RWE Renewables UK Dogger Bank South (West) Limited

RWE Renewables UK Dogger Bank South (East) Limited

Dogger Bank South Offshore Wind Farms

Environmental Statement

Volume 7

Appendix 8-1 Marine Physical Environment Consultation Responses

June 2024

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Unrestricted

Company:	**RWE Renewables UK Dogger Bank South (West) Limited and RWE Renewables UK Dogger Bank South (East) Limited**	Asset:	**Development**
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Unrestricted

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Glossary

Term	Definition
Array Areas	The DBS East and DBS West offshore Array Areas, where the wind turbines, offshore platforms and array cables would be located. The Array Areas do not include the Offshore Export Cable Corridor or the Inter-Platform Cable Corridor within which no wind turbines are proposed. Each area is referred to separately as an Array Area.
Array Cables	Offshore cables which link the wind turbines to the Offshore Converter Platform(s).
Bathymetry	Topography of the seabed.
Beach	A deposit of non-cohesive sediment (e.g. sand, gravel) situated on the interface between dry land and the sea (or other large expanse of water) and actively 'worked' by present-day hydrodynamic processes (i.e. waves, tides and currents) and sometimes by winds.
Bedforms	Features on the seabed (e.g. sand waves, ripples) resulting from the movement of sediment over it.
Climate change	A change in global or regional climate patterns. Within this chapter this usually relates to any long-term trend in mean sea level, wave height, wind speed etc, due to climate change.
Closure depth	The depth that represents the 'seaward limit of significant depth change', but is not an absolute boundary across which there is no cross-shore sediment transport.
Coastal processes	Collective term covering the action of natural forces on the shoreline and nearshore seabed.
Concurrent Scenario	A potential construction scenario for the Projects where DBS East and DBS West are both constructed at the same time.
Cumulative Effects Assessment (CEA)	The assessment of the combined effect of the Projects in combination with the effects of a number of different (defined cumulative) schemes, on the same single receptor/resource.
Current	Flow of water generated by a variety of forcing mechanisms (e.g. waves, tides, wind).

Term	Definition
Development Scenario	Description of how the DBS East and / or DBS West Projects would be constructed either in isolation, sequentially or concurrently.
Dogger Bank South (DBS) offshore wind farms	The collective name for the two Projects, DBS East and DBS West.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the value, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Erosion	Wearing away of the land or seabed by natural forces (e.g. wind, waves, currents, chemical weathering).
Evidence Plan Process (EPP)	A voluntary consultation process with specialist stakeholders to agree the approach, and information to support, the Environmental Impact Assessment (EIA) and Habitats Regulations Assessment (HRA) for certain topics.
Expert Topic Group (ETG)	A forum for targeted engagement with regulators and interested stakeholders through the EPP.
Glacial till	Poorly sorted, non-stratified and unconsolidated sediment carried or deposited by a glacier.
Gravel	Loose, rounded fragments of rock larger than sand but smaller than cobbles. Sediment larger than 2mm (as classified by the Wentworth scale used in sedimentology).
Horizontal Directional Drill (HDD)	HDD is a trenchless technique to bring the offshore cables ashore at the landfall and can be used for crossing other obstacles such as roads, railways and watercourses onshore.
Hydrodynamic	The process and science associated with the flow and motion in water produced by applied forces.

Term	Definition
In Isolation Scenario	A potential construction scenario for one Project which includes either the DBS East or DBS West array, associated offshore and onshore cabling and only the eastern Onshore Converter Station within the Onshore Substation Zone and only the northern route of the onward cable route to the proposed Birkhill Wood National Grid Substation.
Inter-Platform Cables	Buried offshore cables which link offshore platforms.
Intertidal	Area on a shore that lies between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS).
Landfall	The point on the coastline at which the Offshore Export Cables are brought onshore, connecting to the onshore cables at the Transition Joint Bay (TJB) above mean high water.
Low water	The minimum height reached by the falling tide.
Mean Low Water Springs	MLWS is the average of the heights of two successive low waters during a 24 hour period.
Mean Sea Level	The average level of the sea surface over a defined period (usually a year or longer), taking account of all tidal effects and surge events.
Nearshore	The zone which extends from the swash zone to the position marking the start of the offshore zone (~20m).
Numerical modelling	Refers to the analysis of coastal processes using computational models.
Offshore	Area seaward of nearshore in which the transport of sediment is not caused by wave activity.
Offshore Development Area	The Offshore Development Area for ES encompasses both the DBS East and West Array Areas, the Inter-Platform Cable Corridor, the Offshore Export Cable Corridor, plus the associated Construction Buffer Zones.

Term	Definition
Offshore Export Cable Corridor	This is the area which will contain the offshore export cables (and potentially the ESP) between the Offshore Converter Platforms and Transition Joint Bays at the landfall.
Offshore Export Cables	The cables which would bring electricity from the offshore platforms to the Transition Joint Bays (TJBs).
Project Design (or Rochdale) Envelope	A concept that ensures the EIA is based on assessing the realistic worst-case scenario where flexibility or a range of options is sought as part of the consent application.
Quaternary period	The last 2 million years of earth history incorporating the Pleistocene ice ages and the post-glacial (Holocene) Period.
Sand	Sediment particles, mainly of quartz with a diameter of between 0.063mm and 2mm. Sand is generally classified as fine, medium or coarse.
Sand Wave	Bedforms with wavelengths of 10 to 100m, with amplitudes of 1 to 10m.
Scoping report	The report that was produced in order to request a Scoping Opinion from the Secretary of State.
Scour protection	Protective materials to avoid sediment erosion from the base of the wind turbine foundations and offshore substation platform foundations due to water flow.
Sea Level	Generally, refers to 'still water level' (excluding wave influences) averaged over a period of time such that periodic changes in level (e.g. due to the tides) are averaged out.
Sea-Level Rise	The general term given to the upward trend in mean sea level resulting from a combination of local or regional geological movements and global climate change.
Sediment	Particulate matter derived from rock, minerals or bioclastic matter.

Term	Definition
Sediment Transport	The movement of a mass of sediment by the forces of currents and waves.
Sequential Scenario	A potential construction scenario for the Projects where DBS East and DBS West are constructed with a lag between the commencement of construction activities. Either Project could be built first.
Shore platform	A platform of exposed rock or cohesive sediment exposed within the intertidal and subtidal zones.
Significant wave height	The average height of the highest of one third of the waves in a given sea state.
Spring tide	A tide that occurs when the tide-generating forces of the sun and moon are acting in the same directions, so the tidal range is higher than average.
Storm surge	A rise in water level on the open coast due to the action of wind stress as well as atmospheric pressure on the sea surface.
Surge	Changes in water level as a result of meteorological forcing (wind, high or low barometric pressure) causing a difference between the recorded water level and the astronomical tide predicted using harmonic analysis.
Suspended Sediment	The sediment moving in suspension in a fluid kept up by the upward components of the turbulent currents or by the colloidal suspension.
The Applicants	The Applicants for the Projects are RWE Renewables UK Dogger Bank South (East) Limited and RWE Renewables UK Dogger Bank South (West) Limited. The Applicants are themselves jointly owned by the RWE Group of companies (51% stake) and Masdar (49% stake).
The Projects	DBS East and DBS West (collectively referred to as the Dogger Bank South Offshore Wind Farms).

Term	Definition
Tidal current	The alternating horizontal movement of water associated with the rise and fall of the tide.
Wave climate	Average condition of the waves at a given place over a period of years, as shown by height, period, direction etc.
Wave height	The vertical distance between the crest and the trough.
Wind turbine	Power generating device that is driven by the kinetic energy of the wind.

Acronyms

Term	Definition
ADCPs	Acoustic Doppler Current
BGS	British Geological Survey
CEA	Cumulative Effects Assessment
Cefas	Centre for Environment, Fisheries and Aquaculture
CFB	Coastal Flood Boundaries
DBS	Dogger Bank South
DCO	Development Consent Order
DML	Deemed Marine License
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Groups
GBS	Gravity Base Structures
HDD	Horizontal Directional Drilling
HVAC	High Voltage Alternating Current
JNCC	Joint Nature Conservation Committee
LAT	Lowest astronomical tide
MBES	Multi-beam echosounder
MCZ	Marine Conservation Zone

Term	Definition
MMO	Marine Management Organisation
MPA	Marine Protected Area
MW	Mega Watt
NCERM	National Coastal Erosion Risk Mapping
OECC	Offshore Export Cable Corridor
OSPAR Convention	Convention for the Protection of the Marine Environment of the North-East Atlantic
OWF	Offshore Windfarm
PAH	Polyaromatic hydrocarbons
PCB	Polychlorinated biphenyls
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PSA	Particle Size Analysis
RCP	Representative Concentration Pathway
SAC	Special Area of Conservation
SCAPE	Soft Cliff and Platform Erosion
SPA	Special Protected Area
SSC	Suspended Sediment Concentration
SSSI	Site of Special Scientific Interest
UXO	Unexploded Ordnance
WCS	Worst Case Scenario

Term	Definition
WCS	Worst Case Scenario
WFD	Water Framework Directive
WTG	Wind Turbine Generator

8.1 Consultation Reponses

8.1.1 Introduction

1. This appendix covers those statutory consultation responses that have been received as a response to the Scoping Report (2022), the Preliminary Environmental Information Report (PEIR) (2023) and Expect Topic Group (ETG) meetings, in addition to responses received on previous method statements issued for this topic.

2. Response from stakeholders and regard given by the Applicants have been captured in **Table 8-1-1**.

Table 8-1-1 Consultation Responses Related to Chapter 8 Marine Physical Environment

Comment	Project Response
Planning Inspectorate (PINS) Scoping Response 02/09/2022	
The Inspectorate agrees that the effects on waves and tidal currents from equipment during construction can be scoped out in relation to the offshore environment. However, the ES should consider whether nearshore / cable landfall works may impact on waves and tidal currents, and subsequently other coastal processes including geomorphological changes and processes, and surge water levels.	An assessment of the impact of cable installation in the nearshore and at the landfall is considered in sections 8.7.3.3 and 8.7.3.4. Changes to wave and tide regimes due to the presence of cable protection measures in the nearshore during operation are considered in section 8.7.4.5.
In view of the information in the Scoping Report the Inspectorate appreciates that physical alterations to the seabed topography caused by installation techniques are expected to infill naturally, the Scoping Report stating a timescale of 'a few days to months'. In the absence of site-specific information on the seabed conditions the extent of scour/secondary scour effects cannot be understood. The Inspectorate does not agree to scope this matter out at this stage, and advises that this matter is assessed within the ES, or evidence provided to demonstrate that significant effects will not occur.	Physical changes to the seabed due to installation vessels during construction are scoped in and assessed in section 8.7.3.10. The worst case assumes scour protection is required for all foundations. The impact of scour protection is assessed in relation to loss of seabed area in section 8.7.4.8. It is assumed that the design of scour protection will mitigate any impact of scour on the seabed with secondary effects of scour being limited to within a few meters of the protection.
Table 2-3 states that impacts arise from the presence of large foundations will be assessed in the operational phase. The information relating to the impact-effect pathways lacks necessary detail in order to understand why construction processes could not also result in impacts to Flamborough Front. The Inspectorate does not agree to scope this matter out and advises that this matter is addressed within the Evidence Plan Process (EPP) referred to in Paragraph 174.	Changes to water circulation (Flamborough Front) due to the Projects alone have been assessed in section 8.7.4.3. Cumulative changes to the Flamborough Front due to the presence of the Projects alongside other offshore wind farms on Dogger Bank have been assessed in section 8.8.4.
The Scoping Report states that "There is an extensive and robust evidence base on the previous Dogger Bank wind farms work to negate the need for numerical modelling to support the assessment of the Projects.". No evidence is presented within the Scoping Report to support this statement, and as such at present the Inspectorate cannot comment on the requirement for numerical modelling. The ES should present a detailed methodology for the assessment, and include relevant information to inform the assessment such as numerical modelling, as necessary.	Project and site specific marine physical processes modelling has been undertaken for the ES, see **Volume 7, Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**.
The Scoping Report refers (Paragraph 163) to the potential for the nearshore to be affected as a result of the cable landfall. Table 2-4 does not identify whether there are any onshore designated features (such as coastal Sites of Special Scientific Interest (SSSIs)) that may be impacted as a result of the Proposed Development. It is also noted that Flamborough Front is omitted from the Table. While the Inspectorate understands this is an undesignated feature it is nevertheless considered to be of high value and is likely to experience impacts from the Proposed Development. The ES should provide an assessment of the impacts likely to result in significant effects for all relevant receptors.	A full list of receptors considered is detailed in Table 8-22 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and includes the undesignated Flamborough Front which is assessed in section 8.7.4.3.
section 2.1 of the Scoping Report does not refer to the potential effects of encountering unexploded ordnance (UXO), and the potential for accidental or planned detonation, in relation to marine physical processes. The Inspectorate considers that the ES should assess the likely significant effects which could occur in this regard.	The impact of accidental or planned UXO detonation on the marine physical environment has not been assessed as a separate impact, as the worst case for seabed preparation for foundation and cable installation (section 8.7.3.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) will disturb a

Comment	Project Response
	greater volume of sediment in total when compared with the likely number and size of detonations across the Project. Furthermore, the worst case for indentations on the seabed caused by installation vessels (section 8.7.3.10 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) will be greater in number, and cumulative seabed footprint, than from than any impact from localised UXO detonations. A separate marine licence application has been considered for any UXO clearance works which would be subject to its own environmental assessment. Furthermore, in all cases where UXO are found, UXO health and safety procedures take precedence.
Paragraph 39 (Scoping Report section 1.5) indicates that scour protection installation may involve seabed preparation (levelling and gravel installation). The Scoping Report chapter for marine physical processes does not state whether this is to be assessed as a potential impact. The Inspectorate considers that the installation (and subsequent presence) of scour protection should be assessed for all project phases.	Changes in suspended sediment concentration due to seabed preparation for foundation installation are assessed in section 8.7.3.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. The presence of scour protection measures during operation is assessed in relation to loss of seabed area in section 8.7.4.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
The Inspectorate notes the brief commentary in the Scoping Report on the nature of the sediments in the study area and how this affects risk of potential impacts. Assessment of scour impacts during operation is proposed to be scoped out on the basis of the outcomes of previous assessment of Dogger Bank A and B, however this is not supported by any verified information e.g., monitoring data. In the absence of more project specific information on the receiving environment and details of construction and operation activities, the Inspectorate does not consider that the information in the Scoping Report is sufficient to scope these matters out at this stage. The ES should assess this matter or provide the information necessary to demonstrate that assessment is not required.	Scour protection is proposed (see **Volume 7, Chapter 5 Project Description (application ref: 7.5)**) which will minimise scour from the Projects. Scour effects are considered in section 8.7.4.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
The Inspectorate notes the information in the Scoping Report on the levels of contaminants in the study area based on Dogger Bank A and B studies. Information for the Proposed Development is not presented and site-specific analysis is not proposed. In the absence of this information, and details of construction and operation activities, the Inspectorate cannot agree to scope this matter out. The ES should assess this matter or provide the information necessary to demonstrate that assessment is not required.	Site specific information regarding contaminant levels is provided with this application in **Volume 7, Appendix 9-3 Benthic Ecology Monitoring Report (application ref: 7.9.9.3)**.
The Scoping Report does not provide any reasoning for scoping out accidental pollution during operation. Reference is made to the use of a Project Environmental Management Plan under the identified potential impact of pollution form construction vessels, however no other sources of accidental pollution are discussed. Decommissioning impacts are dismissed briefly with the reasoning that they are expected to be lesser than those for construction. The Inspectorate acknowledges that for all project phases the risk of significant effects from accidental pollution can generally be controlled by the use of mitigation plans and measures, and therefore accepts that significant effects are unlikely. Nevertheless, the ES must detail the potential sources and types of accidental pollution for all project phases and set out the proposed mitigation measures, including those to be included within the Project Environmental Management Plan, and indicate how these are to be secured.	**Volume 8, Outline Project Environmental Management Plan (application ref: 8.21)**, included with this application, details the potential sources and types of accidental pollution for all Project phases.

