DBS Offshore Wind

RWE Renewables UK Dogger Bank South (West) Limited

RWE Renewables UK Dogger Bank South (East) Limited

Dogger Bank South Offshore Wind Farms

Benthic Ecology Technical Note (Revision 2) (Clean)

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Revision Change Log

Rev No.	Page	Section	Description
01	N/A	N/A	Submission in response to relevant representations.
02	11	Glossary	Added in term for the Project Change Request 1.
02	15	1	Paragraph added to introduce the accepted Project change request.
02	15-16	1.1	Insert of section to clarify the Marine Physical Environment zone of influence to address response REP2-065:5.2 in **The Applicants' Responses to Deadline 2 Document** [document reference 13.3].
02	17	2.1.1	Clarification on the changes to the zone of influence which do not affect the assessment.
02	20	3.1.1	Clarification on the changes to the zone of influence which do not affect the assessment.
02	21	4.1.1	Clarification on the changes to the zone of influence which do not affect the assessment.
02	22	4.1.2	Correction of typographical error.
02	24	5.1.1.1.1	Addition of distance of the Offshore Export Cable Corridor from the Holderness Offshore MCZ, and text added to explain where the feature sensitivity to pressure range in Table 5-1 has been derived from.
02	26	5.1.1.1.2	Amendment of disposal sites and volumes to be disposed in line with the updated **Disposal Site Characterisation Report (Revision 2)** [REP2-035]
02	28	5.1.2.1.1	Text added to explain where the feature sensitivity to pressure range in Table 5-2 has been derived from.
02	31	5.1.3.1.1	Text added to explain where the feature sensitivity to pressure range in Table 5-3 has been derived from.
02	32	5.1.3.1.2	Addition of distance from the SAC added.
02	39	6	Minor text amendments.
02	40-41	References	Addition of two references.
02	43-86	Appendices	Appendix A to C added.

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Tables

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.
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.
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.
Coarse sediment	Sediment of grain diameter greater than 2mm.
Construction Buffer Zone	1km zone around the Array Areas and Offshore Export Cable Corridor, and 500m zone around the Inter-Platform Cabling Corridor. Construction vessels may occupy this zone but no permanent infrastructure would be installed within these areas.
Cumulative effects	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).
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

Term	Definition
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Statement (ES).
EIA Directive	The EU directive on the assessment of the effects of certain public and private projects on the environment (2011/92/EU as amended by 2014/52/EU)"
EIA Regulations	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.
Environmental Statement (ES)	A document reporting the findings of the EIA and produced in accordance with the EIA Directive as transposed into UK law by the EIA Regulations
Erosion	Wearing away of the land or seabed by natural forces (e.g. wind, waves, currents, chemical weathering).
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).
Habitats Regulations	Conservation of Habitats and Species Regulations 2017 and Conservation of Offshore Marine Habitats and Species Regulations 2017
Impact	Used to describe a change resulting from an activity via the Projects, i.e. increased suspended sediments /increased noise.
Inter-Platform Cable Corridor	The area where Inter-Platform Cables would route between platforms within the DBS East and DBS West Array Areas, should both Projects be constructed.
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.
Nearshore	The zone which extends from the swash zone to the position marking the start of the offshore zone (~20m).

Term	Definition
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.
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 Change Request 1	The changes to the DCO application for the Projects set out in **Project Change Request 1 - Offshore & Intertidal Works** [AS-141] which was accepted into Examination on 21st January 2025.
Receptor	A distinct part of the environment on which effects could occur and can be the subject of specific assessments. Examples of Receptors include species (or groups) of animals, plants, people (often categorised further such as 'residential' or those using areas for amenity or recreation), watercourses etc.
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.
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.
Sediment	Particulate matter derived from rock, minerals or bioclastic matter.
Sediment transport	The movement of a mass of sediment by the forces of currents and waves.
Sedimentation (Siltation)	The process by which sediment is mechanically deposited from suspension within a fluid, generally water, or ice, thereby accumulating as layers of sediment that are segregated owing to differences in size, shape, and composition of the sediment particles.
Short-term	Refers to a time period of months to years.
Significant wave height	The average height of the highest of one third of the waves in a given sea state.

Term	Definition
Special Area of Conservation (SAC)	Strictly protected sites designated pursuant to Article 3 of the Habitats Directive (via the Habitats Regulations) for habitats listed on Annex I and species listed on Annex II of the Directive
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 (Abu Dhabi Future Energy Company) - Masdar (49% stake).
The Projects	DBS East and DBS West (collectively referred to as the Dogger Bank South Offshore Wind Farms).
Tidal current	The alternating horizontal movement of water associated with the rise and fall of the tide.
Trenching	Open cut method for cable or duct installation.
Tunnel valley	Generally U-shaped valley(s) of glacial origin eroded out of sediment through subglacial process including meltwater drainage
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
DBS	Dogger Bank South
EIA	Environmental Impact Assessment
ES	Environmental Statement
HRA	Habitat Regulations Appraisal
JNCC	Joint Nature Conservation Committee
MarESA	Marine Evidence based Sensitivity Assessment
MCZ	Marine Conservation Zone
O&M	Operation and Maintenance
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
SSC	Suspended Sediment Concentration
ZoI	Zone of Influence

1 Introduction

1. This Benthic Ecology Technical Note has been prepared to address comments within the Applicants' **Responses to Natural England's Relevant Representation** [AS-048] (see RR-039: C15 and RR-039: C38) in relation to the request to provide further characterisation and assessment from an Environmental Impact Assessment (EIA) perspective of biotopes of the Flamborough Head Special Area of Conservation (SAC). Natural England's recommendations are listed below:

   - RR-039: C15: *Natural England advises that all benthic receptors within the Zone of Influence (ZoI), particularly those within designated sites, need to be sufficiently characterised to enable a robust, evidenced assessment to be undertaken and presented in light of EIA and Habitat Regulations Appraisal (HRA) requirements. In the absence of characterisation of benthic receptors at a suitable resolution, the worst-case scenario needs to be presented (e.g. most sensitive biotope within the broadscale habitat used as a basis for assessments).*
   - RR-039: C38: *Natural England advises that all benthic receptors within Flamborough Head SAC which are within the Zone of Influence, need to be sufficiently characterised to enable a robust, evidenced assessment to be undertaken and presented in light of HRA requirements. In the absence of characterisation of benthic receptors at a suitable resolution, the worst case scenario needs to be presented (e.g. most sensitivity biotope within the broadscale habitat used as a basis for assessments).*

2. For completeness to cover off all designated sites, an assessment of potential impacts of Dogger Bank South (DBS) East and DBS West ('the Projects') on the designated features of the Holderness Inshore Marine Conservation Zone (MCZ) and Holderness Offshore MCZ is also provided.

3. The assessment is informed by the assessments provided in the **Stage 1 MCZ Assessment (MCZA)** [APP-240] and the **Report to Inform Appropriate Assessment (RIAA) Part 2** [APP-046] and has been undertaken based on the description of the Projects provided within **Chapter 5 Project Description** [APP-071] of the Environmental Statement (ES). The assessment methodology and embedded mitigation measures relevant to this assessment are as described in **Chapter 9 Benthic and Intertidal Ecology** [APP-085] of the ES and are not repeated here.

4. The worst case scenario is summarised in Table 9-1, **Chapter 9 Benthic and Intertidal Ecology** [APP-085] and shows the worst case design parameters for likely significant effects based on design parameters in **Chapter 5 Project Description** [APP-071] of the ES.

5. The Applicants' submitted a change request to the Examining Authority, which was accepted into examination on the 21st January 2025. Table4-3 of **Project Change Request 1 – Offshore and Intertidal Works** [AS-141] details the changes to the benthic and intertidal ecology worst case scenario and effect significance. Both this document and the ES (**Chapter 9 Benthic and Intertidal Ecology** [APP-085]) should be read together. However, as a result of the change request, the significance of effect for all impacts was unchanged from what was presented in the ES.

1.1 Zone of Influence

6. This section has been included to add context regarding updates to the Zone of Influence (ZoI) in response to Natural England's comments [REP2-065] on **Chapter 8 Marine Physical Environment** [APP-080] and the response provided in **The Applicants' Responses to Deadline 2 Document** [document reference 13.3] (REP2-065:5.2).

7. The Zone of Influence (ZoI) used to inform this assessment was defined in **Chapter 8 Marine Physical Environment** [APP-080] using the outputs of the numerical modelling (see **Appendix 8-3 Marine Physical Processes Modelling Technical Report** [APP-084]). The ZoI was defined as 8km based on the maximum extent of the plume created during export cable installation in the surface layer. However, the maximum length of a tidal ellipse was 14km (off the coast of Flamborough Head). Therefore, the more conservative value of 14km was used to determine the search distance from the entire Development Consent Order boundary to screen receptors, noting the length of the tidal ellipse in the Array Areas was much lower at 2km.

8. **Appendix 8-3 Marine Physical Processes Modelling Technical Report** [APP-084] was updated at Deadline 2 as **Appendix 8-3 Marine Physical Processes Modelling Technical Report (Revision 3)** [REP2-017] and further detail was included in this version to show the extent of the plume at different levels in the water column (surface, middle and bottom layer) for three localities (Nearshore, Half way between shore and Offshore) (see Table 8-3-17 of **Appendix 8-3 Marine Physical Processes Modelling Technical Report (Revision 3)** [REP2-017]). These results show that the maximum extent of the plume occurs in the bottom layer close to the coast, where it can extend up to 28km. Using these updated values, 28km would be the maximum ZoI for changes in suspended sediment concentrations and seabed level due to cable installation in the nearshore. However, applying a 28km ZoI to the entire Offshore Development Area would not be appropriate as offshore the maximum plume size in the Array Areas is only 2km in the bottom layer. This 2km plume would be applicable to the Array Areas and 28km would be more applicable in the nearshore. The results of the plume dispersion modelling indicate therefore the application of a 14km ZoI offshore, based on the tidal ellipse, was a very conservative approach.

9. In the nearshore, if the ZoI was increased to 28km to represent the maximum plume extent in the bottom layer, this would not change the assessment as all the receptors included are located within 14km of the Offshore Development Area boundary in the nearshore (e.g. Flamborough Head, Holderness Inshore MCZ and Holderness Offshore MCZ) and all biotopes within these receptors are included in the assessment. No further receptors are brought into the assessment due to this change. Therefore, the outcome of this assessment would be the same for a 14km and 28km ZoI.

2 Holderness Offshore MCZ

2.1 Site Description

10. The Holderness Offshore MCZ is located approximately 11km offshore from the Holderness coast (Joint Nature Conservation Committee (JNCC), 2021). The seabed is dominated by subtidal coarse sediment and hosts subtidal sand, subtidal mixed sediments and part of a glacial tunnel valley. The diverse seabed allows for a wide variety of species which live both in and on the sediment such as, crustaceans (crabs and shrimp), starfish and sponges. This site is also a spawning and nursing ground for a range of fish species, including lemon sole *Microstomus kitt*, plaice *Pleuronectes platessa* and European sprat *Sprattus sprattus*. Therefore, the species living both in and on the sediment may benefit from the protection afforded to the habitat features within this site.

