weak then additional mixing created by leeward wakes from foundations may locally overcome buoyancy forces however where stratification is stronger than buoyancy forces, stratification is retained and no mixing effects are detected which may develop "cold water plumes". Figure 2 of Melville and Colman (2000), whilst showing flow dynamics around a simple cylinder in relation to scour effects, does not consider the consequences of any dampening effects due to the buoyancy forces in the surface layer. These buoyancy forces limit the full influence of tidal mixing in the bottom layer during summer periods. The Applicant notes the sediment plumes observed in relation to the Thanet Offshore Wind Farm. However, this development is located in the Southern North Sea where the water body is well-mixed and so enables such effects to appear at the sea surface. As such, given the different environmental settings of Thanet (well-mixed) and Hornsea Four (stratified), the Applicant does not consider that observations from the former development can be transferred to Hornsea Four. The Applicant maintains its position that the Hornsea Four development will not significantly reduce the total productivity of the North Sea.</p> <p>(3) The implications of non-cylindrical, gravity base structure (GBS) foundations have been assessed (see impact assessment MP-O-2) in APP-013. The Applicant is confident the assessment of wakes, their interactions, and potential direct impacts on the Flamborough Front has been proportionately assessed, The Applicant shall submit a</p>

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	<p>simple modelling results seem to suggest that these cold water plumes will be on a scale smaller than the inter-monopole distance. It should be noted that whilst there is a potential for cumulative impacts if the current is along an axis of monopiles, this should not be the case, as the front meanders back and forward.</p> <p>Any changes to the dynamics of the front could be significant in a number of ways. Firstly, the Front itself creates a "strong jet" heading offshore in the case of Flamborough that transport particles and contaminates East and eventually to the Dogger Bank. Secondly, the Front itself creates pelagic biodiversity as deep nutrients are brought to the surface and create chlorophyll plumes on the surface that can be observed from satellite imagery. Furthermore, a sub-surface chlorophyll maxima (or sub-surface front) can also be seen in sections across the area. The primary productivity in this Deep Chlorophyll Maxima (DCM) has been shown to be 66% of the total productivity of the North Sea (Fernand et al, 2013).</p> <p>3. What are the implications of the inclusion of the non-cylindrical, gravity base structure (GBS) foundations in the array, and what level of certainty can be applied to the consequent wakes, their interactions, and potential direct impacts on the Flamborough Front and indirect impacts on seabirds and marine mammals through changes to its productivity?</p> <p>The introduction of large non-cylindrical gravity based structures will have the same effects as discussed at the beginning of subsection 2 of this answer. However, with these structure the impacts will be more severe.</p> <p>Firstly, the scale of the device is significantly larger and the height /width ratio wider (monopiles are normally considered as slim).</p> <p>Secondly, they are not simple cylinders and may have additional secondary currents at certain tidal elevations/wave heights (for instance around the "shoulders" of the GBS).</p> <p>Whilst there is a theoretical impact pathway from changes in turbulence and thus changes in mixing resulting in a change in primary productivity reductions and hence finally impacts on seabirds/mammals. However, at present the sign of the impact is unknown as is the magnitude or scale or duration of impact (for instance, it could be argued that the additional turbulence will enhance mixing and thus increase productivity or on the other hand, the blockage of the structures will reduce mixing and thus reduce primary productivity).</p> <p>The MMO suggests that monitoring conditions are developed that identify:</p>	<p>supplementary report (Indirect Effects: Forage Fish and Ornithology) at Deadline 5 which shall addresses indirect impacts on seabirds and marine mammals through changes to its productivity.</p> <p>The Applicant does not consider that the application of sea surface temperature satellite data to monitor cold water plumes is an effective strategy to assess the influence of Hornsea Four upon water body mixing.</p> <p>The Applicant refers to the Marine Processes Supplementary Report (G4.9) at Deadline 4 which provides further information on all the above points.</p>

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	<p>i) the changes in the mixing in stratified areas from GBS based structures – satellite monitoring of “cold water surface plumes” and;</p> <p>ii) link any observed cold water plumes with changes in primary productivity (both surface and deep water maxima).</p> <p>The degree of impact of GBS on the structure and function of Flamborough Front has been an issue discussed throughout the EIA process. Whilst the developer has identified some variability in the location of the Front, the potential impact pathways (and their significance) have not been explored. We note that the ExA's have also identified this omission.</p>	