Comment	Project Response
The Scoping Report states that cumulative effects are to be scoped out as all impacts have been scoped out. The Inspectorate considers that a pathway for effects may exist for each of the matters above, and that even if further consideration concludes that effects would be minor, they could combine with others to result in significant effects. Where a pathway for effects cannot be excluded the ES must assess the any likely significant cumulative effects that may occur.	Cumulative effects have been considered in section 8.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Figure 2.6 of the Scoping Report shows historical sample points (around Dogger Bank A and B and associated export cable route), but no coverage of the Dogger Bank South study area. It is not justified why this data can be relied upon to represent conditions within the Proposed Development and why site-specific contaminant analysis is not proposed. This analysis should be carried out and reported in the ES, or the ES should provide full reasoning as to why this is not required including the outcomes of consultation with the relevant stakeholders and consultation bodies.	Site specific information regarding contaminant levels is provided with this application in **Volume 7, Appendix 9-3 Benthic Ecology Monitoring Report (application ref: 7.9.9.3)**.
Table 2-5 and 2-6 provide sediment contaminant analysis for the Dogger Bank A and B export cable corridor, and Tranche A windfarm array area, with reference to Cefas Action Levels. The Action Levels are not explained in the context of the rationale presented. The ES should include this information. In addition, data is only presented for the two datasets noted above, whereas Figure 2-6 indicates that data is available for the nearshore area. The data is also noted to date from 2013. The ES should ensure that data relied upon for the assessment of effects is both relevant and up to date.	An explanation regarding the use of Cefas Action Levels is provided in section 8.4.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Site specific data is included in **Volume 7, Appendix 9-3 Benthic Ecology Monitoring Report (application ref: 7.9.9.3)**.
Environment Agency Scoping Response 23/08/2022	
Do you agree with the characterisation of the existing environment? Broadly yes. The characterisation here is at a very high level, which is understandable for these early stages of planning, although there are some areas that we would comment on: Cliff recession: We note that linear extrapolation of averaged recession rates is used to provide indicative recession distances over the next 60 years, albeit with an accompanying caveat that future rates may be higher. We would encourage a most robust approach to forecasting future trends within the Environmental Statement in order to consider the reasonable worst case scenario at the potential landfall locations. The Environment Agency is currently funding a research project examining projections of future cliff recession rates and the application of regionally specific multipliers to account for accelerated erosion due to climate change, which could be useful for this work (unless similar bespoke work is planned).	Predictions of cliff erosion rates have been made using empirical equations in section 8.6.2 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. The suitability of the outputs of the Environment Agency funded research project to the Skipsea coastline was discussed during a marine physical processes ETG (held on 20th January 2023) and it was agreed that the use of the SCAPE modelling tool would not be suitable over the timeframe of the DBS Projects.
Do you agree with the approach to data collection? Yes.	Noted.
Have all the potential impacts on the marine physical processes resulting from the Projects been identified in the Scoping Report? Largely, yes. Could construction activities / any structures remaining during the operational period result in changes to physical processes, or scour/erosion, in inshore and intertidal areas in the vicinity of the landfall area? It may be necessary to scope in the risk of localised or temporary changes at this stage	Scour around foundations during the operational phase is assessed in section 8.7.4.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. The effect on physical processes will incrementally increase as the wind farms are constructed with the greatest potential impacts resulting from the completed

Comment	Project Response
because the different assessments (Environmental Impact Assessment (EIA) / Habitat Regulations Assessment / Water Environment Regulations assessment) will require impacts to be assessed at different scales.	wind farms. These impacts are therefore covered under operational effects, and are scoped out of further consideration in relation to the construction phase. Changes in the marine physical environment due to installation of trenchless crossing exit pits are scoped in to the construction phase (see sections 8.7.3.4 and 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**).
Do you agree with the impacts which have been scoped in (or scoped out) of further assessment? Largely yes, but we question the decision to scope out the potential for impacts on bedload sediment transport and seabed morphological change during construction. Until a final design is agreed on, we would consider there to be a risk that the construction of landfall infrastructure could impact on coastal processes and geomorphology (e.g. if coffer dams are required). We therefore suggest that this should be scoped in.	An assessment of changes to sediment transport processes at the landfall is provided in sections 8.7.3.4 and 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Do you agree with the proposed approach to assessment? Yes, although having not had the opportunity to review the modelling and assessment work undertaken for all the offshore wind farms mentioned, we are unable at this time to comment on how appropriate it is to re-use this work for this project. In particular, we are keen to ensure that modelling and assessment relating to coastal processes and geomorphology impacts at the landfall locations is appropriate for the specific frontage(s) selected, which may differ from previous offshore wind projects. The assessment should show that the development will not have a negative impact on coastal processes and should consider the impact now and in the future. It will also need to consider the implications of coastal change and flood risk on the development, as well as from the development. The Shoreline Management Plan (SMP) should form the basis for the assessment. If further coastal interventions or mitigation is required, this should be in line with the SMP. It should be noted that some SMP Policy Units contain different options over the epochs included. In such cases, the approach will need to be justified. Where interventions are required / possible, the assessment should set out the requirements and dependencies. Where existing flood or coastal risk management assets exist, we would wish to see that the interests of the relevant management authority are protected. For example, access for operational or maintenance purposes. We may seek legal agreements to protect the interests of the Environment Agency, where appropriate.	An assessment of changes to sediment transport processes at the landfall (and associated implications for coastal processes) is provided in sections 8.7.3.4 and 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. The assessment has considered implications for coastal change and flood risk in line with the SMP as outlined in sections 8.5.15 and 8.6 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Project and site specific marine physical processes modelling has been undertaken for the ES, see **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**.
Cumulative Impacts Assessment: We welcome the acknowledgement of a cumulative impacts assessment to be undertaken as part of the final EIA with an offshore focus. A number of similar projects have been completed in recent years, as well as other similar schemes currently being advanced. However, we are not clear if the offshore focus overlooks activities/impacts in the Humber.	Impacts in the Humber have been considered in section 8.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
The SMP (2010) Flamborough Head to Gibraltar Point identifies policy units based on the intended management approach to the shoreline. In brief, large areas of the coastline are undefended, and natural erosion will occur. This section of the coast has some of the fastest rates of erosion in Europe.	An assessment of coastal erosion has been undertaken (section 8.5.15 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) which considers historic monitoring of coastal retreat undertaken by East Rising of Yorkshire Council

Comment	Project Response
If a landfall option is chosen within the undefended sections of the SMP, the applicant should consider the implications of this on their infrastructure over its lifetime. Please note that coastal erosion is often unpredictable and non-linear (as per para. 144). The assessment should consider the uncertainties and be precautionary. Coastal erosion advice is contained within the Planning Practice Guidance and also the relevant National Policy Statements. We recommend that as part of your assessment you consider a range associated with coastal erosion. The National Coastal Erosion Risk Mapping (https://data.gov.uk/dataset/7564fcf7-2dd2-4878-bfb9-11c5cf971cf9/national-coastal-erosion-risk-mapping-ncerm-national-2018-2021) may be of relevance to your assessment."	and the National Coastal Erosion Risk Mapping (NCERM) risk mapping. These data have been compared to predicted rates of cliff retreat in section 8.6.2 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** to highlight the range and uncertainty in rates depending on the tools used for predictions.
The assessment may need to use other sediment quality guidance in addition to Cefas Action Levels.	Additional assessment has been undertaken within the ES to include use of OSPAR sediment guidelines (see section 8.4.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**).
Water Framework Directive Water Bodies – various additional water bodies to be included.	Water Framework Directive (WFD) water bodies were identified purely to inform the water quality baseline for this topic. **Volume 7, Appendix 20-3 - Water Environment Regulations Compliance Assessment (application ref: 7.20.20.3)** includes rationale for water bodies identified to be at risk and considers all WFD compliance parameters, not just water quality.
Historic England Scoping Response 23/08/2022	
Section 2.1 (Marine Physical Processes) – it is our advice that changes, as proposed by this project arising from 'construction' should be considered as likely to give rise to significant impacts on seabed features and morphology. In reference to the explanation provided about mitigation (section 1.7.2.4) it is a relevant matter that the applicant demonstrates a "commitment" to conduct geophysical, geotechnical survey and other seabed intrusive investigations, as part of the preparation of any Environmental Statement (ES) produced for this proposed project.	A full characterisation of the existing environment (based on site specific surveys undertaken for the Projects) is detailed in section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Natural England Scoping Response 23/08/2022	
Existing Environment. We advise that baseline information on the following; regional solid geology, regional Quaternary geology, bedform mapping, seabed mobility, sediment transport rates and pathways, site-specific geotechnical data, coastal cells and sub-cells should be taken into consideration in the ES to provide environmental context.	Noted. These have been considered in sections 8.5.1, 8.5.2, 8.5.3, 8.5.7, 8.5.8, 8.5.12 and 8.5.13 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and updated with Project-specific survey data for the ES.
We advise the Applicant considers surge water levels.	Extreme water levels have not been considered as trenchless techniques such as HDD would be used at the landfall location. This means the cables will pass below the cliff and will not be influenced by surges. Offshore, storm surges were included for consideration in **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**.
It is noted that at the proposed landfall locations close to Skipsea, there is regional net sediment transport predominantly to the south. The presence of any temporary infrastructure in the nearshore zone, such as access ramps or cofferdams, may interfere with the longshore transport of material along	Baseline coastal sediment transport processes have been assessed in section 8.5.15 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and potential changes to these processes due to construction at the landfall are

Comment	Project Response
the coastline. Longshore transport rates and directions at the landfall/in the nearshore zone should, therefore, be considered and assessed, to determine if there if there is the potential for the development and associated infrastructure to interact with the coast. And any mitigation measures that may be required.	considered in section 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Coastal Erosion. There are no site-specific data for the proposed landfall locations at Skipsea. This is an undefended stretch of coast which experiences high rates of cliff erosion, including episodic events of high cliff retreat. The evolution of the coast at landfall and implications to longshore sediment transportation will need to be taken into account for the lifetime of the development, this is particularly important to cable burial and siting of jointing bay infrastructure and maintaining designated site features further south. We would advise that site-specific cliff height, cliff erosion data and shore platform down wearing data be included in the baseline characterisation for the landfall environment. Cliff erosion data and beach profile data are available from East Riding of Yorkshire Council (ERYC). We would also advise that the Applicant considers how the coast at landfall will alter throughout the lifetime of the development, both in terms of vertical change in beach profile and coastal retreat and the changes this has on longshore sediment transport.	Trenchless installation techniques, such as HDD, will be used at the landfall. This means the cables will pass beneath the cliff system emerging on the onshore side of the cliff top. Historical and future coastal (cliff and shore platform) erosion rates have been considered (see sections 8.6 and 8.5.16 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) in relation to the onshore entrance pit. The location of the offshore exit pit is to be determined but may be within the intertidal zone. Changes to coastal processes during the lifetime of the Projects have been considered in section 8.7.4.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
There are other existing primary data which the Applicant should consider in the baseline environment characterisation, such as: bedform distribution across the study area, seabed mobility, sediment transport pathways, littoral sub-cell boundaries, and any available site specific geotechnical data. This may be in the form of existing data from other OWF projects including those that are operational where appropriate.	Project-specific bathymetric survey data have been used to characterise the seabed and identify bedforms and sediment mobility. Site-specific geotechnical data have been assessed in section 8.5.2 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Tidal ellipse data has been acquired, with analysis provided in section 8.5.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Analysis of seabed mobility within the offshore development area is provided in section 8.5.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
The Cefas suspended sediment concentration data are now old (i.e. 1998-2015). NE best practice advises that, as a general benchmark, care should be taken when considering datasets which are older than five years. Ideally, simultaneous records of SSC, water levels, currents and waves should be obtained to help form a better understanding of the process controls on sediment mobilisation events and subsequent transport across the project study area.	Two wave buoys have been deployed for the Projects, one in DBS East and one in DBS West. These wave buoys include downward facing Acoustic Doppler Current Profilers (ADCPs) that measure current speed and direction. Wave results from these buoys are provided in section 8.5.6 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. The Applicants note Natural England's comment regarding the age of the Cefas sediment concentration datasets. However the Applicants believe these datasets remain value in the characterisation of the existing suspended sediment concentration regime in the region, and have been used (in conjunction with other source) to establish the baseline environment. Additional datasets have been utilised in the characterisation of sediment mobility and mobilisation events, see section 8.5.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** for further details.
We advise that a baseline understanding of Smithic Bank needs to be established in order to understand the potential impact of the Dogger Bank South cable installation, cable repair/replacement, and cable protection alone, or in-combination with other developments.	Available information from Smithic Bank is provided in sections 8.5.1 and 8.5.7 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. It is also

Comment	Project Response
	considered as a key receptor in the impact assessment in section 8.7.3.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Other data sources. Bathymetric data/comparative studies are available as follows: • Brew and Cooper (2022); • Ørsted (2022); and • Pye et al. (2015).	Noted, these have been considered where relevant through of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Other impacts due to construction activities at landfall may include the use of a temporary beach access ramp, construction vehicle/plant traffic across the beach, ancillary infrastructure (e.g. cofferdams) and seabed excavation within shallow nearshore areas. We advise that these potential impacts on the local wave regime and/or coastal morphology may also need to be considered by the Applicant. It would also be appropriate to consider adoption of successful landfall operations undertaken by other OWF developers along this coast.	Trenchless installation techniques, such as HDD, are used at the landfall. This will require an entrance (landward) and exit (seaward) pit. The worst case assumes the exit pit are in the intertidal area. This has been considered in the impact assessment in sections 8.7.3.9 and 8.7.4.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Impacts on seabed morphology due to indentations on the seabed from installation vessels have been scoped out of further consideration. Until site-specific evidence of the subseabed conditions becomes available, there exists the potential for anchoring or jack-up vessel legs to penetrate the seabed, cause scour/secondary scour, and to impact the morphology and features of the seabed both during both construction and operation. We advise that this impact be scoped in for construction and operation/maintenance vessels until further evidence becomes available on the nature of the seabed and its mobility.	Indentations on the seabed due to installation vessels are assessed in section 8.7.3.10 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Scour at each foundation. Consider modelling of scour around foundations, evaluating scour potential and thus, scour protection requirements. Consider including a seabed sediment mobility study.	Scour around foundations has been based on empirical data, and existing 'generic' modelling that has been carried out. A seabed mobility study has been undertaken and has been incorporated into the final assessment.
Flamborough Front. We advise that careful consideration should be given to potential enhanced mixing of the water column due to the Dogger Bank South arrays both alone, and in-combination, with the other Dogger Bank OWF developments. Baseline characterisation surveys should include the natural cycle of water column stratification, biogeochemical fluxes, and primary productivity. The Applicant should also consider turbine spacing and potential wake-wake interactions. This should also be considered in the Outline Monitoring Plan.	The effects on the Flamborough Front are assessed in section 8.7.4.3 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. At a minimum turbine spacing of 830m, the potential for wake-wake effects is considered low.
Cumulative impacts of cable installation and cable repair/replacement/protection due to multiple developments making landfall across Smithic bank. We advise that this needs to be assessed.	This has been assessed in section 8.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Effects on bedload sediment transport and changes to seabed morphology –Construction. Seabed morphology should be scoped in.	This has been scoped in and is assessed in sections 8.7.3.6, 8.7.3.7, 8.7.4.8 and 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.

Comment	Project Response
Effects on bedload sediment transport and changes to seabed morphology – Decommissioning	This has been scoped in and is assumed to be comparable to effects during construction which is assessed in sections 8.7.3.6, 8.7.3.7, 8.7.4.8 and 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Impacts on waves and tidal currents for construction/decommissioning. These impacts be scoped in for the nearshore zone and landfall.	Any changes to waves/tidal current flows at the landfall due to temporary infrastructure would manifest as temporary changes to sediment transport, which is assessed in section 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Impacts on seabed morphology due to indentations on the seabed from installation vessels. This impact should be scoped in for construction and operation, until there is a better understanding of the sub-seabed conditions.	Indentations on the seabed due to installation vessels have now been scoped in and are assessed in section 8.7.3.10 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Use of numerical modelling from other OWF projects. It will need to be robustly demonstrated why/how numerical data designed for other projects are directly relevant, and directly applicable, to Dogger Bank South. Moreover, the Applicant will also need to consider and provide evidence of the cumulative effect of Dogger Bank South and other nearby OWFs, on the hydrodynamic regime.	Project and site specific marine physical processes modelling has been undertaken for the ES, see **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**. The cumulative effect of DBS and other projects on the hydrodynamic regime is assessed within section 8.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Lifetime of the project. Need to consider all stages of the development lifespan. This includes consideration of the potential impacts resulting from any infrastructure that may remain in situ after decommissioning.	Noted. This is considered in section 8.7.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Receptors The list of receptors proposed for inclusion in the assessment does not include the following: • Holderness Coast (morphological feature); • Flamborough Front (water column feature); • Seabed sedimentary features such as The Hills; • Geological SSSIs along the Holderness Coast; and • More distant receptors such as Spurn Head, Humber Estuary etc.	These have been considered as receptors as outlined in section 8.7.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. The location of seabed sedimentary features such as "The Hills" relative to the Projects is detailed in section 8.5.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Increases in suspended sediment concentrations (SSC) during construction and operation (e.g. future dredging works) have the potential to smother sensitive habitats. The ES should include information on the sediment quality and potential for any effects on water quality through suspension of contaminated sediments. The EIA should also consider whether increased suspended sediment concentrations resulting are likely to impact upon the interest features and supporting habitats of the designated sites as listed above.	Increases in suspended sediment concentrations are considered in sections 8.7.3 and 8.7.4 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Project specific data have been used to inform the assessment in the chapter. Information regarding sediment quality is provided in section 8.5.10 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**, with potential effects on water quality assessed in section 8.7.3.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.