11. The slow growing (but widely occurring) bivalve, ocean quahog *Arctica islandica* has been found in the site. Ocean quahog is a threatened / declining species of bivalve mollusc that can take up to six years to reach maturity and can live for over 500 years.

2.1.1 Qualifying Features

12. Designation of this site as a MCZ protects the following features:

- Subtidal coarse sediment;
- Subtidal sand;
- Subtidal mixed sediments;
- Ocean quahog; and
- North Sea glacial tunnel valleys.

13. The Holderness Offshore MCZ lies outside of the Projects' Offshore Development Area, with the closest point where cable burial may take place being located 1.2km outside of the MCZ. Therefore, direct effects on its features will be avoided.

14. However, suspended Sediment Concentrations (SSCs) could increase in the vicinity of the Offshore Export Cable Corridor during cable installation (including seabed preparation), and operation and maintenance (O&M) activities. The maximum tidal excursion ellipse of 14km was used to define ZoI within **Chapter 8 Marine Physical Environment** [APP-080] and was used for the assessment on the Holderness Offshore MCZ features. The changes to the ZoI (see section 1.1) do not affect the assessment given the proximity of the MCZ to the Offshore Export Cable Corridor and the fact that all features of the MCZ were considered irrespective of their mapped location within the site.

15. Increased SSCs could result in potential indirect effects on the MCZ from increases in sediment deposition or deterioration in water quality. It is important to note that the bathymetry data and site surveys recorded no sandbanks or sand waves within the proximity of the MCZ, and therefore impacts are only assessed in relation to export cable trenching (i.e. sand wave levelling is not relevant at this location).

16. The impact of increased SSCs on the features of the Holderness Offshore MCZ is assessed in section 5.1.1 for construction and section 5.2.1 for operation.

2.1.2 Conservation Objectives

17. The conservation objectives for the Holderness Offshore MCZ are that the protected features:

- So far as already in favourable condition, remain in such condition; and
- So far as not already in favourable condition, be brought into such condition, and remain in such condition.

18. With respect to subtidal coarse sediment, subtidal sand and subtidal mixed sediments within the MCZ, this means that:

- Its extent is stable or increasing; and
- Its structures and functions, its quality, and the composition of its characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or inhabiting that habitat) are such as to ensure that it remains in a condition which is healthy and not deteriorating.

19. With respect to ocean quahog within the MCZ, this means that the quality and quantity of its habitat and the composition of its population in terms of number, age and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive. Any temporary reduction of numbers is to be disregarded if the population is sufficiently thriving and resilient to enable its recovery. Any alteration to that feature brought about entirely by natural processes is to be disregarded.

20. With respect to the North Sea glacial tunnel valleys within the MCZ, this means that:

- Its extent, component elements and integrity are maintained.
- Its structure and functioning are unimpaired.
- Its surface remains sufficiently unobscured for the purposes of determining whether the conditions detailed in the above bullets are satisfied.

21. Any obscurement or alteration of that feature brought about entirely by natural processes is to be disregarded (JNCC, 2021).

3 Holderness Inshore MCZ

3.1 Site Description

22. The Holderness Inshore MCZ is located north of the Humber estuary mouth (Defra, 2016). The seabed in this site is comprised of rock, sand, mud and sediment. The mosaic of habitats within the site supports a diverse range of organisms including red algae, sponges and other encrusting fauna. The site also supports fish species such as European eel *Anguilla anguilla*, dab *Limanda limanda* and wrasse *Labridae*, as well as commercially significant crustaceans such as edible crab *Cancer pagurus* and velvet swimming crabs *Necora puber* and lobster *Nephropidae*.

23. Partly above the water, the sandy beaches of intertidal sand and muddy sand are uncovered at low tide. These beaches are home to many species, buried in the damp sand.

24. The Projects' Offshore Export Cable Corridor is located 0.1km from the Holderness Inshore MCZ although the Construction Buffer Zone overlaps the MCZ by approximately 400m. Construction vessels may occupy this area, but no construction would occur within this area. The Applicants' committed pre-application to not using jack-up vessels within the MCZ (see **Draft DCO** [APP-027] and Table 9-3 Embedded Mitigation of **Chapter 9 Benthic and Intertidal Ecology** [APP-085]). In response to the Marine Management Organisation's Relevant Representation (RR-030: 4.15.1) (**The Applicants' Response to Relevant Representations** [PDA-013]), the Applicants have amended this commitment to also include anchoring.

3.1.1 Qualifying Features

25. Designation of this site as a MCZ protects the following features:

- Intertidal sand and muddy sand;
- Moderate energy circalittoral rock;
- High energy circalittoral rock;
- Subtidal coarse sediment;
- Subtidal mixed sediments;
- Subtidal sand;
- Subtidal mud; and
- Spurn Head (subtidal).

26. There is no overlap with the Holderness Inshore MCZ and the Projects' landfall and permanent burial corridor within the Offshore Export Cable Corridor, with the closest point where cable burial may take place being located 0.1km outside of the MCZ. In addition, as the Applicants have committed to no jack-up or anchoring activities taking place within the boundary of the Holderness Inshore MCZ, there is no longer a pathway for direct effects.

27. As noted above for the Holderness Offshore MCZ (section 2.1.1), SSCs could increase in the vicinity of the Offshore Export Cable Corridor during cable installation (including seabed preparation), and O&M activities. In addition, there is the potential during O&M for changes to bedload sediment transport to occur due to the placement of Offshore Export Cable protection within the Offshore Export Cable Corridor.

28. A ZoI of 14km, based on the maximum tidal ellipse (**Chapter 8 Marine Physical Environment** [APP-080]), was used for the assessment on the Holderness Inshore MCZ features. The changes to the ZoI (see section 1.1) do not affect the assessment given the proximity of the MCZ to the Offshore Export Cable Corridor and the fact that all features of the MCZ were considered irrespective of their mapped location within the site.

29. The impact of increased SSCs and changes in bedload sediment transport on the features of the Holderness Inshore MCZ is assessed in section 5.1.2 for construction and section 5.2.2 for operation.

3.1.2 Conservation Objectives

30. The overarching conservation objective for the site is for its designated features to be maintained in 'favourable condition'. For each broadscale marine habitat, favourable condition means that, within an MCZ:

- Its extent is stable or increasing; and
- Its structure and functions, its quality, and the composition of its characteristic biological communities (including diversity and abundance of species forming part or inhabiting the habitat) are sufficient to ensure that its condition remains healthy and does not deteriorate.

31. Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery.

32. Any alteration to a feature brought about entirely by natural processes is to be disregarded when determining whether a protected feature is in favourable condition (Natural England, 2024).

4 Flamborough Head SAC

4.1 Site Description

33. The Flamborough Head SAC is designated for the Annex I habitats 'Reefs', 'Vegetated sea cliffs of the Atlantic and Baltic Coasts' and 'Submerged or partially submerged sea caves'. Of the designated habitats for the SAC, those of interest in relation to potential indirect effects from the Projects' activities are the areas of reef.

34. The clarity of the relatively unpolluted sea water and the hard nature of the extensive sublittoral chalk habitat have enabled kelp *Laminaria hyperborea* forests to become established in the shallow sublittoral zone. The reefs to the north of the site support a different range of species from those on the slightly softer and more sheltered south side of the headland. The site supports an unusual range of marine species and includes rich animal communities and some species that are at the southern limit of their North Sea distribution, e.g. the northern alga *Ptilota plumosa* (JNCC, 2018).

4.1.1 Qualifying Features

35. The site is designated under article 4(4) of the Directive (92/43/EEC) for the following relevant Annex I habitats:

- Reefs;
- Submerged or partially submerged sea caves; and
- Vegetated sea cliffs of the Atlantic and Baltic Coasts.

36. There is no overlap with the Flamborough Head SAC and the Projects' Offshore Development Area, with the closest point where cable burial may take place being located 3.5km outside of the SAC. Therefore, direct effects on its features will be avoided.

37. As noted above for the Holderness MCZs (section 2.1.1 and section 3.1.1), SSCs could increase in the vicinity of the Offshore Export Cable Corridor during cable installation activities (including seabed preparation). A ZoI of 14km, based on the maximum tidal ellipse (**Chapter 8 Marine Physical Environment** [APP-080]), was used for the assessment on the Flamborough Head SAC features. The changes to the ZoI (see section 1.1) do not affect the assessment given the proximity of the SAC to the Offshore Export Cable Corridor and the fact that all subtidal features of the SAC were considered irrespective of their mapped location within the site. Given that any increased SSCs and subsequent deposition would manifest in the subtidal area only, there is no potential for impact on the 'Vegetated sea cliffs of the Atlantic and Baltic Coasts' feature of the SAC and it is therefore not considered further.

38. The impact of increased SSCs on the features of the Flamborough Head SAC is assessed in section 5.1.3 for construction and section 5.2.3 for operation.

4.1.2 Conservation Objectives

39. With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed above), and subject to natural change the conservation objectives as described in Natural England (2018) are to:

- Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:
  - The extent and distribution of qualifying natural habitats;
  - The structure and function (including typical species) of qualifying natural habitats; and
  - The supporting processes on which qualifying natural habitats rely.

5 Assessment of Significance

5.1 Potential Effects during Construction

5.1.1 Holderness Offshore MCZ

5.1.1.1 Increased Suspended Sediment Concentrations (including Sediment Deposition and Smothering) during Export Cable Installation

40. Temporary increases in SSCs within the water column, and subsequent deposition onto the seabed, may occur as a result of cable installation activities, including seabed preparation. Activities such as seabed disturbances from jack-up vessels and placement of cable protection are not expected to increase SSCs to an extent that would result in a measurable effect on the MCZs' features. Section 8.7.3.3 of **Chapter 8 Marine Physical Environment** [APP-080] provides details of changes to SSCs and subsequent sediment disposition.

41. It is important to note that the Projects' Offshore Development Area does not overlap with the Holderness Offshore MCZ, with the nearest point where cable burial could take place being along the Offshore Export Cable Corridor, located 1.2km north-west of the site. However, due to the potential distance of sediment being transported in the water column, the following broadscale marine habitat features could be affected by increased SSCs and subsequent deposition during construction:

- Subtidal coarse sediment (A5.1);
- Subtidal sand (A5.2);
- Subtidal mixed sediments (A5.4); and
- Ocean Quahog.