1.16	<p>Transboundary noise effects on fish</p> <p>The MMO advises that in order to provide clarity regarding previous comments on potential transboundary impacts from underwater noise, it should be recognised that the two sections of comments that the Examining Authority (ExA) is referring to relate to two different receptor groups, and thus the potential effects upon these receptors may be different. Section 3.7.18 of Relevant Representation [RR-020] “the MMO agrees that the risk of significant impact of potential transboundary effects is likely to be low” is directly related to potential transboundary effects from underwater noise upon marine mammals.</p> <p>The first part of the ExA question is related to fish receptors. In our previous advice, it was recognised that it was appropriate that potential direct underwater noise transboundary effects on fish receptors resulting from piling operations had been scoped in.</p> <p>The Environmental Statement (ES) acknowledged that behavioural responses in certain fish species are predicted to extend to several 10s of kilometres beyond Hornsea Four and therefore have the potential to affect fish (and shellfish) habitats of the Netherlands during the construction period. However, as range contours for behavioural responses to noise impact for fish have not been presented in the ES it was not possible to determine the extent of this transboundary impact or determine whether there will be any spatial overlap of noise with spawning and nursery grounds of fish in the Netherlands or any other neighbouring countries.</p> <p>Further comments regarding the requirement for behavioural response impact range noise contours to be mapped are provided in Sections 3.6.15-3.6.17 of the Relevant Representation (RR-020).</p> <p>Potential transboundary effects related to increases in suspended sediment concentrations are predicted to occur up to 14 km from Hornsea Four and are therefore not predicted to extend into the</p>	<p>The Applicant notes that the MMO have requested the inclusion of “behavioural contours” in previous submissions, with other submissions making direct reference to the use of the 135dB SEL threshold as identified in Hawkins et al. (2014). As outlined by the Applicant in previous responses, the use of this threshold has been expressly advised against being used within impact assessments by the authors of the paper (within Hawkins et al., 2014). The study undertaken by Hawkins et al. (2014) was undertaken in a quiet loch. Notwithstanding the statement from the authors of the paper, 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> <p>Furthermore, Dr Hawkins was a co-author on the Popper et al. (2014) guidance for undertaking underwater noise impact assessments on fish, which also advocated for behavioural impact assessments being qualitative rather than specifying noise thresholds due to the lack of evidence for sound levels which trigger behavioural responses in fish. With both of these papers being published within the same year, by the same authors, it is considered that the lack of any guidance for behavioural noise thresholds for fish within Popper et al. (2014) is further evidence of the unsuitability of the 135dB</p>

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	<p>waters of other EEA states. Therefore, the MMO advises that transboundary impacts arising from this effect will not be significant for fish receptors."</p>	<p>threshold within Hawkins et al. (2014) for use in impact assessments. A number of reviews of the evidence base for underwater noise thresholds for fish have been published in the proceeding years (e.g. Popper & Hawkins, 2018; 2022), all of which reiterate that the Popper et al. (2014) guidance remains the most suitable for undertaking impact assessments of noise on fish species. Therefore, it is the Applicant's position that the behavioural responses for herring have been adequately considered within the transboundary effects assessment in Section 3.13 of Volume A2, Chapter 3: Fish and Shellfish Ecology (APP-015). Furthermore, the Applicant confirms that any impacts will be short term and intermittent, with recovery of fish and shellfish populations to affected areas following the completion of all piling activities. In addition to this, the EEZ of the Netherlands is located 87 km from the piling activities and it is unlikely that any noise from the Hornsea Four activities would be at any ecologically meaningful levels at this distance. Therefore, the Applicant is confident that any transboundary impacts on fish and shellfish in the Netherlands will be slight, and not significant in EIA terms.</p> <p>The Applicant notes the MMO's acceptance that transboundary impacts arising from increases in suspended sediment concentrations will not be significant.</p>

3 Applicant's Comments to Natural England (REP3-053 and REP3-054)

Reference	Stakeholder's Written Representation	Applicant's Response
<p><i>Deadline 3 Submission – Natural England Risk and Issues Log (REP3-054)</i></p>		

Reference	Stakeholder's Written Representation	Applicant's Response