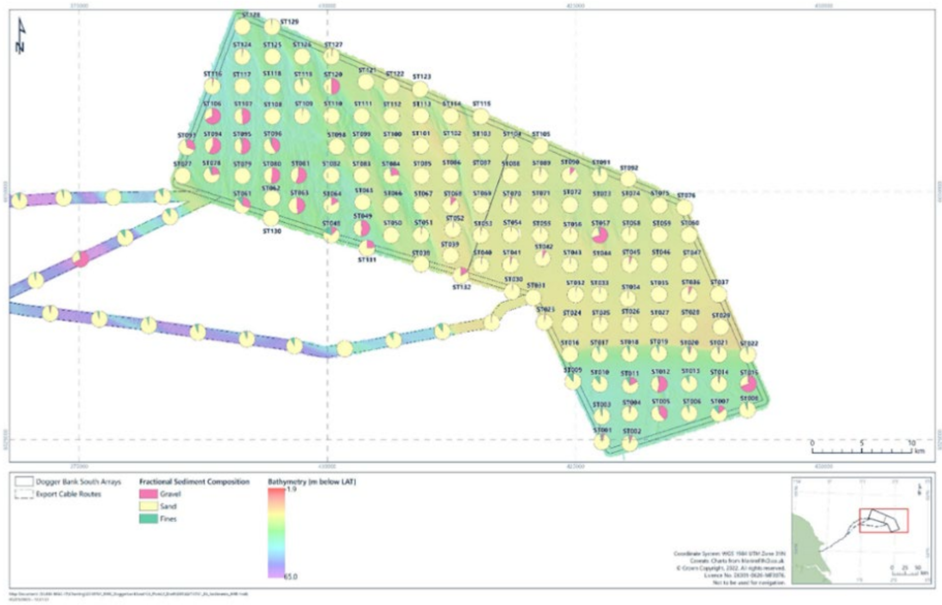
Comment	Project Response
The ES should consider whether there will be an increase in the pollution risk as a result of the construction or operation of the development.	**Volume 8, Outline Project Environmental Management Plan (application ref: 8.21)**, included with this application, details the potential sources and types of accidental pollution for all Project phases.
For activities in the marine environment up to 1 nautical mile out at sea, a Water Framework Directive (WFD) assessment is required as part of any application. The ES should draw upon and report on the WFD assessment considering the impact the proposed activity may have on the immediate water body and any linked water bodies.	A full Water Environment Regulations Compliance Assessment is provided in **Volume 7, Appendix 20-3 (application ref: 7.20.20.3)**.
Natural England Responses to Marine Physical Processes Method Statement 13/01/2023[1]	
Clarification on current design parameters	
NE1 - Could 200 15MW monopiles (11m diameter) be installed as well as 95 31.5MW monopiles (17m diameter)? Making a total of 295 turbines (within 300 originally proposed) or is this an either or option?	No, the maximum number of turbines that could be installed across the two Projects is 200 turbines, the number will be lower if larger turbines are used.
NE2 - Are Jacket foundation turbines still within the current design parameters?	Yes, jacket foundations are still being considered within the current project design envelope.
Limitations of the models	
NE3 - Jacket foundations are not considered in the models and therefore the effect of this type of foundation can't accurately be predicted (different size and design to monopile and gravity bases considered in the model to date).	Operational models were run for the worst case scenario, which was and still is gravity base structures (GBS). The worst case for construction is monopiles, therefore the construction models are representative of the construction worst case for the DBS projects which is monopiles.
NE4 - Whilst the model used 12m wide monopiles which is comparable to the smaller 11m monopiles proposed as one option within Dogger Bank South (DBS), Natural England do not believe the model can be used to accurately predict the effect of larger 17m monopile (32.5MW). These would displace double the volume of sediment, so if they are to be considered within the project design envelope additional modelling or justification would be required.	It is agreed that larger 17m monopiles would generate larger volumes of suspended sediment, and so a 12m monopile simulation would not be comparable. However, the worst case drill arising volume from a 12m monopile was 6220m^3 for Creyke Beck and the modelling undertaken assumed 24 monopiles were installed over a 30 day period resulting in a total volume of sediment released of 149,280m^3. The worst case drill arisings for 17m monopiles at DBS is 17,813m^3. However, a maximum of 5% of monopiles will be drilled, therefore if 95 x 17m monopiles are installed, the worst case volume of sediment released would be 84,611m^3 which is lower than the modelled volume for Creyke Beck. The modelling for Creyke Beck is therefore conservative when compared to the worst case volumes of sediment potentially released during construction of DBS.

[1] Note that the following responses were provided in relation to the Applicants previous proposal to not conduct site-specific modelling for the assessment.

<table>
<tr><th>Comment</th><th>Project Response</th></tr>
<tr><td>NE5 - The Dogger Bank A&B sediment dispersal model does not account for coarser sediment types (present in DBS). Whilst these are unlikely to travel any further than mud or sand, the distance they do travel and thickness in which they are deposited are important factors to consider for other receptors.</td><td>Conceptually the coarser sediment would not travel far from the point of release. These components were not modelled numerically, but impact can be based on a conceptual assessment. Site specific Particle Size Distribution (PSD) information is presented in section 8.5.3 of Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8), and has been used to inform the assessment in section 8.7 of Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8).</td></tr>
<tr><td>NE6 - It is not possible to show locations where sediment dispersal and deposition might occur from the installation of turbines within DBS array areas. This will be important when predicting impact on more sensitive habitats.</td><td>It will not be possible to show precise dispersion footprints and deposition locations, but the general distribution of sediment modelled from the previous wind farms can be used to map conceptually where sediment is likely to go and where it is likely to deposit because the driving processes are similar to DBS. However, following the decision to undertake site specific modelling for the Projects, tidal currents were simulated across the Offshore Development Area using a two-dimensional hydrodynamic model (see Volume 7, Appendix 8-3 (application ref: 7.8.8.3) for the full technical report).</td></tr>
<tr><td>NE7 - The area close to Smithic bank is not covered by the model and is an area of significant concern. Natural England would like to see sediment dispersal and wave / hydrodynamic data in this area.</td><td>This has been looked at conceptually because the use of sediment dispersal and hydrodynamic modelling is considered disproportionate to the potential impacts from cable infrastructure that will be predominantly buried, and at worse, sit proud of the seabed by a maximum of 1.4m over short lengths. The location of Smithic Bank in relation to the offshore export cable corridor and the potential construction and operational impacts will also be assessed using project-specific bathymetric survey data.</td></tr>
<tr><td>NE8 - Due to longer lifespan of the projects and a general pattern of increased storms around the coast of the UK, Natural England advise that 1 in 50 year storm event (if not a 1 in 100year storm event) should be considered in the operational modelled data (wave and hydrodynamics).</td><td>The cable at the landfall will be installed using HDD and so there will be no impact on coastal processes during a storm of any magnitude or during typical conditions. The array is a long distance offshore and will have no impact on coastal processes. A 1 in 50-year storm was modelled previously and the impact was less than for a one-year event (see Table 1-2 below). So, a 1 in 100-year event will also be less. The one-year event is the worst case.

Table 1-2 Return periods used in Creyke Beck A & B models
<table>
<tr><th>Return Period</th><th>Wind Speed (m/s)</th><th>Wave Height (m)</th><th>Wave Period (s)</th><th>Wave Direction (North°)</th><th>Water Level (m, mean sea level)</th></tr>
<tr><td rowspan="2">One-year</td><td>21.5</td><td>7.3</td><td>12.1</td><td>0</td><td>-1.6</td></tr>
<tr><td>19.0</td><td>5</td><td>10.4</td><td>60</td><td>-1.6</td></tr>
<tr><td rowspan="2">50-year</td><td>26.6</td><td>11.5</td><td>15</td><td>0</td><td>-1.6</td></tr>
<tr><td>24.1</td><td>7.5</td><td>12.2</td><td>60</td><td>-1.6</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Comment</th><th>Project Response</th></tr>
<tr><td>NE9 - The wave and hydrodynamic model has not considered the influence of export cables (or array cables) owning to the fact they will be buried or only protrude a small height. Given that shallower depths across the cable route and array area these small protrusions could still be a significant proposition of the water column (in areas less than 10m) and therefore affect wave and hydrodynamics and should to be considered in more detail.</td><td>At this stage of the Projects, it is anticipated much of the export cable in areas less than 10m water depth will be buried and so there is limited requirement for cable protection measures to be required. Engineering work will determine this requirement as the Projects progress. Any changes in wave or tidal regimes caused by upstanding cable protection will manifest as an impact on bedload sediment transport in the nearshore zone. This has been considered as an impact in section 8.7.4.5 of Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8).</td></tr>
<tr><td>NE10 - The sediment dispersal model only considers a situation where one monopile is installed per day for 24 days (with one day of concurrent piling). Will this be true for DBS or could concurrent piling occur more frequently? If so the impact this will have on the modelled data should be shown.</td><td>There is potential for three piles to be installed concurrently across the Offshore Development Area. Project-specific sediment dispersion rates from turbine foundation installation have been calculated in Volume 7, Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3).</td></tr>
<tr><td>NE11 - No frontal data / models are currently considered. Due to increased number and size of windfarm arrays research is starting to show an impact on frontal systems and primary protection.</td><td>Potential impacts on the Flamborough Front and primary productivity are assessed in section 8.7.4.3 of Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8).</td></tr>
<tr><td colspan="2"><u>Differences between Creyke Beck and DBS array areas</u></td></tr>
<tr><td>NE12 - Whilst the depth of the two sites (Dogger Bank A&B and DBS) are similar when averaged, the topography is quite different. DBS is on the slope boundary of Dogger Bank so deeper and shallower depths are both expected. Has any consideration to the effect of this on sediment dispersal, wave height or wave shadow effect been completed.</td><td>A comparison between the bathymetry of the two sites is given in Table 1-3 below. Site specific tidal ellipse data is detailed in section 8.5.5 of Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8).
Table 1-3 Comparison of seabed elevation between DBS and other Dogger Bank Projects
<table>
<tr><th>Wind Farm</th><th>Maximum (m LAT)</th><th>Minimum (m LAT)</th><th>Average (m LAT)</th></tr>
<tr><td>Dogger Bank South (West)</td><td>-38</td><td>-12.5</td><td>-26</td></tr>
<tr><td>Dogger Bank South (East)</td><td>-35</td><td>-10.5</td><td>-20</td></tr>
<tr><td>Dogger Bank A</td><td>-32</td><td>-13.5</td><td>-22.5</td></tr>
<tr><td>Dogger Bank B</td><td>-34</td><td>-14.5</td><td>-25.5</td></tr>
<tr><td>Dogger Bank C</td><td>-35</td><td>-19</td><td>-25</td></tr>
<tr><td>Dogger Bank Sofia</td><td>-35</td><td>-18</td><td>-26.5</td></tr>
</table></td></tr>
<tr><td>NE13 - From current habitat maps DBS is shown to have patches of more coarse sediments. Natural England would like to see the recent geophysical survey data to confirm sediment types across the site before confirming if the modelled data is sufficient. If more coarse sediment has been found then additional data on dispersal distances and thickness of these sediments many be required for these coarser sediment types.</td><td>The results of benthic sampling and particle size analysis have recently been completed. The type and distribution of sediment is given in Figure 1 below. this data has been fully incorporated throughout the assessment in the chapter.</td></tr>
</table>

Comment	Project Response
	Figure 1 Seabed sediment composition within DBS array areas 
Environment Agency Responses to Marine Physical Processes Method Statement 16/01/2023[2]	
EA1 - Lessons learnt. The first scheme was apparently an overall success, it would be good to know that whatever issues arose during construction of the previous phases have been incorporated into the working understanding of the construction of the future works.	The DBA and DBB projects are in early phases of construction and therefore no post-construction monitoring reports were available to inform the assessment for DBS offshore wind farms.
EA2 - The summary report states that the proposed scheme is similar in sediment characteristics to the previous. How has this been investigated and characterised? Where there grab samples, boreholes showing the shallow strata, etc, that show what the bed and near bed sediment is made up of and how the two areas compare?	The comparison of sediment across the sites was based on bespoke sediment samples collected for the previous sites and overview data for DBS from the BGS archive. The results from site-specific benthic surveys and particle size analyses undertaken in 2022 have recently become available and the results are briefly summarised below in Table 1-4 and shown in Figure 1 and Figure 2. Based on this new data, we concluded that the seabed sediment composition is comparable between DBS and Dogger Bank A&B.

[2] Note that the following responses were provided in relation to the Applicants previous proposal to not conduct site-specific modelling for the assessment.

Comment	Project Response
	Figure 2 Location of sediment samples acquired for the Dogger Bank Projects

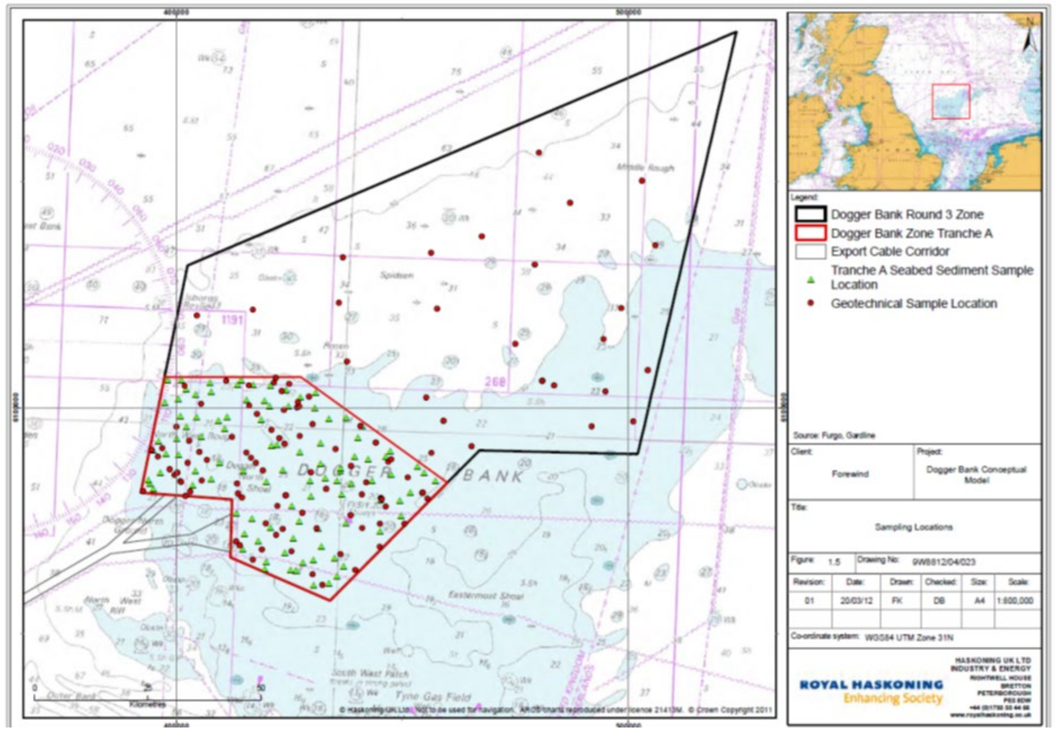
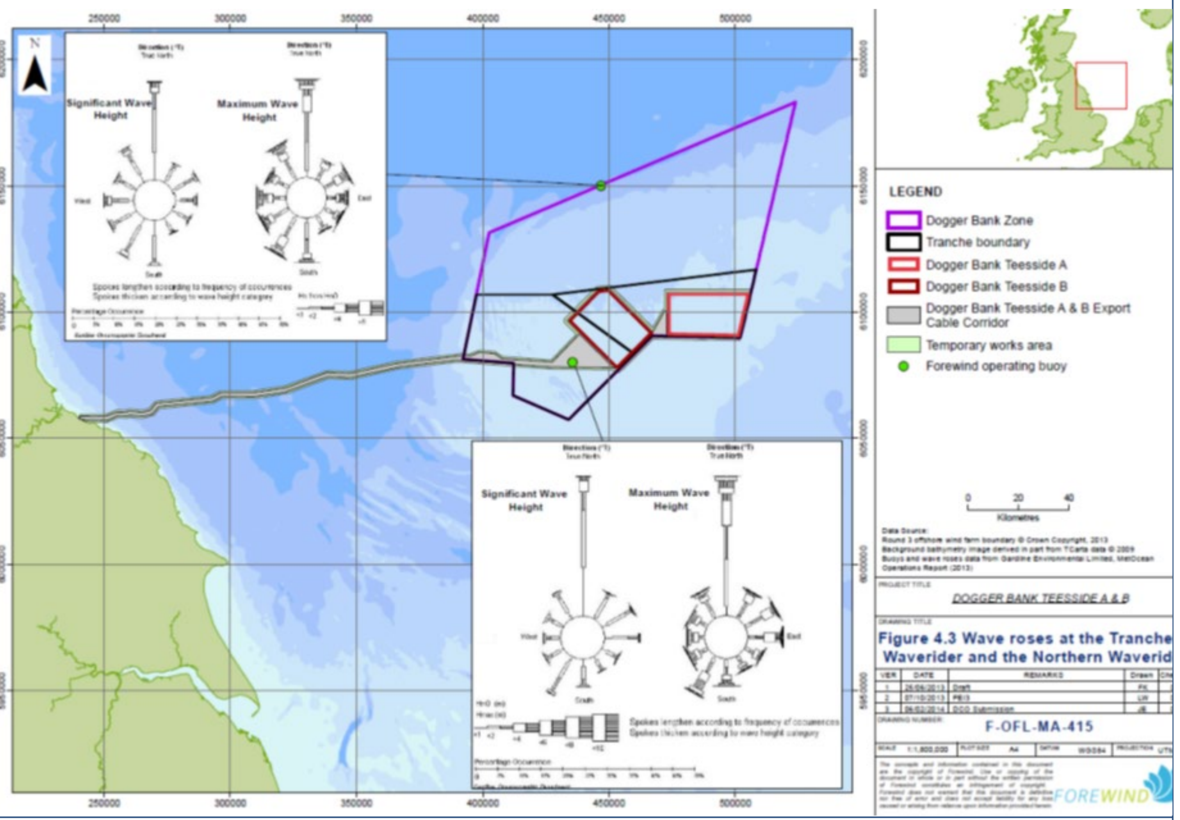


Table 1-4 Comparisons in sediment composition between DBS and other Dogger Bank Projects

DBS	Other Dogger Bank Projects
'Sand', which typified 136 stations	Sand, slightly gravelly sand and gravelly sand represent 86% of the array areas. Mud content is <5% and gravel content is <5%.
'Sandy gravel', which typified 16 stations	
'Gravelly sand', which typified 11 stations	
'Muddy sand', which typified 6 stations	Mixed sediment covers 4% of the array areas
'Muddy sandy gravel', which typified 6 stations	
'Gravelly muddy sand', which typified 3 stations	

Comment	Project Response	
	'Gravel', which typified 1 station	Gravel covers 7% of the array areas.
EA3 - It would be beneficial to see evidence that the baseline conditions inputted to the original model are still valid. For example are there any post construction modelling reports from the existing windfarms to support the conclusion that the model outputs are still valid and the baseline has not significantly altered?	There is no post-construction monitoring available. It is assumed that the baseline as adopted in 2014 will be similar to the baseline in 2023, given changes to tidal currents and waves due to climate change over 10 years will be insignificant.	
EA4 - Whether the original model included any assessment about the impacts of scour protection.	The original model assumed no scour protection to provide the worst-case scenario for sediment release due to scour.	
EA5 - Whether the impacts considered from the operation of the windfarm also modelled the impacts for the lifetime of the project, would any factors such as wind direction, sea level rise change throughout the operational period and if so what would the impacts be?	The impacts of climate change (wind direction and sea-level rise) on offshore wave climate have been deemed minimal by IPCC models and research. Hence, the impacts modelled for the current situation would be equally applicable for the situation at the end of the life of the wind farm.	
EA6 - The modelling was carried out in 2014 so has not incorporated the climate change projections from UKCIP18. Despite the fact that presumably North Sea storms moving south and being funnelled into the Dover Straight could lead to significant surges, which could impact the project.	A 1 in 50-year storm was modelled previously and the impact was less than for a one-year event. Hence, the one-year event is the worst case and any increase in storm frequency would not affect this conclusion.	
EA7 - What wave data was used as an input to the model, was it locally derived data from the coastal monitoring data? How long was the data set? Given that the model was carried out in 2014 it there are 8 years of data that has not been incorporated. Was the dataset which was used in the previous model is so large that the most recent 8 years of data aren't statistically significant?	The wave model was calibrated against the three largest events that were recorded by two bespoke waveriders on Dogger Bank. The data used in the models was captured up to the end of October 2011 (see Figure 4 below). Wave data was acquired in the DBS Array Areas, providing data for the year 2022/2023. The Hornsea wave buoy has been operational since 2008 but its location close to the coast and in much shallower water would mean it is not a suitable analogue. The new data will be analysed and compared against the input parameters for the previous model to test the continued applicability of the wave heights used.	