42. There is currently no advice available regarding the sensitivity of North Sea glacial tunnel valleys to the pressures of offshore wind and power cable development. The North Sea glacial tunnel valleys are geological features characterised as curved sub-linear seabed depressions generally considered to have been formed by subglacial erosion and sediment backfill beneath the outer margins of a receding ice sheet (Pearce *et al.*, 2012). Due to their status as a geological rather than ecological feature, it is considered that the tunnel valleys would not be sensitive to the effects of increased SSCs. As such, based on professional judgement this feature has been screened out of the assessment.

5.1.1.1.1 Sensitivity of Receptor

43. The sensitivities of the habitats discussed above have been assessed in relation to Marine Evidence based Sensitivity Assessment (MarESA) pressures relevant to construction phase increased SSC and deposition. The relevant pressures are:

- Changes in suspended solids (water clarity); and
- Smothering and siltation rate changes (light).

44. As noted in the MarESA pressures and benchmarks on smothering and siltation rate changes, light siltation rate changes are defined as up to 5cm of fine material added to the habitat in a single, discrete event (MarLIN, 2024). Due to the distance of the Holderness Offshore MCZ from the point of sediment disturbance during Offshore Export Cable Corridor installation (1.2km), any sediment deposition within the site resulting from the Projects would be below 5cm in depth. Therefore, no heavy smothering and siltation rate changes would occur as a result of the Projects' Offshore Export Cable Corridor installation activities.

45. Appendix A (**Table A-1** to **Table A-6**) details each of the biotopes and species that comprise the qualifying features detailed in paragraph 37. The MarESA sensitivity (Tyler-Walters *et al.* 2023), based on resistance and resilience, to the impact pressure pathway is also shown. This has been used to inform the pressure range presented in **Table 5-1.** The receptors shown in **Table 5-1** range from 'Not Sensitive' to 'Low' sensitivity (Last *et al.*, 2020), with the highest sensitivity being used to inform the assessment below. Therefore, these biotopes and species will not be affected by, or will recover rapidly from, increased SSCs and subsequent deposition.

Table 5-1 Sensitivity of Biotopes and Species in the Holderness Offshore MCZ to Increased Suspended Sediments (Last *et a*l., 2020)

Receptor	Feature Sensitivity to pressure range
Impact pressure pathway: Changes in suspended solids (water clarity)	
Subtidal coarse sediment (A5.1)	Not sensitive – Low
Subtidal sand (A5.2)	Not sensitive – Low
Subtidal mixed sediments (A5.4)	Not sensitive – Low
Ocean Quahog	Not sensitive
Impact pressure pathway: Smothering and siltation rate changes (light)	
Subtidal coarse sediment (A5.1)	Not sensitive – Low
Subtidal sand (A5.2)	Not sensitive – Low
Subtidal mixed sediments (A5.4)	Not sensitive – Low
Ocean Quahog	Not sensitive

46. Regarding the ocean quahog feature, MarESA describes its sensitivity to the physical pressure of 'changes in suspended solids (water clarity)' and 'smothering and siltation rate changes (light)' as 'Not Sensitive', and therefore any impact on ocean quahog would not be significant and is not considered further.

5.1.1.1.2 Magnitude of Impact

47. As detailed in **Chapter 8 Marine Physical Environment** [APP-080], regional mapping of seabed sediments along the Offshore Export Cable Corridor transition from coarser mixed sediments (sandy gravel and gravelly sand) in the nearshore area, to sand-dominated sediments approaching the Array Areas.

48. It is expected that the coarser sediment found along the Offshore Export Cable Corridor will settle rapidly to the seabed following disturbance, and close to the point of disturbance. The finer sand that comprises the majority of the Array Areas, Inter-Platform Cabling Corridor, and easterly extremes of the Offshore Export Cable Corridor, may stay in suspension within the water column for a longer period of time. Any released fine material will form a plume which would become advected by tidal currents. It is expected that the maximum predicted deposition resulting from a sediment plume will be an average of 1-5mm within 10km of the disturbance. This conceptual evidence-based assessment is supported by the findings of a review of the evidence base into the physical impacts of marine aggregate dredging on sediment plumes and seabed deposits (Whiteside *et al*. 1995; John *et al*. 2000; Hiscock and Bell, 2004; Newell *et al*. 2004; Tillin *et al*. 2011).

49. Based on the modelling undertaken for **Chapter 8 Marine Physical Environment** [APP-080], maximum SSCs due to seabed levelling are predicted to reach up to 5mg/l within 1km of the Offshore Export Cable Corridor with values returning to background levels within 5-7km from the area of disturbance. The plume is expected to persist for a period of two to four hours. The maximum predicted deposition resulting from seabed levelling will be <3cm spatially restricted to within the Offshore Export Cable Corridor.

50. During trenching of the Offshore Export Cable Corridor, SSCs are predicted to reach up to 1,000 – 1,500mg/l, in localised hot spots within the Offshore Export Cable Corridor. However, the extent of the sediment plume differs due to greater variability in tidal currents along the entire length of the Offshore Export Cable Corridor. Closer inshore, and nearer to the MCZ, the extent of the plume may reach 18km due to stronger tidal currents. In the very nearshore part of the Offshore Export Cable Corridor, the plume is much more limited in extent and restricted to within 2km of the point of disturbance. This is likely due to the sheltering effect of Flamborough Head with tidal currents being much lower in the nearshore. While the predicted plume can extend kilometres from the point of disturbance, the changes in SSCs over these distances are small, typically below 1mg/l, persisting for a period of hours. The maximum predicted deposition resulting from trenching will be up to 5cm within and immediately adjacent to the area of trenching, with a maximum change of up to 0.25m occurring in localised hotspots.

51. The maximum predicted deposition resulting from trenching along the Offshore Export Cable Corridor will be up to 5cm within and immediately adjacent to the area of trenching, with a maximum change of up to 0.25m occurring in localised hotspots. Table 8-1 of **Chapter 8 Marine Physical Environment** [APP-080] summarises the worst case volume of sediment displaced.

52. Dredged material from sand wave levelling during the construction process will be disposed at a site or sites agreed during Examination. However, three disposal sites have been proposed within the **Disposal Site Characterisation Report (Revision 2)** [REP2-035] which are defined as the boundaries of each Array Area and the Offshore Export Cable Corridor. The volumes for disposal within the Offshore Export Cable Corridor will be equivalent to a worst case of 33,720,724m³ for DBS East in isolation and 29,901,823m³ for DBS West in isolation or 63,734,551m³ for the Projects together (see **Disposal Site Characterisation Report** [APP-242]). Such redeposition of dredged material will occur over the course of the entire offshore construction period (5 years). In addition, disposal will occur over a large area, for example Dogger Bank C and Sofia were granted a disposal licence across the entirety of their respective Array Areas. As such, it can be expected that redeposition of dredged material for the Projects will disperse over a large area and, thus, will settle at a minimal depth over the existing seabed.

53. Overall, increases in SSCs are expected to be localised and short-term. Fine suspended sediment may be transported a further distance than coarse sediments. However, this is likely to be widely and rapidly dispersed and within the range of natural variability within the region. Also, once installation is complete, tidal currents are likely to rapidly disperse the suspended sediment (i.e. over a period of a few hours) in the absence of any further sediment input.

54. In summary, the maximum predicted deposition resulting from trenching will be within and immediately adjacent to the area of trenching, outside of the MCZ. Deposition within the MCZ is likely to be restricted to fine sediments only with deposition of up to 5mm. Increases in SSCs are expected to be composed of fine sediments. Deposition will be localised and short-term and will be widely and rapidly dispersed. Deposition will be within the range of natural variability within the region. Based on the above, the magnitude of impact is considered to be negligible.

5.1.1.1.3 Significance of Effect

55. Due to the negligible magnitude of impact and 'Not sensitive' to 'Low' sensitivity of biotopes for increased SCCs, the effect is considered to be of **negligible** significance, which is not significant in EIA terms.

56. No additional mitigation is proposed due to the negligible adverse significance of effect. The overall confidence in this assessment is medium (as per MarESA), due to the mix of high and low confidence in assessments for the described biotopes.

5.1.2 Holderness Inshore MCZ

5.1.2.1 Increased Suspended Sediment Concentrations (including Sediment Deposition and Smothering) during Export Cable Installation

57. Increased SSCs effects on the Holderness Inshore MCZ are similar to those discussed in section 5.1.1.1 for the Holderness Offshore MCZ.

58. As mentioned in section 3.1.1, there is no overlap with the Projects' Offshore Export Cable Corridor. However, due to the potential distance of sediment being transported in the water column, the qualifying features of the site could be affected by temporary increases in SSCs and subsequent deposition during construction. Tidal currents close to the Holderness coast and in the Holderness Inshore MCZ run approximately parallel to the coast in a north-south direction. Closer inshore, near the MCZ, the extent of any plumes could reach 18km due to stronger tidal currents. The maximum predicted deposition resulting from trenching will be up to 5cm within and immediately adjacent to the area of trenching, with a maximum change of up to 0.25m occurring in localised hotspots.

59. There is currently no advice available regarding the sensitivity of Spurn Head (subtidal) to the pressures of offshore wind and power cable development. Due to its status as a geological rather than ecological feature, it is considered that the Spurn Head would not be sensitive to the effects of increased SSCs. As such, based on professional judgement this feature has been screened out of the assessment.

5.1.2.1.1 *Sensitivity of Receptor*

60. The sensitivities of the habitats protected within the MCZ have been assessed in relation to MarESA pressures relevant to construction phase increased SSC and deposition. The relevant pressures are:

- Changes in suspended solids (water clarity); and
- Smothering and siltation rate changes (light).

61. As noted in section 5.1.1.1.1, heavy smothering and siltation rate changes will not occur within the Holderness Inshore MCZ as a result of the Projects' installation construction activities.

62. Appendix A (Table B-1 to Table B-14) details each of the biotopes and species that comprise the qualifying features detailed in section 3.1.1. The MarESA sensitivity (Tyler-Walters *et al.* 2023), based on resistance and resilience, to the impact pressure pathway is also shown. This has been used to inform the pressure range presented in **Table 5-2**. The Natural England 'Designated Sites View – Advice on Operations' (Natural England, 2024a) has been used to identify the pressures associated with 'Power cable: laying burial and protection'. This activity was selected as installation of export cables is the relevant construction activity for the Holderness Inshore MCZ.

63. The majority of receptors shown in **Table 5-2** are considered to range from 'Not Sensitive' to 'Low' sensitivity, with the highest sensitivity being used to inform the assessment below. Therefore these habitats and biotopes will not be affected by, or will recover rapidly from an increase in SSCs and subsequent deposition.

64. The exception is Subtidal mixed sediments (A5.4) which have a Medium sensitivity to light smothering and siltation rate changes. For the Holderness Inshore MCZ, this general habitat classification encompasses two biotopes (Natural England, 2024):

- *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment (A5.445); and
- *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment.

65. The *F. foliacea* and *H. falcata* biotope is Not Sensitive to light smothering and siltation rates and is not considered further, whereas the *O. fragilis* and *O. nigra* has a Medium sensitivity. Excessive sedimentation may block brittlestar feeding apparatus (tube feet and arm spines) reducing feeding (De-Bastos & Hill, 2016).