C19 (RR-029 Appendix C 57)	<p>Natural England have reviewed REP1-061 (G1.33 Predator eradication island suitability assessment: Bailiwick of Guernsey Revision: 1.1) and welcome the further refinement of identified sites for predator eradication. Natural England agree that although subject to a number of limitations and assumptions, the methods presented therein would allow at least a comparative assessment of nesting potential between sites, and an estimate of a sites breeding population potential to inform calculations on the required scale of the measure. We note that colonisation potential could also be influenced by factors such as prey availability that will be difficult to account for. However, we must reinforce our significant concern that specific sites have not yet been identified. Full feasibility studies are required to identify sites and ensure they meet a range of established criteria, set out in the Manual of the UK Rodent Eradication Best Practice Toolkit (2018), as acknowledged by the applicant in REP1-061. It is not clear if this will be achievable within the examination period, and if it is not, the measure can not be considered to be secured. Natural England are in broad agreement with the conclusions presented by the RSPB in REP2-093, particularly the assertion that, "the results of any detailed feasibility study and associated implementation plans must be presented to the examination for scrutiny by the Examining Authority and interested parties as soon as practicable". Until this information has been gathered and submitted Natural England can not have any confidence in the ability of the Applicant to initiate a predator eradication scheme that will adequately compensate for any predicted impacts on razorbill or guillemot. Furthermore, there remains a significant risk that feasibility studies fail to identify a suitable site.</p>	<p>The Applicant will present the survey results of the eradication implementation study at Deadline 5. The Applicant has identified a number of specific locations within their REP1-061 which are currently being included within the eradication implementation study. It is important to note that the eradication implementation studies are being conducted by world leading predator eradication experts who have undertaken eradications on behalf of various stakeholders, including the RSPB. They are therefore well versed in eradication best practices.</p> <p>As mentioned above, the initial survey results of the eradication implementation study will be submitted by the Applicant at Deadline 5. This will determine the most suitable island/islets for eradication by the Applicant for delivery of the compensation measure. However, all locations currently being considered within the eradication implementation study are deemed to be suitable for eradication (islands and islets associated with Sark, Alderney and Herm (including Herm Island)). Relevant biosecurity measures will be implemented at the initiation of the eradication project.</p> <p>The Applicant is therefore confident that the most suitable location for a predator eradication will be identified by the extensive eradication implementation study. The initial survey results will be submitted at Deadline 5 and within the examination period. Furthermore, the Applicant is working with relevant landowners, managers and statutory bodies to secure delivery of the measure.</p>
C24 (RR-029 Appendix C 92)	<p>Natural England have reviewed REP1-061 (G1.33 Predator eradication island suitability assessment: Bailiwick of Guernsey Revision: 1.1). As acknowledged in that document, any assessment of potential nest sites and breeding population potential at a site following predator eradication will be subject to numerous limitations and assumptions. Any colonisation potential, or increase of an existing population or its productivity remains highly speculative. We suggest that it may prove useful to</p>	<p>The Applicant has based the calculations within their REP1-061 on precautionary breeding densities for guillemot when compared to other published densities for the species. The Applicant remains cognisant of potential opportunities to ground truth the island suitability assessment and will provide an update to the report following results of the eradication implementation study. The</p>

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	<p>ground truth the nest site identification process detailed in REP1-061 to give a greater level of confidence in its utility. This could be readily achieved by applying it to discrete areas within existing colonies (photographed occupied, and unoccupied, preferably in winter with minimal guano staining). We maintain that due to outstanding uncertainties with the measure and baseline data, the amount of compensation deliverable is not currently possible to quantify. This will be reviewed at Deadline 5 when the results of the feasibility study are submitted (RR-029-APDX:C-92).</p>	<p>Applicant clarified during Issue Specific Hearing 5 that the analysis of MRSea v2 in comparison to MRSea v1 demonstrates that MRSea v1 was suitable for use for assessment purposes and was sufficiently precautionary. Therefore, the impact assessment and compensation as submitted at DCO application is robust and sufficient.</p>