Comment	Project Response
	Figure 3 Wave data acquired for other Dogger Bank Projects 
EA8 - Going back to the waves, the 1 in 1 year storm wave was used as a worst case for the construction phase. How do we know that the last 8 years of data haven't had an effect on our understanding of a 1:1 year storm? Could Haskoning tell us the wave which was input into the model for 1:1 year storm and what the 1:1 year storm level would be if they calculated it today with the most recent data. That would enable us to make a judgement if we think that there is a significant difference in the input waves with the extra 8 years of wave data.	See reply to previous comment on wave inputs above and Table 1-2.
EA9 - The previous sites are further offshore and the proposed are in a group inshore. Is the bathymetry of the two areas broadly similar, or are the proposed sites shallower because they are closer to the shoreline?	See reply to previous comment on bathymetry comparison above and Table 1-3.
EA10 - Cable corridor / landfall infrastructure: we understand that the cable is likely to pass under the beach and cliff via HDD. We would welcome additional clarity on this element of the project, e.g. proposed depth beneath the beach (ideally compared with the active beach envelope to account for drawdown) and distance of the exit pit from the clifftop (preferably considering rates of cliff retreat over the duration of the project's operational phase).	Further detail on the Projects design at landfall is provided in **Volume 7, Chapter 5 Project Description (application ref: 7.5)**.
EA11 - Additionally, we would encourage submission of a clear plan around decommissioning to help with understanding of the likelihood of any residual impacts to coastal processes resulting from	Design details are being confirmed and will be shared when the information is available.

Comment	Project Response
structures remaining in situ. Our preference would be for structures with the potential to interact with coastal processes to be removed at decommissioning.	
PEIR Consultation, Natural England 17/07/2023	
"Based our experience of sustainable development impacts within the Dogger Bank sandbank and wider Northern North Sea, Natural England wishes to highlight the importance of marine physical processes in maintaining balanced coastal and marine ecosystems. Therefore, we advise that changes in marine physical processes are highly likely to have critical cross-cutting impacts across all thematic areas, with potential changes in marine physical processes impacting on benthic SAC/MCZ interest features and supporting habitats and prey availability for mobile Marine Protected Area interest features. Provide robust project and site specific modelling validated where possible from empirical evidence from adjacent windfarms and cables."	Project and site specific marine physical processes modelling has been undertaken, see **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**.
"The marine physical environment baseline is incomplete. Natural England therefore cannot agree with the conclusions of the PEIR at this time. Provide a robust baseline characterisation using site specific data and including the latest modelling results."	The marine physical environment baseline (section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) has been updated to include site specific survey data, the outputs of numerical modelling undertaken to support the ES (see **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**) and updated information and data shared through the consultation process.
"Changes to the Flamborough Front. We advise that consideration should be given to how the interaction between the water flow, infrastructure on the seabed, and stratification for the worst-case scenario (WCS) array layout(s) over the lifetime of the project alone, and as part of a cluster of offshore wind farms (OWF) can be accurately predicted. This should be coupled with an assessment of associated changes to primary production."	Changes to water circulation (Flamborough Front) due to the Projects alone have been assessed in section 8.7.4.3 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Cumulative changes to the Flamborough Front due to the presence of the Projects alongside other offshore wind farms on Dogger Bank has been assessed in section 8.8.4 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Potential effects on primary productivity are covered in section 8.7.4.3.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"Cable installation across Smithic Bank. We advise avoiding cable installation (and cable protection) across Smithic Bank where possible to avoid / reduce the impact to the sandbank. If cable activity cannot be avoided, impacts should be reduced as much as possible. As has been conditioned on other projects, we advise that as a minimum, cable protection is not used within the 10m depth contour. Cumulative impacts due to cable installation (and cable repair, reburial, replacement and protection) for multiple developments should be assessed for the lifetime of the project."	The Offshore Export Cable Corridor (excluding the construction buffer) does not cross Smithic Bank as defined by JNCC or by the British Geological Survey (see section 8.5.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and **Volume 7, Figure 8-2 (application ref: 7.8.1)**). Due to the potential for Chalk bedrock to be present within cable burial depth in water depths <10m below LAT (see section 8.5.2 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**), there is potential cable protection may be required locally within the 10m depth contour. This has been assessed in section 8.7.4.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Cumulative effects from cable installation have been assessed in section 8.8.3 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.

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	Cumulative effects from cable repairs and reburial were not screened into the cumulative effects assessment as the effect occurs at discrete locations, for a limited time in duration.
Data gaps within the geophysical / geotechnical data for the export cable corridor (ECC), HVAC area and Array. Details of what bespoke modelling and geotechnical and geophysical data will be undertaken to fill evidence gaps and inform impact assessment, should be shared with the Expert Topic Group as soon as possible.	The marine physical environment baseline (section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) has been updated to include site specific geophysical and geotechnical survey data. The approach to marine physical processes numerical modelling was shared through the EPP with the Seabed Expert Topic Group.
The Cumulative Effects Assessment (CEA) does not include projects along the Holderness Coast and potentially within the Humber Estuary. The CEA should also include projects along the Holderness Coast and potentially within the Humber Estuary.	The cumulative effects assessment includes projects along the Holderness coast, including offshore wind farms and carbon capture and storage projects that make landfall along the coast. The Humber estuary as a morphological receptor is included as a receptor but is located 40km south of the landfall. The assessment of Projects alone effects did not identify far-field changes that extend 40km along the coast, therefore, projects within the Humber Estuary were not screened into the cumulative effects assessment.
Impacts on coastal processes and nearshore sediment pathways are likely to be key consenting risks for this project. It is important that these aspects are fully assessed and that there is sufficient time to fully explore options to ideally avoid, or if not mitigate the impacts prior to application.	The effect of changes to nearshore sediment transport pathways have been assessed in sections 8.7.3.4, 8.7.3.9 and 8.7.4.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. The results of these assessments have been shared through the EPP via the seabed Expert Topic Group to allow time to consider consultee feedback which has been incorporated into the design and mitigation options for the Projects as appropriate.
"Changes to coastal sediment pathways have the potential to significantly damage or destroy notified features of the Withow Gap, Skipsea SSSI. Natural England notes that the baseline data is incomplete and impacts are to be assessed once site specific data is included in the ES. Withow Gap, Skipsea SSSI should be considered as a receptor in the assessment of changes to Physical Marine Processes. Natural England advises that further engineering investigations which are currently being undertaken will be required pre-Application submission to assess the feasibility of any proposed mitigation measures for the Withow Gap Skipsea SSSI.	Withow Gap Skipsea SSSI has been included as a receptor for marine physical processes and is assessed in relation to changes in nearshore sediment transport pathways in sections 8.7.3.9 and 8.7.4.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
The project parameters for marine process receptors are clearly defined.	Noted with thanks.
The multi-build and operation scenarios make it difficult to fully assess the Worst Case Scenario (WCS) as presented. It is unclear what the implications might be to the marine physical environment in a sequential vs concurrent scenario. Clarification should be provided in the ES on each build out scenario, including implications to receptors, pathways, and impacts.	The multi-build construction scenarios have been defined in section 8.3.2 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and include the following: in-isolation, concurrent and sequential construction. Within the assessment of significance (section 8.7 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) for construction effects, the assessment of magnitude of impact and significance of effect has been separated into a "DBS East

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	and DBS West In-Isolation" which covers the in-isolation construction option only, and a "DBS East and DBS West Together" scenario which includes both concurrent and sequential construction options. Where the effects from concurrent and sequential construction are different, they have been separated out with further clarification provided on each option independently.
The EIA should include the WCS for scouring that may result from the proposed development. Provide WCS for scouring around foundations and cofferdams during construction, and around cable protection and foundations during operation.	Scour protection is included in the worst case scenario table (see Table 8-1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**). The footprint of the scour protection is based on predictions of the area of seabed likely to need protection and therefore impacted by scour. Cofferdams will no longer be installed during cable installation at the landfall.
We note that cliff recession rates and future cliff erosion have been considered and assessed. However, beach profile change/lowering has not. Beach profile change/lowering will need to be considered and assessed over the lifetime of the Project(s).	An assessment of beach platform lowering is outlined in section 8.5.16 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and shown on Plate 8-19.
Bedforms and significant seabed features have not been mapped. Clarity is needed on whether there are any sandbanks (other than Dogger Bank SAC) or sand wave fields within the study area that could be impacted by the Project. We request a map is provided showing seabed morphological features. Sandbanks and sand wave fields should be identified and impacts due to the project should be assessed.	Section 8.5.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated to include site specific bathymetry data which has been interpreted to identify seabed features such as sand wave fields, which is summarised in section 8.5.8 and shown on **Volume 7, Figure 8-6 (application ref: 7.8.1)**. Cross profiles showing bedform morphology are shown in Plate 8-16 and 8-17, with effects assessed in sections 8.7.3.3 and 8.7.3.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"Table 8-7, sections 8.5.4, 8.5.5 & 8.5.7 Several of the datasets used are more than 10 years old and there may be residual uncertainty regarding their precision or accuracy. NE Best Practice (Parker et al., 2022a) guidance advises that as a general benchmark, care should be taken when considering datasets which are older than five years. Therefore, we advise that up to date and project specific data should be used. We note that the British Geological Survey (BGS) have recently released MBES (Multi Beam Echo Sounding) surveys of the Holderness coast out to 10km which may be of use (https://nora.nerc.ac.uk/id/eprint/534206/)."	The recommendations outlined in the Natural England's Approach to Offshore Wind guidance document have been followed where possible. Table 8-7 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated to include site specific data acquired within the last 5 years. There are however data and information sources that are older than 5 years that have been used to inform the baseline environmental characterisation and assessment of significance. These data sets are used in situations when more recent data is unavailable, with a discussion of their accuracy and precision where necessary. An assessment of the British Geological Survey's fine-scale maps of seabed geomorphology Offshore Yorkshire have been included in section 8.5.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
We advise that seabed mobility across the study area should be assessed. Provide a map showing seabed mobility across the project and wider area.	Section 8.5.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated to include site specific bathymetry data which has been interpreted to identify seabed features such as sand wave fields. Section 8.5.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**provides a baseline characterisation of seabed mobility. **Volume 7, Figure 8-6 (application ref: 7.8.1)** shows the morphology and location of mobile seabed features.

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"8.4.2.1, 8.5.3 & 8.5.9 A site-specific geophysical survey and seabed grab sampling survey have been undertaken for the Projects. The results from particle size analysis (PSA) and sediment contaminants have been provided, however the geophysical survey data does not appear to have been provided and the Marine Processes baseline characterisation remains based on pre-existing data which may not be reliable. Therefore, the baseline presented at PEIR for marine physical environment is incomplete. We advise that the Marine Processes baseline is updated with the site-specific survey data."	The marine physical environment baseline (section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) has been updated to include site specific geophysical and geotechnical survey data, in addition to seabed grab sample and particle size analysis data.
"8.4.2.1 We note that Metocean data is currently being collected for the project, and data from March 2022 to date is included in the PEIR. The full dataset will be included in the final ES. The baseline is therefore currently incomplete. A robust baseline characterisation will be needed of the tidal behaviour (water levels and tidal currents), wind and wave climate, and sediment transport regime, both within and adjacent to the development site. This should be incorporated into the ES."	Section 8.5.6 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated to include updated metocean data acquired between March 2022 and May 2023. Sections 8.5.5 and 8.5.6 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** have been updated to incorporate the results of hydrodynamic and wave climate modelling undertaken to support the ES. Water levels from the nearest tidal gauge at Bridlington are included in section 8.5.4 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
8.5. Worst-case scenario estimates for the construction period indicate seven years in total. The MMO recommends commenting on the confidence in this and whether delays and (for example) a 10-year construction period would affect your assessments.	The seven-year construction estimate represents a worst-case timeline for sequential construction activities for DBS East and DBS West, see **Volume 7, Chapter 5 Project Description (application ref: 7.5)** for further discussion of construction timelines for the Projects.
"8.5.2 & 8.5.6 Natural England notes that geotechnical, geophysical and wave buoy survey work to complete this chapter will be included in the final application but we are concerned that there will be insufficient time to ensure all the impacts have been fully explored and assessed and mitigation measures adopted where required. We request that the compete baseline based on site specific data is provided with sufficient time to enable impacts to be assessed and any issues resolved."	The marine physical environment baseline (section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) has been updated to include site specific survey data which is used to inform the assessment of significance.
"8.5.8 / Points 82 & 83 The PEIR refers to: 'Two wave buoys being deployed, one in DBS East and one in DBS West. These wave buoys include downward facing Acoustic Doppler Current Profilers (ADCPs) that measure current speed and direction' with 'the full dataset being available in the ES'. Clarification is needed on whether the ADCP (Acoustic Doppler Current Profilers) backscatter will be used to infer Suspended Sediment Concentration (SSC) and if so, update the SSC dataset. Please provide clarification on whether the ADCP backscatter will be used to infer SSC and update the SSC dataset. "	Backscatter data was not collected by the wave buoy ADCPs, therefore the SSC was not updated by data collected by the ADCPs.
"8.5.7 / Point 81 It is stated that: 'there are no bedforms between Smithic Bank and the Holderness coast which suggests there is relatively little sediment exchange between Smithic Bank and the Holderness coast to the south	The baseline for coastal sediment transport is presented in section 8.5.15 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and includes a review of Pye and Blott (2015) which outlines sediment transport

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(and vice versa).' There is evidence of some exchange of material eroded from cliffs between Skipsea and Fraisthorpe which is transported along the beach, and offshore towards the southern and eastern parts of Smithic Bank (Pye et al 2015). Potential impacts to sediment exchange between the Holderness coast and Smithic Bank should be considered in the ES."	pathways south of Skipsea are to the south, away from Smithic Bank. Potential changes to sediment transport in the nearshore and coastal zone are assessed in sections 8.7.3.4, 8.7.3.9 and 8.7.4.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"8.5.7 / Points 79 & 80 The impact of Smithic Sands on sediment transport pathways is outlined in NE's scoping response. Natural England wishes to understand if / how the proposed cable route over the top of Smithic Sands might contribute to this impact. Natural England would also like to understand how this potential impact has been incorporated in the cliff erosion predictions in 8.5.15. We advise the Project to consider options to avoid impacts to Smithic Bank completely."	The offshore export cable corridor does not cross Smithic Bank as defined by JNCC or by the British Geological Survey (see section 8.5.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**). There is overlap between the construction buffer of the offshore export cable corridor and Smithic Bank as defined by JNCC. However, the Projects have committed to not deploying jack-up legs within Smithic Bank. Potential changes to sediment transport, and associated effects on cliff erosion, in the nearshore and coastal zone are assessed in section 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"8.7.1 Impact receptors have been presented in Table 8-21; however, they have not been identified on a map of the study area. Provide a map showing all receptors and/or include on Figure 8-2."	Impact receptors are shown on **Volume 7, Figure 8-13 (application ref: 7.8.1)**.
"8.7.3 We note that for the purposes of the PEIR, results of modelling and theoretical approaches from DB A, B, C and Sofia have been used as an analogue to assess the potential effects of the Projects on the identified receptors. Natural England has provided feedback on this approach previously (20 January 2023, highlighting notable differences between the physical environments of the proposed Project(s) and those of DB A, B, C and Sofia. However, we also note that bespoke numerical modelling of the Projects effects on the marine physical environment will be undertaken as part of the ES, which we welcome. We advise that output from the new bespoke numerical modelling is shared with the relevant stakeholders as soon as possible as part of the Evidence Plan Process. "	The approach to marine physical processes numerical modelling was shared through the EPP with the Seabed Expert Topic Group and is presented in **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**.
"8.7.5.1.2 / Point 224 The Zone of Potential Influence for tidal regime effects is based on an understanding of the [spring] tidal ellipses. We advise that a map is provided showing the spring tidal ellipse variations across the study area."	Tidal excursion ellipses are shown on **Volume 7, Figure 8-4 (application ref: 7.8.1)**.
"8.7.5.3 Daewel et al. (2022) studied ecosystem response to wind wakes due to large offshore wind farm clusters and provides evidence that the associated wind wakes in the North Sea provoke large-scale changes in annual primary production with local changes of up to +/- 10% not only at the OWF clusters, but also over a wider region."	Potential effects on primary productivity are covered in section 8.7.4.3.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**