Table 5-2 Sensitivity of Habitats and Biotopes in the Holderness Inshore MCZ to Increased Suspended Sediments (Natural England, 2024)

Receptor	Feature Sensitivity to pressure range
Impact pressure pathway: Changes in suspended solids (water clarity)	
Moderate energy circalittoral rock	Not sensitive - Low

Receptor	Feature Sensitivity to pressure range
High energy circalittoral rock	Not sensitive
Intertidal sand and muddy sand (A2.2)	Not sensitive - Low
Subtidal coarse sediment (A5.1)	Not sensitive - Low
Subtidal mixed sediments (A5.4)	Not sensitive
Subtidal sand (A5.2)	Not sensitive - Low
Subtidal mud (A5.3)	Not sensitive - Low
Impact pressure pathway: Smothering and siltation rate changes (light)	
Moderate energy circalittoral rock	Not sensitive - Low
High energy circalittoral rock	Not sensitive - Low
Intertidal sand and muddy sand (A2.2)	Not sensitive - Low
Subtidal coarse sediment (A5.1)	Not sensitive - Low
Subtidal mixed sediments (A5.4)	Not sensitive - Medium
Subtidal sand (A5.2)	Not sensitive - Low
Subtidal mud (A5.3)	Not sensitive - Low

5.1.2.1.2 Magnitude of Impact

66. As described in section 5.1.1.1.2, overall increases in SSCs are expected to be localised and short-term. Fine suspended sediment may be transported a further distance than coarse sediments. However, this is likely to be widely and rapidly dispersed and within the range of natural variability within the region. Also, once export cable installation is complete, tidal currents are likely to rapidly disperse the suspended sediment (i.e. over a period of a few hours) in the absence of any further sediment input.

67. In summary, the maximum predicted deposition resulting from trenching will be within and immediately adjacent to the area of trenching, outside of the MCZ. Deposition within the MCZ is likely to be restricted to fine sediments only with deposition of up to 5mm. Increases in SSCs are expected to be composed of fine sediments and localised and short-term and widely and rapidly dispersed and within the range of natural variability within the region. Based on the above, the magnitude of impact is considered to be negligible.

5.1.2.1.3 Significance of Effect

68. Due to the negligible magnitude of impact and 'Not sensitive' to 'Low' sensitivity of the majority of biotopes and habitats within the Holderness Inshore MCZ to increased SCCs, the effect is considered to be of **negligible** significance.

69. However, the brittlestar biotope encompassed within Subtidal mixed sediments (A5.4) has a Medium sensitivity. As described in section 5.1.2.1.2 above, in areas of high water flow, fine sediments are likely to be rapidly dispersed which would mitigate the magnitude of this pressure by reducing the time exposed. Therefore with a negligible magnitude of impact and a Medium sensitivity, the significance of effect is considered to be of **minor adverse** (at worst), which is not significant in EIA terms. No additional mitigation is proposed due to the minor adverse significance of effect. The overall confidence in this assessment is medium (as per MarESA), due to the mix of high, medium and low confidence in assessments for the described biotopes and habitats.

5.1.3 Flamborough Head SAC

5.1.3.1 Increased Suspended Sediment Concentrations (including Sediment Deposition and Smothering) during Export Cable Installation

70. As described in sections 5.1.1 and 5.1.2, temporary increases in SSCs within the water column, and subsequent deposition onto the seabed, may occur as a result of cable installation activities (including seabed preparation).

71. The Projects' Offshore Development Area does not overlap with the Flamborough Head SAC, with the closest point where cable burial may take place being located 3.5km outside of the SAC. Therefore, there is no pathway for direct impacts to occur. However, due to the potential distance of sediment being transported in the water column, the qualifying features listed in section 4.1.1 could be affected by temporary increases in SSCs and subsequent deposition during construction.

5.1.3.1.1 Sensitivity of Receptor

72. The sensitivity of the habitats protected within the site have been assessed in relation to MarESA pressures relevant to construction phase increased SSCs and deposition. The relevant pressures are:

- Changes in suspended solids (water clarity); and
- Smothering and siltation rate changes (light).

73. As noted in section 5.1.1.1.1, heavy smothering and siltation rate changes will not occur within the Flamborough Head SAC as a result of the Projects' installation construction activities.

74. Appendix A (**Table C-1** to **Table C-6**) details each of the biotopes and species that comprise the qualifying features detailed in section 4.1.1. The MarESA sensitivity (Tyler-Walters *et al.* 2023), based on resistance and resilience, to the impact pressure pathway is also shown. This has been used to inform the pressure range presented in **Table 5-3**. The Natural England 'Designated Sites View – Advice on Operations' (Natural England, 2024a) has been used to identify the pressures associated with 'Power cable: laying burial and protection'. This activity was selected as installation of export cables is the relevant construction activity for the Holderness Inshore MCZ.

75. The receptors shown in **Table 5-3** are considered to range from 'Not Sensitive' to 'Medium' sensitivity with the highest sensitivity being used to inform the assessment below. 'Submerged or partially submerged sea caves' are considered to range from Not sensitive to Low sensitivity, therefore this habitat will not be affected by, or will recover rapidly from an increase in SSCs and subsequent deposition.

76. However, the Annex 1 Reefs of intertidal rock and infralittoral rock have a Medium sensitivity to changes in suspended solids, and intertidal rock and circalittoral rock have Medium sensitivity to light smothering and siltation rate changes. The reef habitat found within the Flamborough Head SAC has been selected as a qualifying feature due to the presence of species associated with the chalk and for the site's location at the southern limit of distribution of several northern species. Communities typically associated with this habitat are known to be tolerant of increased SSCs as the combination of strong tides, wave action and chalk make the shallow waters around the base of the cliffs especially turbid (Howson *et al.*, 2002)

Table 5-3 Sensitivity of Annex 1 Habitats in the Flamborough Head SAC to Increased Suspended Sediments (Natural England, 2024)

Receptor	Feature Sensitivity to pressure range
Impact pressure pathway: Changes in suspended solids (water clarity)	
Reefs - Intertidal Rock	Not sensitive - Medium
Reefs - Infralittoral Rock	Not sensitive - Medium
Reefs - Circalittoral Rock	Not sensitive - Low
Submerged or partially submerged sea caves	Not sensitive - Low
Impact pressure pathway: Smothering and siltation rate changes (light)	
Reefs - Intertidal Rock	Not sensitive - Medium
Reefs - Infralittoral Rock	Not sensitive - Low

Receptor	Feature Sensitivity to pressure range
Reefs - Circalittoral Rock	Not sensitive - Medium
Submerged or partially submerged sea caves	Not sensitive - Low

5.1.3.1.2 Magnitude of Impact

77. As described in section 5.1.1.1.2, the overall increases in SSCs are expected to be localised and short-term. Fine suspended sediment may be transported a further distance than coarse sediments. However, this is likely to be widely and rapidly dispersed and within the range of natural variability within the region. Also, once export cable installation is completed, tidal currents are likely to rapidly disperse the suspended sediment (i.e. over a period of a few hours) in the absence of any further sediment input.

78. In summary, the maximum predicted deposition resulting from trenching will be within and immediately adjacent to the area of trenching, i.e. 3.5km from the SAC. Deposition within the SAC is likely to be restricted to fine sediments only with deposition of up to 5mm. Increases in SSCs are expected to be composed of fine sediments and localised and short-term and widely and rapidly dispersed and within the range of natural variability within the region. Based on the above, the magnitude of impact is considered to be negligible.

5.1.3.1.3 Significance of Effect

79. Based on a sensitivity of 'Not sensitive' to 'Low' and a magnitude of impact of negligible, the overall significance of increased SSCs on 'Submerged or partially submerged sea caves' feature is **negligible**.

80. However, the 'Reef' (i.e. intertidal rock, infralittoral rock and circalittoral rock) features of the Flamborough Head SAC have a higher sensitivity to increased SSCs of Medium. As described in section 5.1.3.1.2 above, in areas of high water flow, fine sediments are likely to be rapidly dispersed which would mitigate the magnitude of this pressure by reducing the time exposed. Therefore, with a negligible magnitude of impact and a Medium sensitivity, the significance of effect is considered to be of **minor adverse** significance (at worst) which is not significant in EIA terms.

81. No additional mitigation is proposed due to the minor adverse significance of effect. The confidence in this assessment is medium (as per MarESA), due to the mix of high, medium and low confidence in assessments for the described habitats.

5.2 Potential Effects during Operation

5.2.1 Holderness Offshore MCZ

5.2.1.1 Increased Suspended Sediment Concentrations (including Sediment Deposition and Smothering) during Export Cable Maintenance

82. As with the impact of increased SSCs during construction (section5.1.1.1), impacts may occur as a result of O&M activities that require the use of jack-up vessels, as well as cable repair, replacement and reburial activities. These activities are not expected to increase SSC to the extent which there could potentially be a significant effect on benthic ecology receptors. The volume of sediment disturbed would be extremely small in comparison to construction. Table 9-1 of **Chapter 9 Benthic and Intertidal Ecology** [APP-085] summarises the worst case volume of sediment displaced.

5.2.1.1.1 Sensitivity of Receptor

83. Features within the Holderness Offshore MCZ as described in **Table 5-1**, are considered to range from 'Not sensitive' to 'Low' sensitivity. Therefore, these biotopes will not be affected by or will recover rapidly from increased SSCs and subsequent deposition.

5.2.1.1.2 Magnitude of Impact

84. As described for the construction phase in section 5.1.1.1.2, the magnitude of impact during construction would be negligible. Any impact during operation would likely be less than that during construction and a magnitude of impact of negligible is therefore assigned for operation.

5.2.1.1.3 Significance of Effect

85. Based on a sensitivity of 'Not sensitive' to 'Low' and a magnitude of impact of negligible, the overall significance of increased SSCs during operation in the Holderness Offshore MCZ is **negligible**, which is not significant in EIA terms.

86. No additional mitigation is proposed due to the negligible adverse significance of effect. The confidence in this assessment is high (as per MarESA) for the described biotopes.

5.2.2 Holderness Inshore MCZ

5.2.2.1 Increased Suspended Sediment Concentrations (including Sediment Deposition and Smothering) during offshore export cable maintenance

87. As with the impact of increased SSCs during construction (section 5.1.2.1), impacts may occur as a result of O&M activities that require the use of jack-up vessels, as well as cable repair, replacement and reburial activities. These activities are not expected to increase SSC to the extent where there could potentially be a significant effect to benthic ecology receptors. The volume of sediment disturbed would be extremely small in comparison to that disturbed during construction. Table 9-1 of **Chapter 9 Benthic and Intertidal Ecology** [APP-085] summarises the worst case volume of sediment displaced.