<p>C26 (RR-029 Appendix C Summary table: target fishery)</p>	<p>Natural England are concerned that the Applicant is not clearly committing to a second year of trials for the LEB (REP1-021). We consider that the LEB remains unproven in a fishery setting or for the species of concern, and its effectiveness must be proven through a robust trial. A single year (in fact, only a winter 'season') of data collection is not sufficient as interannual variation cannot be considered. Further, the raw data must be available in order for us to fully review such a trial, and we understand that only proportional reductions in bycatch will be reported. We appreciate this is a request of the fishery and recognise the sensitivity of the data in question, but therefore must highlight the lack of co-operation and transparency that this suggests, as well as the inherent risk to the perceived legitimacy of the trial results.</p>	<p>The Applicant is confident that the Looming Eye Buoy (LEB) is a viable compensation measure and the preliminary results of the bycatch reduction technology phase using the LEB are promising, with similar bycatch reduction as identified in Rouxel <i>et al.</i>, (2021). We are therefore confident in the LEB technology and therefore do not consider a trial will be necessary. The Applicant will provide an update on the bycatch reduction technology selection phase at Deadline 5 once the full analysis has been completed.</p> <p>We acknowledge the stakeholder comments regarding a second year of data collection. Hornsea Four plan to implement the LEB on vessels between the last quarter of 2022 and the first quarter of 2023 as part of implementation, to reduce risks in terms of stakeholder relations, to inform strategic compensation and to maintain relationships with fishers to prepare for delivering the compensation measure should it be required.</p> <p>As previously stated in G1.9 Applicant's comments on Relevant Representations (REP1-038), due to contractual restrictions, the results of the bycatch reduction technology selection phase can only be disclosed as percentage reductions in bycatch, i.e. not specific numbers of birds, without consent from the participating fishers. It is vital that the Applicant maintains the excellent relationship with fishers to ensure the long-term implementation of</p>

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C29 (RR-029 Appendix C 61, 81)	<p>Natural England have reviewed the calculation methods supplied in REP1-063, and are in broad agreement that they are fundamentally sound and fit for purpose. However, we do not agree that an appropriate approximation of baseline bycatch is being generated in the first step of the compensation calculation for quantifying the scale of bycatch reduction. Therefore, we would also disagree with any subsequent calculation of bycatch reduction. The method detailed relies on questionnaire responses from fishers. An average number of auks bycaught per annum has been provided from those fishers that responded. This is not species-specific, and it is not clear if fishers have competent bird identification skills, so even assignment to this group could be erroneous. Without access to the raw data, and with no further statistics provided, we can not assess how representative the mean value is, or consider variance around it. Interannual variation has also not been accounted for, and it is unclear how many years fishers considered when providing their estimates. It is likely that bycatch varies significantly across vessels, temporally, and spatially. Applying an anecdotal, unsubstantiated average bycatch rate across a number of vessels is not an appropriate baseline to calculate a potential reduction from. A far greater understanding of the bycatch within the target fishery, including spatial and temporal variation as well as between vessels (and their individual practices, gear types, etc) will be essential before we can have any confidence in an estimate of potential reductions arising from the implementation of any bycatch reduction technology. Natural England anticipate that progress has been made by the Applicant in this respect during trials of the Looming Eye Buoy.</p>	<p>the measure. However, a similar trial is running simultaneously under RSPB management which will likely have results published following analysis, without such restrictions.</p> <p>The Applicant has provided a response in the Relevant Representations provided at Deadline 1 within response RR-029-APDX:C-49.</p> <p>In light of a lack of evidence on bycatch rates that are specific to particular locations and based on recent fishing data, the Applicant has undertaken a detailed questionnaire process to gather information from fishers. The questionnaire has been checked by independent social scientists at Exeter University. The questionnaire also included a seabird identification section which provided images of guillemot and razorbill in different plumages to support fisher seabird identification when completing the questionnaire.</p> <p>Averaging of bycatch rates across fishers was supported by the fishing industry. While bycatch rates may differ between fishers, the focus of the questionnaires during the bycatch technology selection phase has been to identify fishers willing to take part in the selection phase who have also reported seabird bycatch in certain locations. Differences in bycatch rates will be important during the delivery stage of compensation. This is informed by monitoring during the technology selection phase.</p> <p>During the analysis of data collected during the bycatch reduction technology selection phase, spatial and temporal differences in bycatch is being examined and considered with the questionnaire results that have been used for the bycatch rate used to determine the number of vessels required during implementation. The process provides an additional level of confidence to the bycatch estimates</p>