Comment	Project Response
"The WCS presented for different impacts are considered to have the same magnitude of impact for DBS E or DBS W developed in isolation (i.e., one array), as for both DBS E and DBS W developed concurrently or sequentially (i.e., two arrays). Logically, the impact of two arrays on the marine physical environment must be twice that of one array. It would be helpful if the rationale behind these magnitude of impact conclusions could be provided. Clarify or provide further explanation of the assessment of magnitude of impact for the two development scenarios."	Further clarity has been provided in the assessment of significance (section 8.7 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) to distinguish between the effects from one Project being built in-isolation when compared to two Projects being built concurrently or sequentially. Further clarity is provided if the effects from any on particular Project built in isolation (e.g. DBS East or DBS West) are greater than if the other Project was built in isolation.
"Chapter 8 / section 5.4.4 In addition to the eight Offshore Substation/Converter/Collector Platforms, there may be a requirement for up to three other platforms either along the export cable or within one of the arrays. Hydrodynamic and sediment transport impacts due to the presence of platform foundations in the offshore export cable corridor (OECC) need to be identified and considered."	Marine physical processes modelling included a scenario where one platform was installed within the Offshore Export Cable Corridor (see **Volume 7, Appendix 8-3 (application ref: 7.8.8.3)**). The outputs of this modelling have been used to inform the assessment of significance in section 8.7 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"8.7.4.10.1 / Point 212 It is stated that if built non-concurrently, it is anticipated that there would be up to a two-year lag between the start of construction for the first project and the start of construction for the second project. If one array is partly constructed at the time the second is being constructed, then the EIA for the marine physical environment should include this scenario. Consider and demonstrate potential impacts that might arise in a sequential build scenario whereby one array is part-built and construction on the other then begins. It would also be good to understand how monitoring of impacts of such a build out scenario would be achieved to enable marine licence discharge."	The worst case scenario for operation impacts is when both arrays are complete and this has been assessed in section 8.7.4 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** as any effects will increase sequentially as more structures are installed. During construction, a maximum of two concurrent installations will be undertaken at a given time. Therefore, as any changes are temporally and spatially restricted there is no difference in magnitude of impact if one project is partially built when construction of the other commences, when compared to the in-isolation and together build scenarios, as a maximum of two installations would occur simultaneously in all scenarios.
"5.5.2 & 8.7.4.10.1 / Point 212 It is anticipated that up to four floatation pits per export cable may be required to be installed in shallow water. This could modify hydrodynamic conditions and in turn, give rise to morphological change. The WCS for floatation pit excavation should be presented and potential impacts to the hydrodynamic and sediment transport regimes should be assessed. Potential impacts to Holderness Inshore MCZ and sediment transport further down the coast will also need to be assessed."	Following further review of the potential construction methodology for the Projects, floatation pits have been removed from the Projects design envelope.
"Chapter 8 / Point 107 & Table 8-19 Representative Concentration Pathways (RCPs) are discussed in Point 107. However, in Table 8-19, these have been written as 'RPC'. This is because there are also 'Reactive Compensation Platforms' (RCPs). Please clarify in the text and Glossary."	The acronym has been corrected in Table 8-20 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and throughout the text.

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"Table 8-21 Withow Gap, Skipsea SSSI and Humber Estuary SSSI and Ramsar have not been included in the list of receptors in Table 8-21. Include Withow Gap SSSI and Humber Estuary SSSI & Ramsar in Table 8-21 and in the EIA."	The Withow Gap Skipsea SSSI is included as an impact receptor in Table 8-22 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**as it is designated for geological interest and is therefore a marine physical environment receptor. The Humber Estuary and its coastal geomorphological features are included as a receptor, but the Humber Estuary SSSI and Ramsar designated sites are not marine physical environment receptors and have therefore not been considered in this assessment. Potential impacts on the Humber Estuary SAC have been assessed in **Volume 6, Report to Inform Appropriate Assessment (application ref: 6.1)**.
"8.7.4 There is the potential for overlapping impacts on the marine physical environment due to different construction activities being carried out. Provide details of WCS for overlapping activities that might take place during construction e.g., sediment plumes, deposition footprints."	The construction schedule is presented in **Volume 7, Chapter 5 Project Description (application ref: 7.5)**. If both Projects are built together, cable installation will be undertaken in a single phase so there are no overlapping effects from cable installation activities. If both Projects are built together, there will be a maximum of two concurrent foundations installation activities and the marine physical processes modelling (**see Volume 7, Appendix 8-3 (application ref: 7.8.8.3)**) shows there are no overlapping effects from the seabed clearance or drilling phases of foundations, assessed in section 8.7.3.1 and 8.7.3.2 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"8.7.4.1-8.7.4.10 As the project-specific PSA data and results from the bespoke modelling are not yet available and/or incorporated, there is insufficient data to adequately inform the impact assessment. The results of the project-specific PSA and numerical modelling should be shared as soon as possible to establish the baseline conditions and potential impacts on the marine physical environment."	The marine physical environment baseline (section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) has been updated to include site specific geophysical, geotechnical survey, seabed grab sample and particle size analysis data. The approach to marine physical processes numerical modelling was shared through the EPP with the Seabed Expert Topic Group. The marine physical processes modelling technical report is presented in (see **Volume 7, Appendix 8-3 (application ref: 7.8.8.3)**.
"8.7.4.1.6 & 8.7.4.2.6 It is stated that it is considered unlikely that sediment plumes (elevated SSCs) will persist for a sufficiently prolonged period of time for them to interact with subsequent operations. Therefore, no cumulative effect is anticipated from multiple installations. It is also stated that construction of DBS E and DBS W together would not result in a more significant effect than DBS E or DBS W (for changes in SSC and transport due to foundation seabed preparation). Clarity is needed on whether overlapping plumes could occur between the DBS E and DBS W arrays.	The marine physical processes modelling (see **Volume 7, Appendix 8-3 (application ref: 7.8.8.3)** shows that the sediment plumes created during foundation installation are small and short-lived with background levels returning to the baseline within hours of the disturbance. The modelling also shows there are no overlapping sediment plumes between structures and given a maximum of two concurrent installations will be undertaken, the effects from overlapping plumes will be negligible.

Comment	Project Response
Please provide the rationale for the conclusion that changes in SSC and transport due to foundation seabed preparation and drill arisings for one array (i.e., DBS E or DBS W) would be the same as for two arrays (i.e., DBS E and W)."	
"Tables 8-23, 8-25, 8-27, 8-33 & 8-35 Dogger Bank SAC tolerance and recoverability have been assessed as 'High' and, sensitivity has been assessed as 'Negligible' for changes to SSC and seabed level. There are several species present within DB SAC that are sensitive to changes in SSC. These should be considered in the sensitivity assessment. We advise the Project to refer to the relevant conservation advice and to consider the sensitivity of the varied species present to this pressure in this assessment."	The Dogger Bank as a morphological feature has been included as a marine physical environment receptor. As Dogger Bank was created by glacial processes around 20,000 years ago it has negligible sensitivity to changes in SSC. The Dogger Bank SAC is not a marine physical environment impact receptor as it is designated for biological functioning and as such is assessed in relation to changes in SSC in **Volume 6, Report to Inform Appropriate Assessment (application ref: 6.1).**
"8.7.4.2.1 / Point 136 It is stated that net movement of fine-grained sediment retained within a plume would be to the northwest or southwest. Should this be northwest or southeast? Please clarify. "	This should be north-west to south-east, the text in section 8.7.4.2.1 has been updated to reflect this.
"8.7.4.3 / Points 145 - 148 The worst-case cable laying technique is considered to be jetting. It is unclear if DBS East and DBS West were developed sequentially, whether the use of jetting would still be a feasible technique for the second wind farm's cable installation. If the cable routes lie next to each other, would the jetting technique cause damage or exposure to the first windfarm's buried cable? Would this result in the cables needing to be buried further apart with a wider impact zone. What impact would this have on the landfall location? Clarification needed on worst case scenario (WCS)."	In the worst-case scenario, offshore export cable trenches have been spaced 50m apart, ensuring the viability of jetting for each individual trench. This has been clarified in Table 8-1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"8.7.4.3 / Point 147 Any sediment excavated during seabed levelling would be disposed of within close proximity to the point of excavation, ensuring there will be no net loss of sediment from any sandbank system. This is welcomed as a mitigation action. We advise that this mitigation is secured in the DCO/DML."	Noted with thanks.
"8.7.4.3.1 We note that project specific data have not been used to quantify/assess sediment plume extent, concentration and persistence due to cable installation activities. We advise using project-specific data to assess and quantify sediment plume extent, concentration and persistence for cable installation activities."	The marine physical environment baseline (section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) has been updated with site-specific particle size analysis data. This data has been incorporated into modelling studies of plume dispersion due to cable installation activities (see **Volume 7, Appendix 8-3 (application ref: 7.8.8.3)**).
"8.7.4.4 / Points 158 - 160 If DBS East and West were developed sequentially, would the same landfall location be able to be used, or would the second cable landfall have to be altered so as to not damage the first? Clarification is needed on the WCS assessed for landfall installation works.	If both Projects are built together, there will be one phase of cable installation activity at the landfall over a maximum duration of 18 months. This has been considered in sections 8.7.3.4 and 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.

Comment	Project Response
We advise that the landfall works including ducting are installed for both projects when the first one constructs to reduce impacts."	
"8.7.4.4.1 & 8.7.4.9 Temporary installation of cofferdams in proposed in the intertidal zone. Clarity is needed on how many cofferdams will be in place at the same time, for how long, and what the WCS blockage effect to hydrodynamic and sediment transport processes will be. Consideration needs to be given to whether the presence of ancillary infrastructure during construction (i.e., cofferdams) could give rise to changes in waves and/or current flows, affecting sediment transport and resulting in morphological change."	Following further review of the potential construction methodology for the Projects, cofferdams have been removed from the Projects design envelope.
"8.7.4.6.3 It is stated that the WCS for changes in seabed level due to the installation of 95 large wind turbines and eleven offshore platforms will have the same magnitude of impact as installation of 48 large wind turbines and six offshore platforms for DBS E or DBS W in isolation. We cannot agree with this, because the amount of seabed loss for the 'together' scenario will be double that of the 'in isolation' scenario. Moreover, the area of impact within DB SAC will be doubled in a 'together' build scenario. Furthermore, the potential for overlapping deposition footprints between the two arrays in the 'together' build scenario should also be considered and assessed. The WCS for 'in isolation' and 'together' scenarios should be assessed/quantified. We advise also considering and assessing potential overlapping deposition footprints between DBS E & DBS W in a 'together' build scenario."	Further clarity has been provided in the assessment of significance (section 8.7 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) to distinguish between the effects from one Project being built in-isolation when compared to two Projects being built concurrently or sequentially. Further clarity is provided if the effects from any on particular Project built in isolation (e.g. DBS East or DBS West) are greater than if the other Project was built in isolation. The marine physical processes modelling (see **Volume 7, Appendix 8-3 (application ref: 7.8.8.3)**) shows that the sediment plumes created during foundation installation are small and short-lived with background levels returning to the baseline within hours of the disturbance. The modelling also shows there are no overlapping sediment plumes between structures and given a maximum of two concurrent installations will be undertaken, the effects from overlapping plumes will be negligible.
"Table 8-3 It is stated that if 'DBS East and DBS West are built in isolation there will be two separate phases of HDD installation'. In the Project Description, the 'isolation' scenario refers to only one project being built in total so would only require one phase of HDD installation. Clarity is needed on the isolation versus sequential scenarios and how these relate to the WCS for landfall works. We request that the terms are used consistently throughout the application documents to avoid confusion. Please see previous advice for installing ducts for both projects when the first project is built. "	If both Projects are built together, there will be one phase of cable installation activity at the landfall over a maximum duration of 18 months. This has been considered in sections 8.7.3.4 and 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"8.7.4.7.2 / 8.7.4.8 / Point 197 Drill arising mounds may be present at up to 5 locations across the array areas. If cable/array installation disturbs till, the PEIR states that the clasts would remain on the seabed and break up later through sediment transport processes.	If glacial till is disturbed during drilling for foundations or due to cable installation, there is potential for the till to form aggregated clasts of various sizes depending on the physical properties of the till. The larger clasts will require relatively higher currents to disaggregate or transport them whereas the smaller clasts will become

Comment	Project Response
Further information is needed on potential extent of the deposited clasts, how long they would remain on the seabed and whether they would impact sediment transport processes."	part of the bedload. This has been included in the assessment in section 8.7.3.7 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"8.7.4.8.4 Cable installation (and cable protection) across and / or near Smithic Bank remains a concern, particularly when considered in-combination with other projects. Successive cable (and cable protection) installation could act cumulatively to increase morphological alteration of the sandbank through changes to sediment transport pathways. In turn, moderate elevation changes to the sandbank could affect the shoreline response to storm waves and shoreline morphology. Furthermore, given the uncertainty regarding the erosional or depositional nature of South Smithic, we are also concerned that burial of the export cable may not be achieved. As a first option, we advise avoiding cable installation (and cable protection) across Smithic Bank as this would remove / reduce the impact to the sandbank. If cable activity cannot be avoided, impacts to the form and function of Smithic Bank due to the project alone, and in-combination, with other projects, should be considered and assessed in the ES."	The offshore export cable corridor (excluding the construction buffer) does not cross Smithic Bank as defined by JNCC or by the British Geological Survey (see section 8.5.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and **Volume 7, Figure 8-2 (application ref: 7.8.1)**). Potential changes to sediment transport, and associated effects on cliff erosion, in the nearshore and coastal zone are assessed in section 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"Table 8-37 The value of Smithic Bank has been assessed as 'Medium'. However, Smithic Bank plays a significant role in dissipating direct wave energy, refracting oblique waves, providing shelter to Bridlington, regulating sediment supply, and is an important nursery and feeding ground for fish. Therefore, we would advise that it is of 'High' value. We advise that Smithic Bank should be considered 'High' value in the EIA."	With regards to marine physical processes, following the definition of value in Table 8-10 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**, Smithic Bank is assigned medium as the receptor is not designated but of local/regional importance. To assign a high value in terms of marine physical processes, the feature would need to be designated. The value of Smithic Bank in relation to nursery and feeding grounds is covered in **Volume 7, Chapter 10 Fish and Shellfish (application ref: 7.10)**.
"8.7.4.9.5 It is stated that upon completion of cable installation at the HDD exit location, the trench will be backfilled, and the beach profile will recover quickly (less than a year). Pre- and post- construction monitoring of beach profile change should be carried out to confirm beach profile recovery and support predictions regarding impacts to the Holderness cliffs. We would also advise sediment being returned in the order it was removed to avoid creating areas of seabed with differing resistance which could erode at different rates"	Noted.
"8.7.5.1 / Points 221-224 Table 8.4 and section 8.3.3 states that: 'A minimum separation distance of 830m has been defined between adjacent wind turbines, minimising the potential for interaction between adjacent wind turbines with respect to the marine physical environment'. The PEIR states potential impacts to the tidal regime due to structures will be based on an understanding of tidal ellipses which will be incorporated into the final ES. Natural England understands	The marine physical environment baseline (section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) has been updated to include site specific geophysical, geotechnical survey seabed grab sample and particle size analysis data. The approach to marine physical processes numerical modelling was shared through the EPP with the Seabed Expert Topic Group.

Comment	Project Response
that further work to complete this chapter will be presented in the final application to confirm whether the distance between turbines is suitable mitigation. Incomplete baseline data, impacts to be assessed once site specific data included in ES. Details of what the site-specific modelling will include should be shared via the ETG. Provide evidence to demonstrate that wake-wake interaction is unlikely to occur at DBS."	The marine physical processes modelling technical report is presented in **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3).**
"8.7.5.1.2 & 8.7.5.1.3 In Table 8-42 it is suggested that the scale of near-field changes to the tidal regime would be 'Low'. As noted in Point 221, changes to baseline tidal conditions may extend beyond the array boundary for some kilometres, therefore, we suggest that the scale of the impact would be greater than low. Changes to the tidal regime could also affect the qualifying feature attributes of the Dogger Bank SAC. Further consideration will need to be given to potential impacts to the DB SAC qualifying feature attributes associated with changes to the tidal regime due to the presence of the array(s) over the lifetime of the Project(s). See Supplementary Advice on Conservation Objectives for Dogger Bank Special Area of Conservation: December 2022 (jncc.gov.uk)"	The marine physical processes modelling shows that changes to tide regime beyond the Array Area boundaries (within a maximum of 8km) are <±0.01m/s **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**. The far-field scale of these changes has been updated to negligible in the assessment in section 8.7.4.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** based on the modelling results. The scale element of magnitude of impact as defined in section 8.4.3.1.3 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** considers a combination of size, extent and intensity. A consideration of extent alone may result in a definition of greater than low, however, the assessment collectively considers extent, size and intensity and given the size and intensity of the change is so small, the overall definition is negligible.
"8.7.5.1.6 / Point 228. This significance of effect discusses 'Construction of DBS East and DBS West together'. However, this section is related to an operation related effect. Please clarify/amend."	"Construction" has been changed to "Development" to avoid confusion with a construction effect.
"8.7.5.2 & Table 8-44 In the assessment of Magnitude of Impact for 'Changes to the Wave Regime due to the Presence of Infrastructure', the scale of the impact is considered low, however there is the potential for the wave shadow effect to extend up to 10km from the site which would not be a small-scale impact. Further consideration will need to be given to potential impacts to the DB SAC qualifying feature attributes associated with changes to the wave regime due to the presence of the array(s) over the lifetime of the Project(s)."	The marine physical processes modelling shows that the maximum changes to wave regime occur during a 1 in 1 year return period event and the changes in significant wave height within 7km of the Array Area boundaries are between 0.04 and 0.06m which are <1.5% of baseline conditions (see **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**). The far-field scale of these changes has been updated to negligible in the assessment in section 8.7.4.2 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** based on the modelling results. A consideration of extent alone may result in a definition of greater than low, however, the assessment collectively considers extent, size and intensity and given the size and intensity of the change is so small, the overall definition is negligible.
"8.7.5.2 / Points 230 & 231 The PEIR states that the change in significant wave height due the presence of foundation structures is predicted to be a worst-case scenario of 10% based on data from other windfarms.	The marine physical environment baseline (section 8.5.6 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) has been updated to include wave data from the metocean buoy deployed between March 2022 and May 2023.