5.2.2.1.1 Sensitivity of Receptor

88. The majority of features within the Holderness Inshore MCZ as described in **Table 5-2** are considered to range from 'Not sensitive' to 'Low' sensitivity. Therefore, these biotopes and habitats will not be affected by, or will recover rapidly from increased SSCs and subsequent deposition. The exception is Subtidal mixed sediments (A5.4) which have a Medium sensitivity to light smothering and siltation rate changes.

5.2.2.1.2 Magnitude of Impact

89. As described for the construction phase in section 5.1.2.1.2, the magnitude of impact for construction would be negligible. Any impact during operation would likely be less than that during construction and a magnitude of impact of negligible is therefore assigned for operation.

5.2.2.1.3 Significance of Effect

90. Due to the negligible magnitude and 'Not sensitive' to 'Low' sensitivity of the majority of biotopes and habitats within the Holderness Inshore MCZ to increased SCCs, the effect is considered to be of **negligible** significance, which is not significant in EIA terms.

91. However, subtidal mixed sediments (A5.4) has a Medium sensitivity, this combined with a negligible magnitude of impact results in a minor adverse significance, which is not significant in EIA terms.

92. No additional mitigation is proposed due to the negligible adverse significance of effect. The overall confidence in this assessment is medium (as per MarESA), due to the mix of high, medium and low confidence in assessments for the described biotopes and habitats.

5.2.3 Flamborough Head SAC

5.2.3.1 Increased Suspended Sediment Concentrations (including Sediment Deposition and Smothering) during Export Cable Maintenance

93. As with the impact of increased SSCs during construction (section 5.1.3.1), impacts may occur as a result of O&M activities that require the use of jack-up vessels, as well as cable repair, replacement and reburial activities. These activities are not expected to increase SSC to the extent which there could potentially be a significant effect to benthic ecology receptors. The volume of sediment disturbed would be extremely small in comparison Table 9-1 of **Chapter 9 Benthic and Intertidal Ecology** [APP-085] summarises the worst case volume of sediment displaced.

5.2.3.1.1 Sensitivity of Receptor

94. The sensitivity of receptors within the Flamborough Head SAC is described in **Table 5-3**. 'Submerged or partially submerged sea caves' are considered to be 'Not sensitive' to 'Low' sensitivity, and therefore will not be affected by, or will recover rapidly from increased SSCs and subsequent deposition.

95. However, the Annex 1 Reefs of intertidal rock and infralittoral rock have a Medium sensitivity to changes in suspended solids, and intertidal rock and circalittoral rock have Medium sensitivity to light smothering and siltation rate changes.

5.2.3.1.2 Magnitude of Impact

96. As described for the construction phase in section 5.1.3.1.2, the magnitude of impact for construction would be negligible. Any impact during operation would likely be less than that during construction and a magnitude of impact of negligible is therefore assigned for operation.

5.2.3.1.3 Significance of Effect

97. Due to the negligible magnitude and 'Not sensitive' to 'Low' sensitivity of 'Submerged or partially submerged sea caves' feature to increased SSCs, the effect is considered to be of **negligible** significance.

98. However, the 'Reef' (i.e. intertidal rock, infralittoral rock and circalittoral rock) features of the Flamborough Head SAC have a higher sensitivity to increased SSCs of Medium. As described in section 5.1.3.1.2 above, in areas of high water flow, fine sediments are likely to be rapidly dispersed which would mitigate the magnitude of this pressure by reducing the time exposed. Therefore, with a negligible magnitude of impact and a Medium sensitivity, the significance of effect is considered to be of **minor adverse** significance (at worst) which is not significant in EIA terms.

99. No additional mitigation is proposed due to the minor adverse significance of effect. The overall confidence in this assessment is medium (as per MarESA), due to the mix of high, medium and low confidence in assessments for the described habitats.

5.3 Potential Effects during Decommissioning

100. A decision regarding the final decommissioning policy is yet to be decided as it is recognised that rules and legislation change over time in line with best industry practice. The offshore decommissioning programme would be submitted prior to the construction of offshore works (see requirement 7 of the **Draft DCO** [APP-027]), with the methodology and programme finalised nearer to the end of the lifetime of the proposed Projects to ensure it is in line with the most recent guidance, policy and legislation.

101. The scope of the decommissioning works would most likely involve removal of the accessible installed components. This is outlined in **Chapter 5 Project Description** [APP-071] 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.

102. During the decommissioning phase, there is potential for wind turbine foundation and cable removal activities to cause effects that would be comparable to those identified for the construction phase and the operational phase, specifically:

- Temporary increase of SSCs (including sediment deposition and smothering);
- Remobilisation of contaminated sediments; and
- Underwater noise and vibration.

103. The significance of decommissioning effects will be comparable to or less than the construction phase. Accordingly, given that effects were assessed to be of no greater than minor adverse significance for the identified benthic ecology receptors during the construction phase, it is anticipated that the same would be true for the decommissioning phase.

5.4 Cumulative Effects

Cumulative effects can be defined as incremental effects on that same receptor from other proposed and reasonably foreseeable schemes and developments in combination with the Projects. This includes all schemes that result in a comparative effect that is not intrinsically considered as part of the existing environment and is not limited to offshore wind projects. **Chapter 9 Benthic and Intertidal Ecology** [APP-085], section 9.8.1 discusses the methodology for screening cumulative effects. The relevant potential cumulative effects are described in **Table 5-4.**

Table 5-4 Potential Cumulative Effects

Impact	Potential for Cumulative Effects	Data Confidence	Rationale
Construction (and decommissioning)			
Increased SSCs (including sediment deposition and smothering)	Yes	High	Increased SSCs from projects with overlapping ZoIs could result in a cumulative effect on benthic receptors.
Operation & Maintenance			
Increased SSCs (including sediment deposition and smothering)	Yes	High	Increased SSCs from projects with overlapping ZoIs could result in a cumulative effect on benthic receptors.
Changes to Bedload Sediment Transport	Yes	High	Changes in Bedload Sediment Transport from projects with overlapping ZoIs could result in a cumulative effect on benthic receptors.

5.4.1 Potential Cumulative Effects during Construction

5.4.1.1 Increased suspended sediment concentrations (including sediment deposition and smothering)

104. There is the potential for cumulative increased SSCs and associated deposition as a result of construction activities associated with the Projects and other schemes. This could interact with the features of the Holderness Offshore MCZ, Holderness Inshore MCZ and Flamborough Head SAC.

105. **Chapter 9 Benthic and Intertidal Ecology** [APP-085] section 9.8.2.2 provides a detailed assessment of the potential cumulative impact of increased SSCs. Construction of the Projects could result in a cumulative effect on SSCs due to overlapping ZoIs with Hornsea Project Four, Dogger Bank D and Eastern Green Link 2 (if construction with those schemes occurs at the same time). Where sediment plumes interact, there is likely to be a corresponding increase in SSCs at that location over and above what would be expected should the developments be undertaken in isolation.

106. The cumulative impacts of increased SSCs (and deposition), in keeping with the Projects' assessment are expected to be of local spatial extent, temporary duration, intermittent and reversible. Fine suspended sediment may be transported a further distance than coarse sediments, however this is likely to be widely and rapidly dispersed and within the range of natural variability within the region. The magnitude of impacts is therefore considered to be low.

107. Based on a maximum medium sensitivity of the assessed biotopes (as per those described in section 5.1) and maximum low magnitude of impact, cumulatively increased SSCs and subsequent deposition during construction would have a **minor adverse** (at worst) effect on the features of the Holderness Offshore MCZ, Holderness Inshore MCZ and Flamborough Head SAC, which is not significant in EIA terms.

5.4.2 Potential Cumulative Effects during Operation

5.4.2.1 Increased suspended sediment concentrations (including sediment deposition and smothering)

108. **Chapter 9 Benthic and Intertidal Ecology** [APP-085], section 9.8.3.2 provides details on the potential cumulative effects of increased SSCs.

109. Overall, it is unlikely that maintenance activities would overlap spatially and temporally. However, the impacts associated with maintenance would be temporary and localised, therefore potential for any cumulative impacts is expected to be minimal.

110. As with the cumulative impact of increased SSCs during construction (section 5.4.1.1), impacts are expected to be highly localised, temporary and intermittent. Fine suspended sediment may be transported a further distance than coarse sediments, however this is likely to be widely and rapidly dispersed and within the range of natural variability within the region. The magnitude of impacts is therefore considered to be low.

111. Based on a maximum medium sensitivity of the assessed biotopes (as per those described in section 5.2), and maximum low magnitude of impact, increased SSCs and subsequent deposition during operations would have a **minor adverse** effect (at worst) on the features of the Holderness Offshore MCZ, Holderness Inshore MCZ and Flamborough Head SAC, which is not significant in EIA terms.

6 Summary

112. This Benthic Ecology Technical Note has addressed comments within the Applicants' **Responses to Natural England's Relevant Representations** [AS-048], in relation to the requirement to provide further characterisation and assessment from an EIA perspective of the habitats of the Flamborough Head SAC. It has also investigated the potential impacts on the designated features of the Holderness Inshore MCZ and Holderness Offshore MCZ.

113. The assessment has established that there will be some negligible to minor adverse residual effects during the construction, operation and decommissioning phases of the Projects. Effects are generally localised in nature, being restricted to the project boundaries and immediate surrounding area.

114. Cumulative effects were also considered, and an assessment was carried out examining the potential for interaction of impacts as a result of the combined activities of the Projects and other schemes in the study area. The cumulative assessment established that there will be some minor adverse (at worst) residual effects during the construction and operation of DBS East and DBS West with other schemes in the area.

115. The potential effects (including cumulatively) of the Projects on intertidal and subtidal benthic ecology receptors are therefore not significant in terms of the EIA Regulations.

116. In addition, the updated assessment findings presented in this report do not alter the conclusions reached in the **Stage 1 MCZA** [APP-240] or the **RIAA Part 2 2 of 4 – Annex I Offshore Habitats and Annex II Migratory Fish** [APP-045].