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		<p>and allows compensation delivery to be focused on regional specific data.</p> <p>Further information on recent advancements made by the Applicant are provided within Revision 3 of the Bycatch Reduction Roadmap (B2.8.2 Volume B2, Annex 8.2: Compensation measures for Flamborough and Filey Coast (FFC) Special Protection Area (SPA): Guillemot and Razorbill Bycatch Reduction: Roadmap (REP2-011)).</p>
C38 (RR-029 Appendix C 79)	<p>Natural England are concerned that the Applicant is not clearly committing to a second year of trials for the LEB (REP1-021). We consider that the LEB remains unproven in a fishery setting, and its effectiveness must be proven through a robust trial. A single year (season) of data collection is not sufficient as interannual variation can not be considered. Further, the raw data must be available in order for us to fully review such a trial, and we understand that only proportional reductions in bycatch will be reported on. We appreciate this is a request of the fishery, but therefore must highlight the lack of co-operation and transparency that this suggests. We draw attention to the fact that in order to collect sufficient data, the LEB trial will not complete within the timescale of the examination.</p>	<p>Please see the Applicant's response to C26 (RR-029 Appendix C Summary table: target fishery).</p>
	<p>Gannet bycatch reduction.</p> <p>Natural England have reviewed REP1-064. A significant amount of useful information is presented, however, due to the provision of this document part way through examination, we will focus on our key concerns to justify Natural England's overarching position. We highlight that there is no proven method of reducing Northern gannet bycatch specifically. It will not be possible to trial a bycatch reduction method within the timescales of examination. Even if an immediate start was possible, any such trial would be unable to deliver conclusive results until 2024 at the very earliest. The level of Northern gannet bycatch in UK fisheries remains highly uncertain, and would need to be properly understood and quantified in a target fishery before any bycatch reduction could be quantified. Scottish longline fisheries are identified as being most likely to have significant levels of gannet bycatch. These fisheries are unlikely to be available to English projects hoping to</p>	<p>The Applicant welcomes the positive feedback from Natural England on the recent gannet bycatch reduction workstream.</p> <p>As presented within the Applicants G1.42 Compensation measures for Flamborough and Filey Coast (FFC) Special Protection Area (SPA: Gannet Bycatch Reduction: Ecological Evidence (REP1-064)), there are a number of methods available to reduce gannet bycatch. One particular method, the Hookpod, removes the risk of plunge diving seabirds such as gannet from reaching baited hooks, therefore removing the risk of bycatch. Unlike gillnet bycatch reduction techniques which are largely species specific as they rely on behavioural responses, the Hookpod is not species specific as it does not rely on a behavioural response.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
	<p>deliver compensation. In summary, Natural England agree that it is likely that Northern gannet are subject to bycatch in UK fisheries, and that reducing this bycatch is theoretically possible with an existing technology (or possibly, by adapting an existing technology). However, Natural England do not believe that reducing the bycatch of Northern gannet is a currently viable compensatory measure. Further, we consider the process required to develop and secure the measure to be unachievable with respect to the project timelines.</p>	<p>The Applicant has spoken to RSPB and their bycatch experts (at BirdLife International) to discuss gannet bycatch. The Hookpod was mentioned as a technique which the RSPB were confident in as it removes the hook from capture for seabirds and therefore removes the risk of bycatch for the species.</p> <p>The Applicant is working with fishers who fish within known gannet bycatch areas to determine the implementation of the measure. Based on the extremely high bycatch rates reported for gannet in Anderson <i>et al</i> 2011, and the very small anticipated impact for gannet by the Hornsea Four project, it is likely bycatch reduction would only be required on a single or small number of vessels.</p> <p>The Applicant will continue to work with stakeholders to advance the understanding of this measure for gannet and will provide relevant updates within the Gannet Bycatch Roadmap which will be provided at Deadline 5.</p>