Comment	Project Response
As wave buoys have been deployed on site, the data from these should be used to understand baseline conditions along with site specific numerical modelling to determine impacts on site, and that turbine spacing is suitable to minimize impact. Incomplete baseline data, impacts to be assessed once site specific data is included in the ES. We advise a review of the impact of the project on wave climate is also included as part of the cumulative impact assessment with other nearby windfarms on sensitive receptors."	Numerical modelling of changes to wave climate has been undertaken and is used to inform the assessment of significance (see **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**). The outputs of the wave modelling have been used to inform the cumulative impact assessment in section 8.8.4 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"8.7.5.3.4 The Flamborough Front gives rise to nutrient-rich waters which create a biodiversity hotspot attracting seabirds and marine mammals to the area each year. It plays a key role in primary production, the marine ecosystem and biogeochemical cycles. Therefore, we advise that its value should be 'High' rather than 'Medium'. There is growing evidence that clusters of offshore wind farms alter stratification and, in turn, primary production. This poses a potential risk to the Attribute: 'Supporting Processes' associated with the DB SAC qualifying feature conservation objective. Therefore, we would also advise that 'Sensitivity' of the Flamborough Front due to the presence of the DBS arrays, is not 'Negligible'. Consideration should be given to how to accurately predict the interaction between the flow, infrastructure on the seabed, and stratification for the WCS array layout(s) over the lifetime of the project alone, and as part of a cluster of OWFs. Assessing potential changes to primary production should also be considered."	With regards to marine physical processes, following the definition of value in Table 8-10, Flamborough Front is assigned medium as the receptor is not designated but of local/regional importance. To assign a high value in terms of marine physical processes, the feature would need to be designated. Potential effects on primary productivity are covered in section 8.7.4.3.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** Changes to water circulation (Flamborough Front) due to the cumulative effect of windfarm infrastructure is assessed in section 8.8.4 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"8.7.5.3 / Points 238 - 244 The PEIR states that the main potential impact on the Flamborough Front is changes to near field mixing due to foundation wake effects and the potential for destabilising local water column stratification. All foundations will lead to some level of local turbulence and depending on the final design configuration of the foundations, the gravity-based foundation cross-section through the water column has the potential to lead to the highest level of turbulence compared to other foundation options. The chapter concludes that the scale of turbulence is considered to remain localised in the form of a wake in the lee of each foundation without a larger array scale effect. Cold water plumes could also form in the lee of the foundation structures of the array, altering the sea temperature. These cold-water plumes could, on an array-scale, also have a significant ecological impact on the primary production and the wider marine ecosystem. Further assessment of this is needed in the final assessment. Include a review of the impact of the project on the Flamborough Front as part of the cumulative impact assessment with other nearby windfarms on sensitive receptors. It will be important to establish a monitoring programme to record any changes to stratification and primary productivity, which would require surveys pre-construction, post-construction, and for the lifetime of the project. We advise this is discussed as part of the EP process. This should include "trigger points" to allow interventions/remediation if required."	Potential effects on primary productivity are covered in section 8.7.4.3.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** Changes to water circulation (Flamborough Front) due to the cumulative effect of windfarm infrastructure is assessed in section 8.8.4 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.

Comment	Project Response
"8.7.5.5 The introduction of infrastructure and hard substrata to an MPA is likely to hinder the conservation objectives of the site. Therefore, our preference is for cables to buried. We would also be concerned with the placement of any cable protection across Smithic Bank as this could lead to a reduction in water depth within the water column, and potentially lead to local scour and the formation of a barrier to sediment transport. Significantly altering the profile of the sandbank could have a significant impact on longshore drift. Similarly, we would also be concerned with cable protection being placed in Holderness Inshore MCZ. We advise the Project to commit to cable burial in suitable habitats, before considering use of external cable protection. We advise that cable protection should be avoided within designated sites, Smithic Bank and in depths less than 10m where possible. Providing a cable burial risk assessment at the time of Application would help ensure that cable protection requirements were understood and refined down as far as possible."	The Offshore Export Cable Corridor (excluding the construction buffer) does not cross Smithic Bank as defined by JNCC or by the British Geological Survey (see section 8.5.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and **Volume 7, Figure 8-2 (application ref: 7.8.1)**). Due to the potential for Chalk bedrock to be present within cable burial depth in water depths <10m below LAT (see section 8.5.2), there is potential cable protection may be required locally within the 10m depth contour. This has been assessed in section 8.7.4.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. A preliminary cable burial risk assessment has been undertaken and is provided as support information in **Volume 8, Cable Statement (application ref: 8.20)**.
"8.7.5.5 / Point 258 The locations where cable protection measures are most likely to be required are areas of cable crossings and seabed characterised by exposed bedrock. Provide a map showing the location of areas most likely to require cable protection, including all crossings, and identify any sensitive receptors and designated areas. If any cable crossings are anticipated to be in the nearshore or near Smithic Bank, impacts to nearshore sediment transport pathways should be considered."	Potential subsea cable / pipeline crossings along the Offshore Export Cable Corridor are presented in **Volume 7, Figure 8-14 (application ref: 7.8.1)**.
"8.7.5.6 / Points 275-278 & Table 5-24 (Chapter 5) The worst-case maximum disturbance area for cable repair assumes 25% amounting to a total area of 1,354,662m2, if DBS E and DBS W are built together. Please provide rationale for the 25% disturbance area. Where MPAs are likely to be affected, the WCS of impact for each MPA for cable repair needs to be established."	Cable repair estimates are based on the Applicants experience of operating transmission assets for other offshore wind farms. MPAs are not marine physical environment receptors and the effects of cable repair and reburial on these impact receptors are assessed in **Volume 6, Report to Inform Appropriate Assessment (application ref: 6.1)**.
"8.7.5.6 / Table 8-53 The sensitivity of Smithic Bank to cable repair and maintenance operations has been assessed as 'Low'. We are concerned that cable installation, repairs, maintenance, replacement, protection by multiple developments on Smithic Bank, could affect its form and function. There is also uncertainty regarding the erosional/depositional nature of South Smithic and how its morphology will respond to the impact of multiple development installation and O&M activities. We would also advise that its value is 'High'. The potential impact to Smithic Bank of cable reburial, cable replacement, and cable remediation activities through the lifetime of the Project(s) (including climate change impacts) need to be adequately assessed."	The Offshore Export Cable Corridor (excluding the construction buffer) does not cross Smithic Bank as defined by JNCC or by the British Geological Survey (see section 8.5.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and **Volume 7, Figure 8-2 (application ref: 7.8.1)**). With regards to marine physical processes, following the definition of value in Table 8-10 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**, Smithic Bank is assigned medium as the receptor is not designated but of local/regional importance. To assign a high value in terms of marine physical processes, the feature would need to be designated.

Comment	Project Response
"8.7.5.6 Cable repairs during operation are included, but not during construction. Cable remediation work may be required after installation (but before operation) to address faults and / or damages to the inter-array and export cables which occurred prior to installation or during installation. This is considered a separate activity to cable repairs and maintenance during operation and should be assessed as an additional phase of offshore wind development (see Natural England's Best Practice Guidance)."	Once the cable is installed, if repairs are required these are accounted for in the estimates for the Operation and Maintenance phase of the Projects.
"8.9 Monitoring currently proposed for marine physical environment receptors: Pre- and post-construction monitoring of sand waves to assess recovery rates and re-exposure of buried cables. Recovery of the physical form of the seabed, including from export cable installation in the Holderness Inshore MCZ and across Smithic Sands. Monitoring of scour protection measures and secondary scour to identify the extent, volume and integrity of any scour protection used. We welcome these proposed monitoring programmes. Further monitoring may be needed and we advise this is discussed as part of the EP process."	Noted with thanks.
"8.7.6 / Points 304 & 306 The PEIR states for decommissioning that scour, and cable protection would be left in-situ other than where there is a specific condition for its removal. It is not clear from the PEIR how impacts to marine processes beyond the lifetime of the project have been assessed. Natural England advises that any scour prevention and cable protection within designated sites will need to be removed at the time of decommissioning."	The scope of the decommissioning works would most likely involve removal of the accessible installed components. This is outlined in **Volume 7, Chapter 5 Project Description (application ref: 7.5)** and the detail would be agreed with the relevant authorities at the time of decommissioning. Offshore, this is likely to include removal of all of the wind turbine components and part of the foundations (those above seabed level), removal of some or all of the array and export cables. Scour and cable protection would likely be left *in situ* unless removal is deemed to be of a greater benefit to the environment at the time of decommissioning. The effects of scour protection and cable protection on the surrounding environment following decommissioning would be comparable to that of the operational stage of the Projects. Accordingly, given that no significant impact was assessed for the identified marine physical environment receptors during the operational phase of the Projects, it is anticipated that the same would be valid for the decommissioning phase.
"8.8 & 8.9 / Points 312 - 315 The PEIR states for cumulative impacts that several relevant projects have been listed. However, the chapter concludes: 'With respect to these activities, the cumulative assessment considers them to be part of the baseline conditions for the surrounding area'.	It is not the scope of this ES to assess the residual ongoing impacts on receptors from other projects. Impacts from other existing projects in the region are considered as part of the baseline environment.

Comment	Project Response
More information should be provided around the potential interaction between DB South Projects and the other projects listed by reviewing any residual on-going impacts against receptors. Need to consider and assess the following: Given the connectivity along the Holderness coast and beyond, additional plans and projects should be scoped in. This should include (but not necessarily limited to) coastal infrastructure."	Coastal infrastructure projects are included in the cumulative effects assessment in section 8.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**, where relevant.
"Chapter 6 / Point 61 We note that only those potential effects identified as major or moderate are regarded as 'significant' in EIA terms. This cut-off excludes minor or negligible effects from being regarded as 'significant'. We note that for Marine Physical Environment effects, several impact magnitudes and receptor sensitivities appear to have been underestimated. The matrix approach adopted in this EIA for determining effect significance relies, in part upon expert judgement, particularly for receptor value and sensitivity, which can be quite subjective. Moreover, having a cut-off between those effects determined to be 'significant' or not, in EIA terms, could lead to errors in assessing cumulative effects adequately. We advise a less subjective and more evidence-based approach to determining significance of effect."	The marine physical environment baseline (section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) has been updated to include site specific data and the outputs from marine physical processes numerical modelling (see **Volume 7, Figure 8-2 (application ref: 7.8.1)**). These data provide the evidence base for the assessment of significance, which is supported by expert judgment.
"Chapter 8 / Table 8-3 Impact C1b: Volume of drill arisings from a large WTG monopile foundation is given as 17,813m3 per pile. It is assumed 5% of all WTGs will be drilled, which equates to 5 WTGs across both Projects. Thus, drill arisings from 5% of 95 large WTGs would be 5 x 17,813 = 89,065m3. However, in Table 8-3, drill arisings from 95 large WTGs = 84,611m3. Please clarify. "	Table 8-1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated to reflect a refined project design envelope and any reference to these values has also been updated in the relevant section of the text.
"Chapter 8 / Table 8-3 Impact C1c: The assumptions used for estimating the maximum seabed footprint area for sand wave levelling and volume of sand wave material dredged/relocated, are not clear. What is the sand wave levelling corridor width and depth? Please clarify. It would also be useful to state the WCS total volume sand wave material to be dredged/relocated for offshore export, array, and inter platform cable corridors."	Table 8-1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated to reflect a refined project design envelope and any reference to these values has also been updated in the relevant section of the text.
"In Table 8-3, it states that the maximum sand wave material to be dredged for the OECC is 99,365,402m³ and for the array and inter platform cables 99,365,402m³. However, in Table 5-7 (Chapter 5), WCS sand wave levelling scenario for DBS E and DBS W concurrently and/or sequentially in the array areas is 1,047,938m³ and within the OECC, is 99,365,402m³. There is a significant difference in WCS between these two tables. Moreover, this is an incredibly significant volume based on the assumption that sand wave levelling will be carried out along the total (100%) offshore cable length, which we do not believe is a realistic worst-case scenario.	Table 8-1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated to reflect a refined project design envelope and any reference to these values has also been updated in the relevant section of the text. Pre- and post-construction monitoring of sand waves to seabed assess recovery rates is proposed in section 8.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. The effects from seabed levelling (sand wave clearance) have been modelled (see **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**) and used to inform the assessment of effects.

Comment	Project Response
All possible efforts should be made to avoid areas of sand waves or minimise the need for clearance by microrouting. We advise using project-specific geophysical survey data to refine down the WCS for sand wave clearance and a sandwave levelling management plan is provided for Dogger Bank SAC. If sand wave levelling cannot be avoided in a designated site where the sand waves are related to a designated feature, we advise that monitoring is undertaken to assess whether the cable remains buried, the sand waves recover, and how the natural processes reinstate themselves. The extent and location of sediment disturbance (area, volume) should be provided for affected MPAs / features and other receptors (e.g., DB SAC, Annex I sandbanks, Smithic Bank)."	
"Table 8-3 Impact O1: The parameters described for this impact include 'seabed preparation for 48 x large suction bucket foundations with 4 x 25m diameter buckets per pile…'. Seabed preparation for gravity base foundation OCPs is also evaluated for this impact. However, seabed preparation is a construction-related activity not operation-related. Seabed preparation for foundations should be included in the Construction impact section where impacts are likely to short term. Evaluate the worst-case seabed obstruction footprint instead."	Table 8-1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated to reflect a refined project design envelope and any reference to these values has also been updated in the relevant section of the text.
"Table 8-3, section 5.4.7.7.1 & section 5.4.7.7.3 Impact O4b: The maximum cable protection requirement for export cable length does not appear to be included in the 'Notes and Rationale'. In section 5.4.7.7.1, Point 157 states that: an 'allowance of up to 170km of cable protection (total across both Projects) is included for array cables in close proximity to the wind turbines. How / where is this allowance included in the WCS in Table 8-3? Similarly, in section 5.4.7.7.3, it states that a 'total allowance of [cable protection of] up to 177.7km is assumed for the export cables, 76.52km for the inter-platform cables (for both Projects) and 162.8km for the array cables.' How do these values relate to the WCS seabed footprint of cable protection estimates provided in Table 8-3? Please can this be clarified."	Total cable protection requirements have been included in Table 8-1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"Table 8-3 Impact O4b: Changes to bedload sediment transport and seabed morphology due to the presence of cable protection measures. We note that this WCS includes allowance for remedial cable protection for 20% of the route. It is unclear which route this relates to, for example, offshore export cable? The rationale for 20% remedial cable protection has also not been provided. Please clarify and provide the rationale for 20% remedial cable protection and in which habitats this is likely to occur."	Remedial cable protection may be used for up to a maximum of 20% of the total length of the Offshore Export Cable Corridor. This figure represents an absolute worst case cable protection allowance in line with that consented for other offshore wind farm projects in the North Sea. Cable protection may be required in areas where the sediment depth is less than 0.5m above the underlying bedrock, or at subsea cables / pipelines. **Volume 7, Figure 8-14 (application ref: 7.8.1)** presents the locations of potential subsea cables / pipelines along the Offshore Export Cable Corridor. Due to the potential for Chalk bedrock to be present within cable burial depth in water depths <10m below LAT (see section 8.5.2 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**), there is potential cable protection may be required locally within the 10m depth contour. This has been assessed in

Comment	Project Response
	section 8.7.4.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
"8.4.3.1.3 / Table 8-11 It is unclear if spatial / geographical extent been taken into consideration within the definition of magnitude of impacts. Please clarify. "	The definition of magnitude takes into consideration scale (e.g. size, extent and intensity) as outlined in paragraph Section 8.4.3.1.3 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
The marine physical environment baseline data are still being collected and/or analysed, therefore, the baseline is currently incomplete. These data should be used to make an informed assessment of impacts to designated sites.	The marine physical processes baseline in section 8.5 has been updated with project specific data and the results from marine physical processes numerical modelling (see **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**), and the assessment of significance updated where appropriate.
One of the potential landfalls is located within Holderness Inshore MCZ. Consideration will need to be given to whether cable installation will disturb sensitive areas of seabed in the intertidal and supratidal areas at landfall and the impact assessed appropriately.	The offshore export cable route has been reduced at landfall and the corridor no longer overlaps with the Holderness Inshore MCZ.
"Withow Gap, Skipsea SSSI: Coastal Erosion The coastal exposure of the Withow Gap, Skipsea SSSI comprises low cliffs of peat deposits, which are particularly vulnerable to coastal erosion, even in the context of the Holderness Coast. Changes to coastal sediment pathways therefore have the potential to significantly damage or destroy features for which the SSSI has been notified. The most concerning pathway stems from the potential for a coastal cofferdam to the north of the site, which would interrupt the flow of sediment along southwards along the coast. This could lower the beach profile immediately seaward of the SSSI cliffs and expose them to increased coastal erosion. Withow Gap, Skipsea SSSI should be considered as a receptor in the assessment of changes to Physical Marine Processes. Include this site in impact assessments and consider any requirements for changes to project design so operations likely to damage are avoided."	Withow Gap Skipsea SSSI has been included as a receptor for marine physical processes and is assessed in relation to changes in nearshore sediment transport pathways in section 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and section 8.7.4.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Cofferdams have been removed from the project design envelope.
"The evidence used to determine impacts on marine processes in the PEIR currently consists of an extensive literature review and conclusions drawn from the impact assessments from existing nearby wind farms and the initial results, where available, from site specific surveys. The results of a number of project specific surveys remain outstanding. These include but are not limited to a project specific bathymetric survey, geotechnical studies, tidal ellipse data and a sediment mobility study. Project-specific modelling of changes to the marine physical environment have also not been included but will be part of the Environmental Statement (ES). The lack of site-specific data to inform baseline characterisation presents significant uncertainties and therefore conclusions cannot be drawn with any confidence at this point. Consequently, Natural England cannot agree with the conclusions of the PEIR at this stage.	The marine physical processes baseline in section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated with project specific data and the results from marine physical processes numerical modelling (see **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**), and the assessment of significance updated where appropriate.