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Appendix A: Biotopes / species of the Holderness Offshore MCZ

Table A-1 - Biotopes / species comprising Subtidal Coarse Sediment in the Holderness Offshore MCZ and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Last *et al*, 2020; www.marlin.ac.uk)

EUNIS Code	EUNIS Name	Sensitivity	Resistance	Resilience
A5.134	*Hesionura elongata and Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand	Not Sensitive	High	High
A5.135	*Glycera lapidum* in impoverished infralittoral mobile gravel and sand	Not Sensitive	High	High
A5.137	*Dense Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand	Not Sensitive	High	High
A5.131	Sparse fauna on highly mobile sublittoral shingle (cobbles and pebbles)	Not Sensitive	High	High
A5.133	*Moerella* spp. with venerid bivalves in infralittoral gravelly sand	Low	Medium	High
A5.136	*Cumaceans and Chaetozone setosa* in infralittoral gravelly sand	Low	Medium	High
A5.143	*Protodorvillea kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand	Not sensitive	High	High

EUNIS Code	EUNIS Name	Sensitivity	Resistance	Resilience
A5.141	*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Not sensitive	High	High
A5.142	*Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel	Low	Medium	High
A5.145	*Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel	Not sensitive	High	High
A5.146	Scallops on shell gravel and sand with some sand scour	Unknown	Unknown	Unknown
A5.152	*Hesionura elongata* and *Protodorvillea kefersteini* in offshore coarse sand	No evidence	No evidence	Not relevant
A5.151	*Glycera lapidum*, *Thyasira* spp. and *Amythasides macroglossus* in offshore gravelly sand	Not sensitive	High	High

Table A-2 Biotopes / species comprising subtidal mixed sediments in the Holderness Offshore MCZ and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Last *et al*, 2020; www.marlin.ac.uk)

EUNIS Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.441	*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment	Not sensitive	High	High
A5.444	*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Not sensitive	High	High

EUNIS Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.445	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	Not sensitive	High	High
A5.443	*Mysella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment	Not sensitive	High	High
A5.451	Polychaete-rich deep *Venus* community in offshore mixed sediments	Low	Medium	High

Table A-3 Biotopes / species comprising subtidal sand in the Holderness Offshore MCZ and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Last *et al*, 2020; www.marlin.ac.uk)

EUNIS Code	EUNIS Name	Sensitivity	Resistance	Resilience
A5.231	Infralittoral mobile clean sand with sparse fauna	Low	Medium	High
A5.233	*Nephtys cirrosa* and Bathyporeia spp. in infralittoral sand	Low	Medium	High
A5.232	*Sertularia cupressina* and *Hydrallmania falcata* on tide-swept sublittoral sand with cobbles or pebbles	Not sensitive	High	High
A5.234	Semi-permanent tube-building amphipods and polychaetes in sublittoral sand	Low	Low	High
A5.242	*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand	Low	Medium	High

EUNIS Code	EUNIS Name	Sensitivity	Resistance	Resilience
A5.241	*Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand	Not sensitive	High	High
A5.243	*Arenicola marina* in infralittoral fine sand or muddy sand	Not sensitive	High	High
A5.244	*Spisula subtruncata* and *Nephtys hombergii* in shallow muddy sand	Low	Medium	High
A5.251	*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand	Low	Medium	High
A5.252	*Abra prismatica, Bathyporeia elegans* and polychaetes in circalittoral fine sand	Low	Medium	High
A5.261	*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment	Low	Medium	High
A5.262	*Amphiura brachiata* with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand	Not sensitive	High	High
A5.271	Maldanid polychaetes and *Eudorellopsis* deformis in deep circalittoral sand or muddy sand	Not sensitive	High	High
A5.272	*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand	Not sensitive	High	High

Table A-4 Biotopes / species comprising subtidal coarse sediment in the Holderness Offshore MCZ and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Last *et al*, 2020; www.marlin.ac.uk)

EUNIS Code	EUNIS Name	Sensitivity	Resistance	Resilience
A5.134	*Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand	Low	Medium	High
A5.135	*Glycera lapidum* in impoverished infralittoral mobile gravel and sand	Low	Medium	High
A5.137	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand	Not sensitive	High	High
A5.131	Sparse fauna on highly mobile sublittoral shingle (cobbles and pebbles)	Not sensitive	High	High
A5.133	*Moerella* spp. with venerid bivalves in infralittoral gravelly sand	Low	Medium	High
A5.136	*Cumaceans* and *Chaetozone setosa* in infralittoral gravelly sand	No evidence	No evidence	Not relevant
A5.143	*Protodorvillea kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand	No evidence	No evidence	Not relevant
A5.141	*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Not sensitive	High	High
A5.142	*Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel	Low	Medium	High

EUNIS Code	EUNIS Name	Sensitivity	Resistance	Resilience
A5.145	*Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel	Low	Low	High
A5.146	Scallops on shell gravel and sand with some sand scour	Unknown	Unknown	Unknown
A5.152	*Hesionura elongata* and *Protodorvillea kefersteini* in offshore coarse sand	No evidence	No evidence	Not relevant
A5.151	*Glycera lapidum, Thyasira* spp. and *Amythasides macroglossus* in offshore gravelly sand	Low	Medium	High

Table A-5 Biotopes / species comprising subtidal mixed sediments in the Holderness Offshore MCZ and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Last *et al*, 2020; www.marlin.ac.uk)

EUNIS Code	EUNIS Name	Sensitivity	Resistance	Resilience
A5.441	*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment	Medium	Medium	Medium
A5.444	*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Not sensitive	High	High
A5.445	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	Medium	Low	Medium
A5.443	*Mysella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment	Not sensitive	High	High
A5.451	Polychaete-rich deep Venus community in offshore mixed sediments	Low	Medium	High

Table A-6 Biotopes / species comprising subtidal sand in the Holderness Offshore MCZ and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Last *et al*, 2020; www.marlin.ac.uk)

EUNIS Code	EUNIS Name	Sensitivity	Resistance	Resilience
A5.231	Infralittoral mobile clean sand with sparse fauna	Not sensitive	High	High
A5.233	*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand	Not sensitive	High	High
A5.232	*Sertularia cupressina* and *Hydrallmania falcata* on tide-swept sublittoral sand with cobbles or pebbles	Not sensitive	High	High
A5.234	Semi-permanent tube-building amphipods and polychaetes in sublittoral sand	Low	Medium	High
A5.242	*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand	Low	Medium	High
A5.241	*Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand	Not sensitive	High	High
A5.243	*Arenicola marina* in infralittoral fine sand or muddy sand	Not sensitive	High	High
A5.244	*Spisula subtruncata* and *Nephtys hombergii* in shallow muddy sand	Low	Medium	High
A5.251	*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand	Low	Medium	High
A5.252	*Abra prismatica, Bathyporeia elegan*s and polychaetes in circalittoral fine sand	Low	Medium	High

EUNIS Code	EUNIS Name	Sensitivity	Resistance	Resilience
A5.261	*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment	Low	Medium	High
A5.262	*Amphiura brachiata* with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand	Low	Medium	High
A5.271	*Maldanid polychaetes* and *Eudorellopsis deformis* in deep circalittoral sand or muddy sand	Not sensitive	High	High
A5.272	*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand	Low	Medium	High

Appendix B: Biotopes / species of the Holderness Inshore MCZ

Table B-1 Biotopes / species comprising intertidal sand and muddy sand in the Holderness Inshore MCZ and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A2.222	Oligochaetes in littoral mobile sand	Low	Medium	High
A2.2221	Oligochaetes in full salinity littoral mobile sand	Low	Medium	High
A2.223	Amphipods and *Scolelepis* spp. in littoral medium-fine sand	Low	Low	High
A2.2231	*Scolelepis* spp. in littoral mobile sand	Low	Medium	High
A2.2232	*Eurydice pulchra* in littoral mobile sand	Low	Low	High
A2.2233	Pontocrates arenarius in littoral mobile sand	Low	Low	High
A2.231	Polychaetes in littoral fine sand	Low	Medium	High
A2.2312	Polychaetes and Angulus tenuis in littoral fine sand	Low	Low	High
A2.2313	*Nephtys cirrosa*-dominated littoral fine sand	Low	Medium	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A2.242	*Cerastoderma edule* and polychaetes in littoral muddy sand	Low	Medium	High
A2.243	*Hediste diversicolor*, *Macoma balthica* and *Eteone longa* in littoral muddy sand	Low	Medium	High
A2.244	*Bathyporeia pilosa* and *Corophium arenarium* in littoral muddy sand	Low	Low	High
A2.211	Talitrids on the upper shore and strandline	Low	Low	High
A2.22	Barren or amphipod-dominated mobile sand shores	Not sensitive	High	High
A2.221	Barren littoral coarse sand	Not sensitive	High	High

Table B-2 Biotopes / species comprising subtidal coarse sediment in the Holderness Inshore MCZ and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.136	Cumaceans and *Chaetozone setosa* in infralittoral gravelly sand	Low	Medium	High
A5.137	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.141	*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Not sensitive	High	High
A5.143	*Protodorvillea kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand	Not sensitive	High	High
A5.134	*Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand	Not sensitive	High	High
A5.135	*Glycera lapidum* in impoverished infralittoral mobile gravel and sand	Not sensitive	High	High

Table B-3 Biotopes / species comprising subtidal mixed sediments in the Holderness Inshore MCZ and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.444	*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Not sensitive	High	High
A5.445	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	Not sensitive	High	High

Table B-4 Biotopes / species comprising subtidal mud in the Holderness Inshore MCZ and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.321	*Polydora ciliata* and *Corophium volutator* in variable salinity infralittoral firm mud or clay	Low	Low	High
A5.325	*Capitella capitata* and *Tubificoides* spp. in reduced salinity infralittoral muddy sediment	Low	Medium	High
A5.334	*Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud	Low	Low	High
A5.336	*Capitella capitata* in enriched sublittoral muddy sediments	Low	Medium	High
A5.331	*Nephtys hombergii* and *Macoma balthica* in infralittoral sandy mud	Not sensitive	High	High
A5.322	*Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud	Not sensitive	High	High

Table B-5 Biotopes / species comprising subtidal sand in the Holderness Inshore MCZ and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.222	*Nephtys cirrosa* and *Macoma balthica* in variable salinity infralittoral mobile sand	Low	Medium	High
A5.223	*Neomysis integer* and *Gammarus* spp. in fluctuating low salinity infralittoral mobile sand	Low	Medium	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.231	Infralittoral mobile clean sand with sparse fauna	Low	Medium	High
A5.233	*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand	Low	Medium	High
A5.242	*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand	Low	Medium	High
A5.22	Sublittoral sand in variable salinity (estuaries)	Low	Medium	High
A5.261	*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment	Low	Medium	High
A5.221	Infralittoral mobile sand in variable salinity (estuaries)	Not sensitive	High	High
A5.243	*Arenicola marina* in infralittoral fine sand or muddy sand	Not sensitive	High	High

Table B-6 Biotopes / species comprising high energy circalittoral rock in the Holderness Inshore MCZ and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.134	*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.1341	*Polyclinum aurantium* and *Flustra foliacea* on sand-scoured tide-swept moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.1343	*Flustra foliacea* and colonial ascidians on tide-swept exposed circalittoral mixed substrata	Not sensitive	High	High
A4.137	*Flustra foliacea* and *Haliclona oculata* with a rich faunal turf on tide-swept circalittoral mixed substrata	Not sensitive	High	High
A4.138	*Molgula manhattensis* with a hydroid and bryozoan turf on tide-swept moderately wave-exposed circalittoral rock	Not sensitive	High	High