<p><i>Deadline 3 Submission – Natural England Risk and Issues Log (REP3-054)</i></p>		
<p>D2 (RR-029 Appendix D 2)</p>	<p>As requested, the Applicant has provided a table showing the number of animals that may experience PTS-onset based on concurrent piling. In this respect they have sufficiently addressed our original comment.</p> <p>However, from the new data we note that for harbour porpoise the number of individuals that may experience PTS from concurrent piling (of pin piles) is 1661-1792 (dependent on density estimate used). This represents a ~5-6-fold increase in the numbers, and so percentage of the MU (~0.5% compared to ~0.1%), exposed to PTS (when compared to single event piling). For minke whales, the number of animals potentially exposed to PTS has increased from <1 (single piling) to 9 (concurrent piling).</p>	<p>Mitigation for the PTS zone is based on SELcum Please see the Clarification Note on Marine Mammals (G4.11) submitted at Deadline 4 with provided further information on PTS in marine mammals.</p> <p>Maximum separation distance The maximum separation distance between two concurrent monopiles has been assessed with the modelling assuming piling at the NW and the E locations within the array area (on opposite sides of the array). The Applicant does not agree with the need to impose a minimum separation distance to mitigate the effects arising from a concurrent piling scenario.</p>

Reference	Stakeholder's Written Representation	Applicant's Response
	<p>In the MMMP the Applicant is proposing to only mitigate the instantaneous PTS zone (based on SPLpeak), which is <1000m. The Applicant has not committed to mitigation for the PTS zone based on SELcum, which is much larger than the one based on SPLpeak. The distances presented for this cumulative piling scenario is based on SELcum. Although the impact distances are not presented, it can be inferred from the area of impact (~1000 km2) that the mitigation proposed by the Applicant will not mitigate the full PTS zone. Therefore we do not agree that the risk from PTS will be minimised to negligible levels. We have provided more information on this point in our response the Examiner's Questions.</p> <p>Consideration should be given to implementing a maximum separation distance between two concurrent piling events, which limits how far apart the concurrent piling locations can be. A maximum separation distance would help to maximise the overlap of impact zones from piling, and therefore minimise the number of individuals potentially impacted.</p>	
D20 (RR-029 Appendix D 29)	<p>"The Applicant has provided a document [REP2-050] that details the environmental conditions of the site, in relation to the environmental limitations of noise abatement systems (NAS). The document demonstrates that the conditions on the site are within the known limits of NAS for wind speed and current state; the theoretical limits for water depth; and potentially approaching the limits of wave height in the winter months. This document therefore confirms that this site is suitable for NAS and addresses our query in this respect.</p> <p>We maintain that mitigation should be committed to at this stage and that it would be appropriate for NAS to be considered within this."</p>	<p>The Applicant confirms that the specific mitigation measure (or suite of measures) that may be implemented during the construction of Hornsea Four will be determined, in consultation with the relevant SNCB, following confirmation of final hammer energies and foundation types, collection of additional survey data (noise or geophysical data), and/or acquisition of noise monitoring data, and/or information on maturation of emerging technologies. This additional data and information will allow the noise modelling to be updated and support discussions on the appropriate mitigation measure(s). This process includes provision for at-source mitigation, if required. The F2.5: Outline Marine Mammal Mitigation Protocol (APP-240) finalisation processes includes provision for at source mitigation, if required. As such, the Applicant does not consider it necessary to include specific further commitments at this stage.</p>
D21 (RR-029 Appendix D 30)	<p>Natural England maintains that mitigation should be committed to at this stage. This concern has not been resolved.</p>	<p>See response to D20 (RR-029 Appendix D 29).</p>

Reference	Stakeholder's Written Representation	Applicant's Response
D24 (RR-029 Appendix D 37)	The Applicant has not addressed our concerns. We maintain that the timeframe of the SIP needs to be secured in the DCO.	The Applicant maintains that it is not necessary to secure the timeframe of the SIP in the DCO and re-iterates that it has voluntarily committed to undertaking consultation on the draft SIP with Natural England and the MMO prior to submission to the MMO for approval, alongside an indicative timescale for doing so (six to nine months prior to construction). This is secured via F2.11 Outline Southern North Sea Special Area of Conservation Site Integrity Plan (APP-246) and is considered appropriate and proportionate. Furthermore, the Applicant notes that recent SoS decisions i.e. Hornsea Three, Norfolk Boreas, Norfolk Vanguard have not included a requirement to secure the timeframe of the SIP in the DCO.