Comment	Project Response
Impacts on coastal processes and nearshore sediment pathways in relation to the Humber Estuary SAC/SPA/Ramsar/SSSI, Holderness Inshore MCZ and Withow Gap, Skipsea SSSI are likely to be key consenting risks for this project. It is therefore important that these aspects are fully assessed and that there is sufficient time to fully explore options to ideally avoid, or if not mitigate the impacts prior to application. The Project should consider options to avoid impacts to Smithic Bank completely, and to reduce/remove the potential for impacts on coastal processes. "	
PEIR Consultation, Environment Agency 17/07/23	
You will need to consider the implications of coastal change on your chosen landfall siting and construction methodology. This will also need to consider the impact on coastal processes both within the development site, and the consequences elsewhere. We recommend you also speak to East Riding of Yorkshire Council as the Coastal Risk Management Authority to obtain latest data and projections on coastal erosion and change. You should also consider precautionary estimates for coastal change, ensuring you set back any infrastructure where coastal erosion is expected to occur. Where relevant, you should consider a credible maximum for coastal change, and consider any implications this may have on flood risk within your site(s). The National Coastal Erosion Risk Mapping (https://data.gov.uk/dataset/7564fcf7 2dd2 4878 bfb 9 11c5cf971cf9/national coastal erosion risk mapping ncerm national 2018 2021) may be of relevance to your assessment.	Coastal monitoring data from East Riding of Yorkshire Council is presented in section 8.5.16 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and has been used to predict future coastal erosion using the precautionary UK Climate Projections Representative Concentration Pathway 8.5 in section 8.6.2 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. This information has been used in the design of the Projects, e.g. to inform the appropriate setback distance for the transition joint bays at landfall to allow for predicted erosion of the nearby cliffs over the lifetime of the Projects. Coastal erosion rates from the National Coastal Erosion Risk Mapping data are also quoted in section 8.5.16 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Please note that a new national product is in the process of being developed (NCERM2) mapping coastal erosion. This is likely to be available by the end of the year.	NCERM2 data was not published prior to 31st March 2024, and thus was not available to inform this assessment.
PEIR Consultation, MMO 17/07/23	
The MMO agrees with the majority of the scoping of receptors and processes. The Applicant has made a reasonable case for omitting re-powering from the scope of this application – however, as noted in the application, this could involve replacement of everything except cables, and therefore a potential to repeat many impacts after 30 years. The ES should note this in the assessments, as a foreseeable potential frequency of impact occurrence (akin to the assessment of decommissioning - this is not specifically considered in detail, but the application notes that impacts will be of similar magnitude to installation).	If the specifications and designs of the new turbines and/or foundations were outside the existing maximum design scenario, or the impacts of constructing, operating, and decommissioning them were to fall outside those considered in this ES, repowering would require further consent (and EIA). Given the uncertainty regarding the technical specifications around any potential repowering and therefore potential levels of impacts, reference to repowering has not been made in this ES.
The description of physical process influence on habitat assessments provided in the benthic habitats Chapter 9 are consistent with the physical processes Chapter 8. However, it should be noted that the physical process impacts are generalised (i.e., estimated based on an 'expert judgement' application of impacts approximated on the basis of other locations) and so are not site specific to the same extent and resolution that habitat distribution has been surveyed.	The marine physical processes baseline in section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated with project specific data and the results from marine physical processes numerical modelling (see **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3)**), and the assessment of significance updated where appropriate.
In relation to section 8.7.5, Potential Effects During Operation, it is not particularly useful to the understanding of geomorphic impacts to express changes to hydrodynamics in purely percentage terms	Changes to hydrodynamics were assessed in section 8.7.4.1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** and quoted as a percentage

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(e.g., 7% decrease in tidal currents). The key process to understand is any changes in net volumes of sediment supply upstream and downstream along major transport pathways. For example does the associated reduction in sediment transport rate result in new 'gradients' in transport across any features or significant transport pathways. Consideration should be given as to whether sediment will be progressively removed from areas where the transport rate increases in the direction of transport. The size of the sedimentary features may mean that any eventual impacts due to small changes may take years or decades to be manifest. As the projects have an (initial) lifetime of 30 years, and there are many adjacent developments of similar nature which may be introducing their own gradients, this should be discussed in the cumulative impacts assessment. This is particularly important to consider since there is no specific modelling identifying sediment transport changes.	change from baseline condition and also expressed in terms of the maximum change to current velocity. When quantifying changes to hydrodynamics it is appropriate to express this as both a value and a percentage change. Changes in net volumes of sediment supply and sediment transport pathways are assessed separately in section 8.7.4.4 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. A reduction in sediment transport potential is predicted as a result of lower current velocities associated with changes in wave and tidal regime (see sections 8.7.4.1 and 8.7.4.2 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**). These changes have been confined to local areas around each individual foundation due to localised wave shadow and wake effects. Given their limited geographical extent, this is not expected to change significant sediment transport pathways or gradients which could lead to removal or additional of sediment from any particular area, changing the net volumes of sediment supply. If individual sedimentary features such as sand waves are present within the area effected by the wave shadow or wake, there is potential for these individual features to be affected by changes in bedload sediment transport due to changes in wave and tide regime. However, a review of project specific bathymetry data has not identified any sand waves within the Array Areas. Therefore, the effect of infrastructure on sand waves has not been assessed. The cumulative effects of changes in hydrodynamic regime have been assessed in section 8.8.4 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. No overlapping effects are predicted between adjacent projects, therefore no cumulative changes in net sediment transport are expected.
The cumulative impact assessment appears to be based on the temporal overlap of activities i.e., defining simultaneous, or in-combination impacts, rather than cumulative. Table 8-61 does not refer to the Dogger Bank sites already present. A cumulative assessment of coastal process impacts should map the impact zones of all developments (past and anticipated future), defined using the same expert judgment method applied for the projects against the transport pathways already mapped for the PEIR. This map should be assessed in the way discussed in Paragraph 2.1 (in terms of potential changes to transport rate gradients).	When assessing cumulative effects during construction, temporal overlap in activities is required to cause a cumulative effect as once the construction activity ceases, suspended sediment concentrations return to baseline conditions with a period of hours so there is no potential for overlap with other construction activities unless they occur within the same timeframe (of the order of hours) (see **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3))**. With regards to cumulative effects during operation, the assessment requires each individual project to be constructed to understand how the effects increase cumulatively until all projects are built and there is temporal overlap in their presence. Table 8-62 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated to include other Dogger Bank Projects.
Embedded mitigation for coastal process impacts (section 8.3.3) includes a pollution (spill) control plan, turbine spacing to avoid overlapping wakes, scour protection (though this is largely mitigation of	Further information regarding post-construction monitoring has been included within the section 8.9 of **Volume 7, Chapter 8 Marine Physical Environment**

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engineering risk), drilled foundations where possible to minimise sediment deposition, cable burial (micrositing) and Horizontal Directional Drilling (HDD) at the coast. All impact estimates being assessed already reflect these measures (i.e., 100 million metres cubed (m^3) of sediment excavation for sand wave levelling is already accounting for the embedded mitigation). Further mitigation is not proposed. However, section 8.9 contains proposals for an In Principle Monitoring Plan, to include pre- and post-cable installation monitoring of sandwaves. It would be of value to provide more information on the timing of these proposed surveys, and the expectations (what the monitoring is intended to observe), including explanation should the observations not meet these expectations. The expressed intention is to monitor bed recovery in Holderness Inshore Marine Conservation Zone (MCZ) and Smithic bank, plus scour impacts, implying potentially extensive surveying, interpretation and reporting requirements. The ES should discuss what mitigation would be applied if recovery is not observed.	**(application ref: 7.8)** and **Volume 8, In Principle Monitoring Plan (application ref: 8.23)**. It should be noted that the Projects no longer directly interact with the Smithic Bank sandbank feature or the Holderness Offshore MCZ, with the Projects now only having potential indirect effects on these features. As the Offshore Export Cable Corridor construction buffer zone overlaps with the Holderness Inshore MCZ, there still exists the potential for direct impacts from anchoring events during cable installation activities. Further details on the site selection and impacts to the MCZs are detailed in **Volume 7, Chapter 4 Site Selection and Assessment of Alternatives (application ref: 7.4)** and **Volume 8, Stage 1 Marine Conservation Zone Assessment (application ref: 8.17)**.
The MMO notes that Paragraph 158 indicates that the HDD ducts for the export cable landfall may exit into the intertidal zone. An assessment of the impacts on local transport is indicated. However, the MMO is not certain that this includes the potential impact of shoreline retreat. Shoreline retreat is described as possibly the greatest rate in the UK and shown in Table 8-20 to reach up to 1.5m per year or more.	The design of the trenchless duct locations will include an assessment of shoreline retreat to ensure the ducts on both the landward and seaward side are not affected by the retreating coast which would cause an engineering risk. This is outlined in section 8.3.3 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Enhanced shoreline retreat is also assessed within section 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Table 8-20 provides a valuable assessment of potential future cliff retreat of up to (an extreme) of 326 metres (m). Associated retreat of the intertidal can also be expected, potentially exposing the cable ducts. Sections 8.7.4.4 to 8.7.4.9 assesses excavation of the HDD exit pit during the construction phase only; but a cable landfall structure in the intertidal may need to be designed to allow for shoreline retreat. The ES assessment should account for a potentially larger exposure during the latter part of the site life.	A baseline understanding of platform lowering has been included in section 8.5.16 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Any changes in beach elevation due to cable installation at the landfall is assessed in section 8.7.3.9 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Plate 8-4 (showing the Flamborough Front) is low resolution and shows the whole UK coastline. To support the accompanying text, in the ES the image should focus on the area of relevance at a legible resolution.	Plate 8-4 has been replaced with **Volume 7, Figure 8-10 (application ref: 7.8.1)** which is of higher resolution and includes the Projects' Offshore Development Area.
Paragraph 209 of Chapter 8 discusses the 'Significance of Effect – DBS East or DBS West in Isolation'; interruption to Longshore Transport in a sparsely-sedimented, eroding shoreline area may be more likely to have a lasting fingerprint (compared to a more sediment-rich setting), rather than less as stated. The MMO recommends the assessment of impact not be based on this assumption, since shoreline impacts at eroding sites frequently vary over scales of tens of metres alongshore and the true exposure to impact may depend on highly localised details of the transport and sediment supply. Such information is not available in this case.	Following further review of the potential construction methodology for the Projects, cofferdams have been removed from the Projects design envelope.
Section 8.7.5.5 identifies the impact on sediment transport of cable protection measures. The PEIR asserts that sediment will build a ramp and pass over any obstruction. However, this would take a finite period of time, resulting in potential stripping of sediment downstream while the ramp is incomplete, which may result in new sedimentary features for a distance downstream (akin to the formation of large	An assessment of the effects of cable protection measures is outlined in section 8.7.4.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. There is no observational evidence from other projects that show formation of new sedimentary bedforms downstream of cable protection measures.

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bedforms). Any observational evidence of such ramps from existing installations should be included in the ES to support your assessment.	
"It would be of value to indicate how the worst-case scenarios for construction quantities (Table 5-3) were determined. This is because the ES will be limited to the stated values, and works which exceed these estimates will not be covered by the ES assessments. The calculated impacts are very large but it would be of value to review the ES to understand the expected 'margin of error' allowed for in such large values. In particular those for: • sand wave levelling - 9 kilometres squared (km²), 100 million metres cubed (m³) of sediment extraction, and then additional re-disposal, within nominally protected areas; • cable protection - unburied cable estimates of ~415km and 136 cable crossings amounting to an affected area of 5 million metres squared (m²); and • scour protection. • In addition estimates of quantities of reworking based on typical maintenance or cable exposure from existing operational sites should be considered."	Table 8-1 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated to reflect a refined project design envelope and any reference to these values has also been updated in the relevant section of the text.
Section 8.4.1. states that site specific data will be included in the ES, indicating that data was not available for the production of this PEIR chapter and therefore the same information in the scoping report was included in the interim. Sample sites for the nearshore are presented in Figure 8-8 and the data in Table 8-16, however, the PEIR states that the sediment data available shows that for all parameters the contaminant concentrations are likely to be low, indicating a minimal risk to the water column if suspended, this would also be relevant to translocated/redeposited sediments.	The marine physical processes baseline in section 8.5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** has been updated with project specific data.
This should be caveated that the borehole data for arisings would need to be individually assessed to determine if the same level of contaminants was found at depth in fine sediments.	Given drilled piles would only release geological material (i.e., uncontaminated material) depth samples are not generally collected for offshore windfarms in relation to sediment contaminant assessments.
Worst case scenarios have been provided for transport and contamination levels of material for both the export cable corridor (ECC) and within the array as a result of various aspects of the construction operation and decommissioning e.g. bed levelling, trenching, jetting or dredging of sand waves. The use of Cefas Action levels, Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) sediment quality guidelines for the assessment of impacts of the transport and deposition of the sediments including potential impacts on water quality, is appropriate.	Noted.
Sediment contaminant data from Dogger Bank A, B, C and Sofia from 2011 and 2012 are cited as other available data and information (Table 8-7) as outlined in Figure 8-8. Please note these are not considered timely under OSPAR, however, due to the nature and location of the material they are a useful indication of the cable area.	Noted. Site specific data is now available and has been included within **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8).**
Chapter 9 provides more timely data and information for use in physicochemical characterisation. Whilst the temporal and spatial coverage appears appropriate, these appear to be surface only samples and no information from samples at depth have been provided e.g. to look at potential contamination	Site specific data is now available and is included within the ES. Given drilled piles would only release geological material (ie uncontaminated material) depth samples

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from arisings for any drilled piles or from areas where there has been potential spills would still require additional testing.	are not generally collected for offshore windfarms in relation to sediment contaminant assessments.
Information on contaminants in boreholes should also be provided for completeness.	Site specific data is now available and is included within the ES. Given drilled piles would only release geological material (ie uncontaminated material) depth samples are not generally collected for offshore windfarms in relation to sediment contaminant assessments.
Table 8-15 and 8-16 provide levels of trace heavy metals in samples from the array and export cable sites for Tranche A windfarm sites, however, to be able to accurately assess the levels against Cefas action levels and use the data with confidence, the actual laboratory and method of extraction and analysis should be provided and should be in line with the MMO approved laboratories. A list of MMO approved laboratories can be found here: https://www.gov.uk/guidance/marine-licensing-sediment-analysis-and-sample-plans. This should be similar to the detail of information provided in Chapter 9 or at least reference to the information provided.	Site specific data is now available and is included within the ES. PSA was conducted by Fugro and THC PAHs metals organotins and PCBs were analysed by SOCOTEC as per MMO requirements.
Figure 8-8 indicates sediment contaminant sample locations which were undertaken for Dogger Bank A and B and the ECC. Chapter 9.2 of the draft ecology benthic monitoring report provides consideration of 197 sampling stations to provide coverage of DBS and the ECC. Fauna and particle size distribution were collected using a 0.1m² Hamon grab and the chemistry samples collected using a 0.1m² Day grab. It should be noted that the aliquot for particle size analysis (PSA) should be from the same sample used for chemical sampling, however the method followed here is for standard offshore monitoring and therefore done for different purposes.	Site specific data is now available and is included within **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
The report provides results for 20 sample sites across the array and 10 sample sites for the export cable which appear to provide good spatial coverage. The sediment samples were analysed for total hydrocarbons (THC), 22 individual poly aromatic hydrocarbons (PAHs), metals, polychlorinated biphenyls (PCBs) and organotins (di and tri-butyl tin).	No response required.
The results of these analysis have been compared to OSPAR effects range low (ERL), the National Oceanic and Atmospheric Administration (NOAA) effects range median (ERM) and Cefas Action Levels (ALs) as well as Canadian Sediment Quality Guideline threshold effects level (TEL) and probable effects level (PEL).	No response required.
The interpretation using these comparisons is that the levels are generally low with levels of total hydrocarbons and PAHs at the array being generally lower than the ECC. Considering that the ECC is likely to comprise material with more fines than the array due to being closer to the shore, this is not unexpected. Levels for metals indicated three stations with arsenic levels above the Cefas action level one with the remaining concentrations for individual contaminants below this. For PCBs the sum of the 25 congeners were all below Cefas Action Levels at all stations as were the levels of organotins.	No response required.
PSA was conducted by Fugro and THC PAHs metals organotins and PCBs were analysed by SOCOTEC, therefore, the provision of data for use with the assessment appear appropriate and proportionate.	Noted with thanks.