Table B-7 Biotopes / species comprising moderate energy circalittoral rock in the Holderness Inshore MCZ and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.232	*Polydora* sp. tubes on moderately exposed sublittoral soft rock	Low	Low	High
A4.233	*Hiatella*-bored vertical sublittoral limestone rock	Low	Medium	High
A4.241	*Mytilus edulis* beds with hydroids and ascidians on tide-swept exposed to moderately wave-exposed circalittoral rock	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.213	*Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock	Not sensitive	High	High
A4.214	Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.2141	*Flustra foliacea* on slightly scoured silty circalittoral rock	Not sensitive	High	High
A4.22	*Sabellaria* reefs on circalittoral rock	Not sensitive	High	High
A4.221	*Sabellaria spinulosa* encrusted circalittoral rock	Not sensitive	High	High
A4.2211	*Sabellaria spinulosa* with a bryozoan turf and barnacles on silty turbid circalittoral rock	Not sensitive	High	High
A4.231	Piddocks with a sparse associated fauna in sublittoral very soft chalk or clay	Not sensitive	High	High

Table B-8 Biotopes / species comprising intertidal sand and muddy sand in the Holderness Inshore MCZ and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A2.242	*Cerastoderma edule* and polychaetes in littoral muddy sand	Low	Medium	High
A2.243	*Hediste diversicolor*, *Macoma balthica* and *Eteone longa* in littoral muddy sand	Low	Medium	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A2.244	*Bathyporeia pilosa* and *Corophium arenarium* in littoral muddy sand	Low	Medium	High
A2.211	Talitrids on the upper shore and strandline	Not sensitive	High	High
A2.22	Barren or amphipod-dominated mobile sand shores	Not sensitive	High	High
A2.221	Barren littoral coarse sand	Not sensitive	High	High
A2.222	Oligochaetes in littoral mobile sand	Not sensitive	High	High
A2.2221	Oligochaetes in full salinity littoral mobile sand	Not sensitive	High	High
A2.223	Amphipods and *Scolelepis* spp. in littoral medium-fine sand	Not sensitive	High	High
A2.2231	*Scolelepis* spp. in littoral mobile sand	Not sensitive	High	High
A2.2232	*Eurydice pulchra* in littoral mobile sand	Not sensitive	High	High
A2.2233	*Pontocrates arenarius* in littoral mobile sand	Not sensitive	High	High
A2.231	Polychaetes in littoral fine sand	Not sensitive	High	High
A2.2312	Polychaetes and *Angulus tenuis* in littoral fine sand	Not sensitive	High	High
A2.2313	*Nephtys cirrosa*-dominated littoral fine sand	Not sensitive	High	High

Table B-9 Biotopes / species comprising subtidal coarse sediments in the Holderness Inshore MCZ and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.134	*Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand	Low	Medium	High
A5.135	*Glycera lapidum* in impoverished infralittoral mobile gravel and sand	Low	Medium	High
A5.136	Cumaceans and *Chaetozone setosa* in infralittoral gravelly sand	No evidence	No evidence	No evidence
A5.143	*Protodorvillea kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand	No evidence	No evidence	No evidence
A5.137	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand	Not sensitive	High	High
A5.141	*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Not sensitive	High	High

Table B-10 Biotopes / species comprising subtidal mixed sediments in the Holderness Inshore MCZ and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.445	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	Medium	Low	Medium
A5.444	*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Not sensitive	High	High

Table B-11 Biotopes / species comprising subtidal mud in the Holderness Inshore MCZ and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.321	*Polydora ciliata* and *Corophium volutator* in variable salinity infralittoral firm mud or clay	Low	Low	High
A5.325	*Capitella capitata* and *Tubificoides* spp. in reduced salinity infralittoral muddy sediment	Low	Low	High
A5.336	*Capitella capitata* in enriched sublittoral muddy sediments	Low	Low	High
A5.331	*Nephtys hombergii* and *Macoma balthica* in infralittoral sandy mud	Not sensitive	High	High
A5.334	*Melinna palmata* with *Magelona* spp. and Thyasira spp. in infralittoral sandy mud	Not sensitive	High	High
A5.322	*Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud	Not sensitive	High	High

Table B-12 Biotopes / species comprising subtidal sand in the Holderness Inshore MCZ and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A5.242	*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand	Low	Medium	High
A5.261	*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment	Low	Medium	High
A5.243	*Arenicola marina* in infralittoral fine sand or muddy sand	Not sensitive	High	High
A5.22	Sublittoral sand in variable salinity (estuaries)	Not sensitive	High	High
A5.221	Infralittoral mobile sand in variable salinity (estuaries)	Not sensitive	High	High
A5.222	*Nephtys cirrosa* and *Macoma balthica* in variable salinity infralittoral mobile sand	Not sensitive	High	High
A5.223	*Neomysis integer* and *Gammarus* spp. in fluctuating low salinity infralittoral mobile sand	Not sensitive	High	High
A5.231	Infralittoral mobile clean sand with sparse fauna	Not sensitive	High	High
A5.233	*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand	Not sensitive	High	High

Table B-13 Biotopes / species comprising high energy circalittoral rock in the Holderness Inshore MCZ and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.134	*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Low	Medium	High
A4.1341	*Polyclinum aurantium* and *Flustra foliacea* on sand-scoured tide-swept moderately wave-exposed circalittoral rock	Low	Medium	High
A4.1343	*Flustra foliacea* and colonial ascidians on tide-swept exposed circalittoral mixed substrata	Low	Medium	High
A4.137	*Flustra foliacea* and *Haliclona oculata* with a rich faunal turf on tide-swept circalittoral mixed substrata	Low	Medium	High
A4.138	*Molgula manhattensis* with a hydroid and bryozoan turf on tide-swept moderately wave-exposed circalittoral rock	Not sensitive	High	High

Table B-14 Biotopes / species comprising moderate energy circalittoral rock in the Holderness Inshore MCZ and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Natural England, 2024a; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.231	Piddocks with a sparse associated fauna in sublittoral very soft chalk or clay	Medium	Medium	Medium

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.233	*Hiatella*-bored vertical sublittoral limestone rock	Medium	Low	Medium
A4.241	*Mytilus edulis* beds with hydroids and ascidians on tide-swept exposed to moderately wave-exposed circalittoral rock	Medium	Medium	Medium
A4.2141	*Flustra foliacea* on slightly scoured silty circalittoral rock	Low	Medium	High
A4.22	*Sabellaria* reefs on circalittoral rock	Not sensitive	High	High
A4.221	*Sabellaria spinulosa* encrusted circalittoral rock	Not sensitive	High	High
A4.2211	*Sabellaria spinulosa* with a bryozoan turf and barnacles on silty turbid circalittoral rock	Not sensitive	High	High
A4.232	*Polydora* sp. tubes on moderately exposed sublittoral soft rock	Not sensitive	High	High
A4.213	*Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock	Not sensitive	High	High
A4.214	Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock	Not sensitive	High	High

Appendix C: Biotopes / species of the Flamborough Head SAC

Table C-1 Biotopes / species comprising intertidal rock in the Flamborough Head SAC and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Natural England, 2024b; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.21	Barnacles and fucoids on moderately exposed shores	Medium	Medium	Medium
A1.212	*Fucus spiralis* on full salinity exposed to moderately exposed upper eulittoral rock	Medium	Medium	Medium
A1.213	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock	Medium	Medium	Medium
A1.313	*Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock	Medium	Medium	Medium
A1.3131	*Fucus vesiculosus* on full salinity moderately exposed to sheltered mid eulittoral rock	Medium	Medium	Medium
A1.3132	*Fucus vesiculosus* on mid eulittoral mixed substrata	Medium	Medium	Medium
A1.322	*Fucus spiralis* on sheltered variable salinity upper eulittoral rock	Medium	Medium	Medium
A1.323	*Fucus vesiculosus* on variable salinity mid eulittoral boulders and stable mixed substrata	Medium	Medium	Medium
A1.412	Fucoids and kelp in deep eulittoral rockpools	Medium	Low	Medium

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.413	Seaweeds in sediment-floored eulittoral rockpools	Low	Medium	High
A1.446	Sponges and shade-tolerant red seaweeds on overhanging lower eulittoral bedrock and in cave entrances	Low	Medium	High
A1.4461	Sponges, shade-tolerant red seaweeds and *Dendrodoa grossularia* on wave-surged overhanging lower eulittoral bedrock and caves	Low	Medium	High
A1.447	Sponges, bryozoans and ascidians on deeply overhanging lower shore bedrock or caves	Low	Medium	High
A1.448	Faunal crusts on wave-surged littoral cave walls	Low	Medium	High
A1.315	*Fucus serratus* on sheltered lower eulittoral rock	Low	Medium	High
A1.3151	*Fucus serratus* on full salinity sheltered lower eulittoral rock	Low	Medium	High
A1.3152	*Fucus serratus* on full salinity lower eulittoral mixed substrata	Low	Medium	High
A1.222	*Mytilus edulis*, *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	Low	Low	High
A1.214	*Fucus serratus* on moderately exposed lower eulittoral rock	Low	Medium	High
A1.2141	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	Low	Medium	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.2142	*Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders	Low	Low	High
A1.113	*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock	Low	Medium	High
A1.1131	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock	Low	Medium	High
A1.1132	*Semibalanus balanoides*, *Fucus vesiculosus* and red seaweeds on exposed to moderately exposed eulittoral rock	Low	Medium	High
A1.1133	*Semibalanus balanoides* and *Littorina* spp. on exposed to moderately exposed eulittoral boulders and cobbles	Low	Medium	High
A1.122	*Corallina officinalis* on exposed to moderately exposed lower eulittoral rock	Not sensitive	High	High
A1.1221	*Corallina officinalis* and *Mastocarpus stellatus* on exposed to moderately exposed lower eulittoral rock	Not sensitive	High	High
A1.1222	*Corallina officinalis*, *Himanthalia elongata* and *Patella ulyssiponensis* on very exposed lower eulittoral rock	Not sensitive	High	High
A1.123	*Himanthalia elongata* and red seaweeds on exposed lower eulittoral rock	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.125	*Mastocarpus stellatus* and *Chondrus crispus* on very exposed to moderately exposed lower eulittoral rock	Not sensitive	High	High
A1.126	*Osmundea pinnatifida* on moderately exposed mid eulittoral rock	Not sensitive	High	High
A1.215	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock	Not sensitive	High	High
A1.221	*Mytilus edulis* and *Fucus vesiculosus* on moderately exposed mid eulittoral rock	Not sensitive	High	High
A1.311	*Pelvetia canaliculata* on sheltered littoral fringe rock	Not sensitive	High	High
A1.312	*Fucus spiralis* on sheltered upper eulittoral rock	Not sensitive	High	High
A1.3121	*Fucus spiralis* on full salinity sheltered upper eulittoral rock	Not sensitive	High	High
A1.3122	*Fucus spiralis* on full salinity upper eulittoral mixed substrata	Not sensitive	High	High
A1.314	*Ascophyllum nodosum* on very sheltered mid eulittoral rock	Not sensitive	High	High
A1.3141	*Ascophyllum nodosum* on full salinity mid eulittoral rock	Not sensitive	High	High
A1.3142	*Ascophyllum nodosum* on full salinity mid eulittoral mixed substrata	Not sensitive	High	High
A1.321	*Pelvetia canaliculata* on sheltered variable salinity littoral fringe rock	Not sensitive	High	High
A1.324	*Ascophyllum nodosum* and *Fucus vesiculosus* on variable salinity mid eulittoral rock	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.326	*Fucus serratus* and large *Mytilus edulis* on variable salinity lower eulittoral rock	Not sensitive	High	High
A1.327	*Fucus ceranoides* on reduced salinity eulittoral rock	Not sensitive	High	High
A1.411	Coralline crust-dominated shallow eulittoral rockpools	Not sensitive	High	High
A1.4111	Coralline crusts and *Corallina officinalis* in shallow eulittoral rockpools	Not sensitive	High	High
A1.449	Sparse fauna (barnacles and spirorbids) on sand/pebble-scoured rock in littoral caves	Not sensitive	High	High
A1.44A	Barren and/or boulder-scoured littoral cave walls and floors	Not sensitive	High	High
A1.451	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock	Not sensitive	High	High
A1.452	*Porphyra purpurea* or *Enteromorpha* spp. on sand-scoured mid or lower eulittoral rock	Not sensitive	High	High
A1.421	Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in shallow upper shore rockpools	Not sensitive	High	High
A1.111	*Mytilus edulis* and barnacles on very exposed eulittoral rock	Not sensitive	High	High
A1.441	*Chrysophyceae* and *Haptophyceae* on vertical upper littoral fringe soft rock	Not relevant (NR)	Not relevant (NR)	Not relevant (NR)
A1.442	Green algal films on upper and mid-shore cave walls and ceilings	Not relevant (NR)	Not relevant (NR)	Not relevant (NR)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.443	*Audouinella purpurea* and *Pilinia maritima* crusts on upper and mid-shore cave walls and ceilings	Not relevant (NR)	Not relevant (NR)	Not relevant (NR)
A1.444	*Audouinella purpurea* and *Cladophora rupestris* on upper to mid-shore cave walls	Not relevant (NR)	Not relevant (NR)	Not relevant (NR)
A1.445	*Verrucaria mucosa* and/or *Hildenbrandia rubra* on upper to mid shore cave walls	Not relevant (NR)	Not relevant (NR)	Not relevant (NR)