D28 (RR-029 Appendix D 46)	The Applicant agrees that further discussion is needed. It can be inferred from their response that they would intend to have this discussion post-consent. The exact timings of the ADD duration could be finalised post-consent (after further modelling is undertaken). However, the principles which determine ADD duration should be discussed at this stage (i.e. whether ADD duration corresponds to the instantaneous PTS zone or the cumulative PTS zone). Agreement is needed on this point. Note that this discussion is related to our concerns over no commitment to mitigate the full cumulative PTS zone as per our previous comments.	<p>The Applicant maintains that only instantaneous PTS should require mitigation. To support this position the Applicant has drafted a Cumulative PTS (see Clarification Note on Marine Mammals (G4.11)), on the limitations of modelling cumulative PTS, to be submitted to the Examination at Deadline 4.</p> <p>The Applicant welcomes further discussions with Natural England with the aim of resolving the differing positions with regards to cumulative PTS mitigation. The outcome of these discussions will inform subsequent agreements around appropriate mitigation measures such as, for example, ADD.</p>
E16 (RR-029 Appendix E 5, 12, 13 & 5-61)	Whilst the Applicant has considered long-term average cliff recession rates in the planning of the HDD TJB locations inland, they have not included estimates of changes to the intertidal area due to climate change/sea level rise, or through the project lifetime. Similarly, there is no consideration of changes to the Holderness Cliff due to the coastal access ramp, changes to the coastline linked to lowering of Smithic Bank due to the proposed development and climate change/sea level rise. We would also wish to seek clarification of the anticipated need for remedial works for landfill infrastructure beyond the lifetime of the project, as we note it is the Applicant's position that there is no requirement for remediation plans. Therefore, we would advise that annual monitoring of cliff retreat and beach lowering rates over the	Climate change factors for the relevant period are considered from paragraph 1.7.11.3 to 1.7.11.11 of Volume A2 Chapter 1 Marine Geology Oceanography and Physical Processes (APP-013) . The review considers sea level rise, waves, surges, increased cliff erosion and the potential relationship of Smithic Bank. It is the Applicant's view that the proposed development will not lead to a change to the Holderness Cliffs or lower Smithic Bank as suggested, and therefore the Applicant does not accept the need for a monitoring regime.

Reference	Stakeholder's Written Representation	Applicant's Response
E27 (RR-029 Appendix E 52, 53, 61 & 64)	<p>lifetime of the project should be carried out in order to assess cliff/beach stability and cable exposure.</p> <p>No change - We advise that a realistic worst-case cable crossing footprint area needs to be presented.</p>	<p>We believe there may be some misunderstanding in the information presented. Figure 1.2 shows the width of cable corridors for both the Dogger Bank and Hornsea Four projects within which there will be export cables which only occupy part of the corridor width (indicative alignment of up to 6 cables shown for Hornsea Four only which also serves to illustrate the amount of width required for cables within the full cable route corridor width) and where these cross there is planned to be a rock berm, the final locations of cables and crossing yet to be confirmed within the overall width. The details assessed in the modelling are entirely consistent with those described in the Project Description for the rock berm with the MDS location of the crossing chosen to be the closest possible to Smithic Bank within the width of the corridor. The model has enhanced detailed at this location to help properly resolve the interactions with waves and flows. Further to this, various configurations of the berm have been represented in the model for heights of 1.8 m (standard), 3.0 m (most extreme) and with added friction to account for rock material. Figure 45 shows how waves might be attenuated for the MDS case which includes the cable crossing. Similarly, Appendix C of Volume A5 Annex 1.1 Marine Processes Technical Report (APP-067) shows details of the rock berm and how flows might be locally moderated.</p>