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Table 8-6 shows Cefas Action Levels. This table is incorrect. Mercury levels quoted as Action level 1 of 40 milligrams per kilogram (mg/kg) and Action Level 2 as 400mg/kg these should be 0.3mg/kg and 3mg/kg respectively.	This has been amended within Table 8-5 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
Table 8-2 states that an explanation regarding the use of Cefas action levels is provided in section 8.4.1 and that site specific data will be included with the ES that were not available for the production of the PIER chapter, and therefore the same information as presented in the scoping report is included here in the interim. However, section 8.4.1 is Policy, legislation and guidance and does not have a such a description. This should be amended to 8.4.1.2 for clarity where there is an adequate comment on Cefas Action Levels at Paragraph 29 of the chapter.	This has been amended to refer to section 8.4.1.2 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.
The MMO is of the opinion that, although material will be maintained within the same area, a designation of a disposal site will be required for these works. This site would cover the array and cable areas, in order to comply with the UK's obligations under OSPAR and the London Convention and Protocol.	See **Volume 8, Disposal Site Characterisation Report (application ref: 8.18)** for information regarding the Projects disposal site designation.
Please note, this would only be required were it is anticipated that material will be removed from the water, however briefly this may be (i.e. bed levelling works carried out by means of plough dredging for example, may not be subject to the requirement of a disposal site, whereas removal via trailer suction dredging, for example, for release at the sea-surface would be subject to this requirement). In line with this requirement, annual disposal returns must be submitted to the MMO during the project's construction. A Site Characterisation Report must be submitted to enable the MMO to designate one or more disposal sites.	See **Volume 8, Disposal Site Characterisation Report (application ref: 8.18)** for information regarding the Projects disposal site designation.
Drill arisings must be included within the Chapters and be included in any disposal site worst case scenario figures.	Noted, where relevant estimated drill arising figures are included with the ES and associated reporting.
"The MMO defers to Historic England regarding the potential impacts to offshore archaeology that may occur because of the North Falls OWF. The MMO will maintain a watching brief on anything that may fall within the MMO's remit – such as DML conditions."	No Action Required.
Natural England Comments Regarding Marine Physical Processes ETG 11/09/23	
Marine Physical Processes Numerical Modelling	
Marine Physical Processes Modelling Natural England requests that a method statement and modelled outputs are provided for review. We request that the method statement contain information on the size of the wind turbine foundations used in the modelling scenarios.	The marine physical processes modelling technical report is presented in **Appendix 8-3 Marine Physical Processes Modelling Technical Report (application ref: 7.8.8.3).**
Worst Case Scenario	As acknowledged by Natural England, Option 2 is considered the worst case array layout for changes to wave and tide regime. The minimum turbine spacing presented within Option 2 is included within the design envelope that the Applicants

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As discussed during the ETG, whilst we acknowledge that Option 2 presents the worst-case array layout for marine process impacts based on the minimum spacing that could be achieved between turbines, Natural England is of the view that it is an unrealistic scenario to use for the assessment due to the unlikelihood of the array being designed in this way. We consider that Option 1 represents a more realistic worst-case scenario and advise that this option is used for the bespoke numerical modelling and ES assessment.	are seeking consent for. Option 2 is considered realistic by the Applicants if the design process identifies situations where the minimum distance between turbines is required. The approach to the assessment of effects on marine physical processes is to consider the worst case scenario which, in the case of wave and tide regime, is the turbine spacing presented Option 2.
Modelling Return Period Natural England is concerned about uncertainties relating to timeframe for the construction, operation, decommissioning phases of the two arrays and potential future climate change effects such as increased storminess. We therefore request that the following return periods, as used in recent Examinations are also covered: • 50% no exceedance; • 10 in 1-year; • 1 in 1-year; • 1 in 10-year; • 1 in 50-year; and • 1 in 100-year.	With the exception of Hornsea Project Four, marine physical process modelling for recent Round Three wind projects have considered a maximum of three return periods, ranging from 1 in 1 year to 1 in 100 year. There is no consistency in the return periods used. Hornsea Project Four assessed the six return periods as has been advised here and they concluded that "the relative magnitude and extent of the effect is greatest for the 50% exceedance return period scenario (the lowest energy wave height condition considered) progressively decreasing for higher return period scenarios for all of the wave directions tested". Considering the advice received and the outcomes from the Hornsea Project Four marine physical processes modelling, the following wave periods have been modelled to represent the full envelope of wave conditions: • 50% no exceedance; • 1 in 1 year; and • 1 in 100 year.
Modelling scenarios Natural England is concerned that the potential for isolation and sequential build out scenarios has not been addressed and advises that the modelling is done for each array separately to also include: • Baseline plus DBS East; and • Baseline plus DBS West.	Noted, the modelling scenarios included in the assessment cover: • Baseline – no offshore wind farms present; • Baseline plus DBS West; • Baseline plus DBS East; and • Baseline plus DBS West and DBS East;
Natural England Comments on Marine Physical Process ETG 12/02/2024	
Intertidal Works (between MLWS and MHWS)	
Natural England is concerned about the changes in nearshore hydrodynamics, sediment transport pathways and concentration due to the proposed intertidal works associated with the cofferdams. Temporary cofferdams may lead to local blockage effects in the landfall area, interrupting local flows and waves which may also lead to local scouring around their base, subject to the erodibility of the seabed. Closely spaced cofferdams may also lead to interaction of wakes and develop group scour. We advise that configuration and separation between cofferdams is reviewed in order to reduce the impact on longshore transport. Consideration should also be given to where material removed from cofferdams	The Applicants have committed to not installing cofferdams in the exit pits to minimise any impact within the intertidal zone. Therefore, there will be no structures within the intertidal zone that could significantly interrupt sediment transport. For a single exit pit, the worst case scenario is that there would be an obstacle of only 20m extending across the intertidal zone. This has the potential to act as a short groyne-like structure, partially interrupting alongshore sediment transport. Assuming the worst case scenario, six exit pits will be constructed over a period up to 18 months

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and HDD pits will be placed. We advise that material from excavated HDD pits should be utilised for back filling. Furthermore, we advise that all realistic scenarios are considered and that the worst case scenario is clearly defined, taking into account factors such as the number of HDD exit pits and cofferdams likely to be open concurrently in the nearshore, potential shore parallel blockage, local scouring and sediment transport pathways.	separated by an alongshore distance of 50m. Each individual pit will be open for a maximum of four months within this period. One or more exit pits open during construction will provide an almost continuous barrier to sediment transport over a cross-shore width of 20m for up to 18 months. Evidence suggests that the most active zone for wave-driven sediment transport along the Holderness coast is the intertidal zone. In a study at Easington along south Holderness, HR Wallingford (2011) showed that most of the longshore transport from wave-breaking occurs close to the shoreline, within approximately 250m of the cliff line. Given the similar shore profile gradients at the landfall and Easington (East Riding of Yorkshire Council, 2014) the conclusion can be drawn that the active zone at the landfall is about 250m wide, similar in width to that at Easington. Given that longshore sediment transport from wave breaking occurs within approximately 250m of the cliff line, the length of obstruction caused by the exit pits is likely to be less than 8% of the active beach profile. Therefore, at landfall, of the vast majority of the predominantly southwards directed sediment transport will be able to bypass the exit pits around their seaward and landward flanks. Assuming a sediment transport rate of 100,000m^3/year (Sutherland et al., 2002), distributed evenly across the intertidal zone, would equate to 150,000m3 over the 18 months of exit pit placement. The presence of the exit pits would potentially obstruct approximately 12,000m^3 of mobile sediment over the 18-month period. This is a small amount compared to the overall volumes of sediment transport along the Holderness coast. If this sediment does deposit in the exit pits, it will be excavated and returned to the beach where it will once again be available for transport alongshore to the south.
In regard to UXO clearance modelling, we would welcome any evidence the Project is able to provide of successful low order campaigns to inform the Worst Case Scenario modelled. If evidence cannot be provided, high order clearance will need to be included in the assessment.	Acknowledged. UXO clearance if required, will be the subject of a separate Marine Licence post-consent.
Marine Physical Processes Numerical Modelling	
Worst Case Scenario We understand that the Project has modelled both the Option1 and 2 array layouts, but that Option 2 is to be taken forward for assessment. Natural England maintain our previous advice that Option 1 represents a more realistic worst case scenario (WCS) and advise that this option is presented in the assessment (in place of or alongside Option 2). We would also welcome further detail on which activities were used to inform the Maximum Design Scenario for sediment disturbance. Furthermore, it was confirmed during the ETG that offshore platforms within Dogger Bank SAC will be constructed using either monopile or pin-pile foundations rather than gravity base foundations. NE welcomes the removal of gravity base foundations from the Project envelope, but note that they have been included as the WCS in the marine processes modelling. Natural England acknowledges that this is	Both Options 1 and 2 array layouts have been modelled for potential changes to waves and tidal currents. The model outputs suggest that Option 2 is the worst case scenario for changes to both these parameters, in terms of changes to wave heights and changes to tidal current speeds/bed shear stress. The model results for both Options are presented in **Volume 7, Appendix 8-3 (application ref: 7.8.8.3).** At the time the modelling was undertaken, gravity based foundations were considered the worst case for offshore platforms located within the DBS Array Area only (a maximum of four structures per project). The modelling for wind turbine locations used monopile foundations (a maximum of 100 structures per project). Gravity based foundations were not modelled for these structures. Hence, GBS foundations were modelled for <4% of the structures considered within the

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due to the timing of the decision being made versus the modelling being run, and that the removal of gravity bases will reduce the impacts, however the WCS should be based on the Maximum Design Parameters of the project being applied for. We therefore advise that the modelling is rerun to reflect the realistic WCS. See below for further comment on this related to water circulation.	modelling exercise. Since completion of the modelling, a commitment has been made to not use gravity based foundations within the DBS Array Areas. Therefore, the 'modelled' worst case scenario for offshore platform foundations assessed in the ES is gravity bases, whereas the realistic worst case scenario relates to monopile foundations. The effects of gravity based foundations for the offshore platforms will be greater in magnitude compared to the effects that monopile foundations will have. Therefore, the modelling results using gravity bases as inputs present an over-estimate the effects of the offshore platforms. Hence, the actual effect of the offshore platforms in the DBS Array Areas will be less than the predicted effect for gravity based foundations. Given that there are a small number of offshore platforms (four for DBS East or DBS West in isolation or eight for DBS East and DBS West together) compared to wind turbines (100 for DBS East or DBS West in isolation or 200 for DBS East and DBS West together), it is not necessary or proportionate to update the modelling, as a worst case scenario has been modelled and any update to the models would present the most modest of differences in results in comparison to the results presented.
Water circulation and Flamborough Front We acknowledge that changes to water circulation (Flamborough Front) due to the presence of infrastructure will not be modelled. However, Natural England advises that interactions with the Flamborough Front are taken into account and assessed during the lifetime of the project including incombination with other projects. For further context, the impacts of the development of Hornsea Project Four on Flamborough Front was also a concern. We refer the Project to the following two submissions from the Hornsea Four Examination for further reference: EN010098-001741-Hornsea Project Four - Other- G5.33 Clarification Note on Marine Processes Mitigation and Monitoring.pdf (planninginspectorate.gov.uk) and https://infrastructure.planninginspectorate.gov.uk/wpcontent/ipc/uploads/projects/EN010098/EN010098-001971-Natural%20England%20-%20Comments%20on%20any%20submissions%20received%20at%20Deadline%206%202.pdf. Mitigation to reduce potential impacts would be the use of monopiles instead of gravity based solutions. As mentioned above, clarification on the worst-case scenario in terms of investigating the impact on Flamborough Front is required. Furthermore, due to the lack of knowledge of the response of the Flamborough Front to construction, Hornsea Project Four 4 committed to a monitoring plan to monitor impacts of stratification changes on Flamborough Front. It is recommended that this is also considered for Dogger Bank South. We refer you to Hornsea Project Four Offshore Wind Farm for further information and recommend recent research on this subject is investigated.	Interactions with the Flamborough Front are assessed in section 8.7.4.3 of the chapter: Changes to Water Circulation (Flamborough Front) Due to the Presence of Infrastructure (Wind Turbines and Offshore Platforms). Carpenter et al. (2016), Cazenave et al. (2016), and Schultze et al. (2020) investigated the potential large-scale impacts of wind farm turbine foundations on shelf sea stratification. These assessments were used as the evidence base to assess impacts of DBS on Flamborough Front, in a similar way to the Hornsea Project Four submissions. The worst case for foundations would be monopile foundations for wind turbines and offshore platforms within the Array Areas. These foundations are considered to have the greatest blockage effect and hence could create the greatest amount of turbulence.
Cable protection measures in the nearshore	

Comment	Project Response
It was stated in the ETG that cable protection may be required in localised areas and may be located between -9m and -10m LAT. As discussed during the ETG and previously advised (our ref 437845, dated 17 July 2023), Natural England do not support the use of cable protection within the 10m depth contour. Cable protection could act cumulatively to disrupt longshore sediment transport to the Humber Estuary and Spurn Point. This has been standard advice for ten years and is based on evidence provided for the Dogger Bank A&B OWF, and has subsequently been committed to for Hornsea Project Four, Eastern Green Link 2 and Northern Endurance. We recommend the Project investigate alternative installation methods as necessary to remove the need for cable protection. Further to this, slide 30 states that depth closure is based on a significant wave height of 6m based on Hornsea buoy wave data. The seaward limit of the wave driven littoral zone for longshore drift can be estimated by the theoretical "Inner – Depth of Closure". In addition, the "Outer – Depth of Closure" represents the seaward limit of the effect of wave shoaling. Based on standard expressions developed by Hallermeier (1983), and by applying relevant environmental parameters for waves and sediments, for Hornsea 4 the "Inner – Depth of Closure" is estimated to be a depth of 7m (below LAT) and the "Outer – Depth of Closure" is estimated to be a depth of 9m (below LAT). See Hornsea Project Four ES for further information. Furthermore, we advise that a Cable Burial Risk Assessment is provided as part of the Application to inform likely burial depth and protection requirements for the whole project.	Interpretation of the nearshore geophysical data has provided an estimate of the anticipated locations of cable protection that may be required in the nearshore subtidal area, approaching the Holderness coast. The data indicates that burial or trenching is likely to be achievable for >90% of the route from the mean low water spring tide level out to the 10m depth contour (approximately 1,050m from mean low water spring). The Applicants propose to commit to installing protection along no more than 10% of the cable length landward of the 10m depth contour. In addition, the Applicants have committed to installing no cable protection in the intertidal zone and from mean low water spring tide to 350m seaward of this tidal datum (included in the 90% above). At the landfall, the mean low spring tide line is about 130m seaward of the cliffs. This means that from the cliffs to approximately 480m seaward (across the intertidal zone and shallow subtidal zone), the cables will be buried and have no effect on coastal processes. The seaward limit which marks the effective boundary of wave-driven sediment transport is called the 'closure depth'. The magnitude of wave driven transport would decrease with distance offshore within the closure depth, with other evidence suggesting that the most active zone for wave-driven sediment transport along the Holderness coast is the intertidal zone. In a study at Easington along south Holderness, HR Wallingford (2011) showed that most of the longshore transport from wave breaking occurs close to the shoreline, within approximately 250m of the cliff line. Seaward of this, the wave-driven sediment transport is effectively zero. Given the similar shore profile gradients at the landfall and Easington (East Riding of Yorkshire Council, 2014) the conclusion can be drawn that the active zone at the landfall is similar in width to that at Easington. Hence, sediment transport driven by waves seaward of 250m from the cliffs at the landfall is very low (although still within the closure depth) and there will be no effect on these processes by the presence of the cable protection structures. The evidence shows that there will no interruption of wave-driven alongshore sediment supply to the beaches south of the landfall and to Spurn Head. This is because any export cables across the most active zone of wave-driven sediment transport will be buried (with the Applicants having committed to burial from the base of the cliffs to 480m offshore) and will have no effect on sedimentary processes. Further offshore, where the seabed is composed of mobile sand, it can be transported under existing tidal conditions. If the protection does present an obstruction to this bedload transport the sediment would first accumulate on one side or both sides of the obstacle (depending on the gross and net transport at that location) to the height of the protrusion (up to 1.4m in a worse case). With continued build-up, it would then form a 'ramp' over which sediment transport would eventually occur by bedload processes, thereby bypassing the protection. The gross patterns

Comment	Project Response
	of bedload transport across the export cables would therefore not be affected significantly.
Scour Protection and Measures	
We advise that the worst case scenario for scouring around infrastructure such as foundations and cofferdams be included in the EIA.	Scour protection around foundations will be installed where necessary. Therefore, there will be no scouring around these types of infrastructure. To note, the Applicants have committed to not installing cofferdams in the exit pits at the landfall.
PEIR Consultation, Dutch Reaction - Netherlands, with inputs provided by the Dutch Ministry of Infrastructure and Water Management, the Ministry of Economic Affairs and Climate Policy, and the Ministry of Agriculture, Nature and Food Quality (15/09/2023)	
Physical marine environment Regarding the physical marine environment we would like to note that according to the documentation provided, no direct transboundary ecosystem effects are expected. However, we feel the need to emphasise that transboundary effects cannot be ruled out solely based on the 40 km distance from the nearest EEZ boundary. This is especially true when considering indirect ecosystem effects. As such, we would like to bring to your attention ecosystem effect modelling studies by Deltares which show that ecosystem effects might be incurred over longerdistances than 40 km (see Annex for ecosystem effect modelling study from Deltares). Furthermore, there are indications that turbidity caused by construction has a more significant impact than thus far assumed. Sediment from the construction of one turbine might settle within a few days and therefore is not likely to create significant negative effects. However, a total of 200 wind turbines (100 per area) are planned to be constructed, which encompasses a large proportion of the entire construction period and may well have a more significant impact on turbidity than is assumed.	As noted in **Volume 7, Appendix 8-3 (application ref: 7.8.8.3)**, project specific modelling undertaken for the Projects details that the maximum extent of the sediment plume during peak tidal currents from installation activities reaches 18km from the Offshore Development Area. As such, there is no potential for transboundary effects resulting from the Projects.

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