Table C-2 Biotopes / species comprising infralittoral rock in the Flamborough Head SAC and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Natural England, 2024b; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A3.115	*Laminaria hyperborea* with dense foliose red seaweeds on exposed infralittoral rock	Medium	None	Medium
A3.1151	*Laminaria hyperborea* forest with dense foliose red seaweeds on exposed upper infralittoral rock	Medium	None	Medium
A3.116	Foliose red seaweeds on exposed lower infralittoral rock	Medium	Low	Medium
A3.1161	Foliose red seaweeds with dense *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed lower infralittoral rock	Medium	Low	Medium

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A3.123	*Laminaria saccharina, Chorda filum* and dense red seaweeds on shallow unstable infralittoral boulders and cobbles	Medium	None	Medium
A3.212	*Laminaria hyperborea* on tide-swept, infralittoral rock	Medium	Low	Medium
A3.2121	*Laminaria hyperborea* forest, foliose red seaweeds and a diverse fauna on tide-swept upper infralittoral rock	Medium	Low	Medium
A3.213	*Laminaria hyperborea* on tide-swept infralittoral mixed substrata	Medium	None	Medium
A3.2131	*Laminaria hyperborea* forest and foliose red seaweeds on tide-swept upper infralittoral mixed substrata	Medium	Low	Medium
A3.2132	*Laminaria hyperborea* park and foliose red seaweeds on tide-swept lower infralittoral mixed substrata	Medium	None	Medium
A3.214	*Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock	Medium	Low	Medium
A3.2141	*Laminaria hyperborea* forest and foliose red seaweeds on moderately exposed upper infralittoral rock	Medium	Low	Medium
A3.2142	*Laminaria hyperborea* park and foliose red seaweeds on moderately exposed lower infralittoral rock	Medium	Low	Medium
A3.2143	Grazed *Laminaria hyperborea* forest with coralline crusts on upper infralittoral rock	Medium	None	Medium

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A3.2144	Grazed *Laminaria hyperborea* park with coralline crusts on lower infralittoral rock	Medium	None	Medium
A3.2145	*Sabellaria spinulosa* with kelp and red seaweeds on sand-influenced infralittoral rock	Medium	Low	Medium
A3.216	*Laminaria hyperborea* on moderately exposed vertical rock	Medium	Low	Medium
A3.222	Mixed kelp with foliose red seaweeds, sponges and ascidians on sheltered tide-swept infralittoral rock	Medium	Low	Medium
A3.223	Mixed kelp and red seaweeds on infralittoral boulders, cobbles and gravel in tidal rapids	Medium	Low	Medium
A3.312	Mixed *Laminaria hyperborea* and *Laminaria saccharina* on sheltered infralittoral rock	Medium	Low	Medium
A3.3121	Mixed *Laminaria hyperborea* and *Laminaria saccharina* forest on sheltered upper infralittoral rock	Medium	Low	Medium
A3.313	*Laminaria saccharina* on very sheltered infralittoral rock	Low	Low	High
A3.3131	*Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock	Low	Low	High
A3.3133	*Laminaria saccharina* park on very sheltered lower infralittoral rock	Low	Low	High
A3.713	Crustose sponges and colonial ascidians with *Dendrodoa grossularia* or barnacles on wave-surged infralittoral rock	Low	Medium	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A3.714	*Dendrodoa grossularia* and *Clathrina coriacea* on wave-surged vertical infralittoral rock	Low	Medium	High
A3.715	Crustose sponges on extremely wave-surged infralittoral cave or gully walls	Low	Medium	High
A3.111	*Alaria esculenta* on exposed sublittoral fringe bedrock	Low	Medium	High
A3.1112	*Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock	Low	Medium	High
A3.124	Dense *Desmarestia* spp. with filamentous red seaweeds on exposed infralittoral cobbles, pebbles and bedrock	Low	Low	High
A3.125	Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock	Low	Low	High
A3.211	*Laminaria digitata* on moderately exposed sublittoral fringe rock	Low	Medium	High
A3.2111	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock	Low	Medium	High
A3.2112	*Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders	Low	Low	High
A3.121	*Saccorhiza polyschides* and other opportunistic kelps on disturbed upper infralittoral rock	Low	Low	High
A3.215	Dense foliose red seaweeds on silty moderately exposed infralittoral rock	Not sensitive	High	High
A3.716	Coralline crusts in surge gullies and scoured infralittoral rock	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A3.7162	Coralline crusts and crustaceans on mobile boulders or cobbles in surge gullies	Not sensitive	High	High

Table C-3 Biotopes / species comprising circalittoral rock in the Flamborough Head SAC and MarESA sensitivity classification to changes in suspended solids (water clarity) (taken from Natural England, 2024b; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.232	*Polydora* sp. tubes on moderately exposed sublittoral soft rock	Low	Low	High
A4.233	*Hiatella*-bored vertical sublittoral limestone rock	Low	Medium	High
A4.241	*Mytilus edulis* beds with hydroids and ascidians on tide-swept exposed to moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.71	Communities of circalittoral caves and overhangs	Not sensitive	High	High
A4.134	*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.1341	*Polyclinum aurantium* and *Flustra foliacea* on sand-scoured tide-swept moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.1343	*Flustra foliacea* and colonial ascidians on tide-swept exposed circalittoral mixed substrata	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.137	*Flustra foliacea* and *Haliclona oculata* with a rich faunal turf on tide-swept circalittoral mixed substrata	Not sensitive	High	High
A4.138	*Molgula manhattensis* with a hydroid and bryozoan turf on tide-swept moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.213	*Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock	Not sensitive	High	High
A4.214	Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.2141	Flustra foliacea on slightly scoured silty circalittoral rock	Not sensitive	High	High
A4.2142	*Alcyonium digitatum*, *Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock	Not sensitive	High	High
A4.2143	*Alcyonium digitatum* with *Securiflustra securifrons* on tide-swept moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.2145	Faunal and algal crusts with *Pomatoceros triqueter* and sparse *Alcyonium digitatum* on exposed to moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.215	*Alcyonium digitatum* and faunal crust communities on vertical circalittoral bedrock	Not sensitive	High	High
A4.22	*Sabellaria* reefs on circalittoral rock	Not sensitive	High	High
A4.221	*Sabellaria spinulosa* encrusted circalittoral rock	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.2211	*Sabellaria spinulosa* with a bryozoan turf and barnacles on silty turbid circalittoral rock	Not sensitive	High	High
A4.231	Piddocks with a sparse associated fauna in sublittoral very soft chalk or clay	Not sensitive	High	High

Table C-4 Biotopes / species comprising intertidal rock in the Flamborough Head SAC and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Natural England, 2024b; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.113	*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock	Medium	Low	Medium
A1.1131	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock	Medium	Low	Medium
A1.1132	*Semibalanus balanoides*, *Fucus vesiculosus* and red seaweeds on exposed to moderately exposed eulittoral rock	Medium	Low	Medium
A1.1133	*Semibalanus balanoides* and *Littorina* spp. on exposed to moderately exposed eulittoral boulders and cobbles	Medium	Low	Medium
A1.21	Barnacles and fucoids on moderately exposed shores	Medium	Medium	Medium
A1.213	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock	Medium	Medium	Medium

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.313	*Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock	Medium	Medium	Medium
A1.3131	*Fucus vesiculosus* on full salinity moderately exposed to sheltered mid eulittoral rock	Medium	Medium	Medium
A1.3132	*Fucus vesiculosus* on mid eulittoral mixed substrata	Medium	Medium	Medium
A1.314	*Ascophyllum nodosum* on very sheltered mid eulittoral rock	Medium	Medium	Medium
A1.3141	*Ascophyllum nodosum* on full salinity mid eulittoral rock	Medium	Medium	Medium
A1.3142	*Ascophyllum nodosum* on full salinity mid eulittoral mixed substrata	Medium	Medium	Medium
A1.321	*Pelvetia canaliculata* on sheltered variable salinity littoral fringe rock	Medium	Medium	Medium
A1.322	*Fucus spiralis* on sheltered variable salinity upper eulittoral rock	Medium	Medium	Medium
A1.323	*Fucus vesiculosus* on variable salinity mid eulittoral boulders and stable mixed substrata	Medium	Medium	Medium
A1.324	*Ascophyllum nodosum* and *Fucus vesiculosus* on variable salinity mid eulittoral rock	Medium	Medium	Medium
A1.326	*Fucus serratus* and large *Mytilus edulis* on variable salinity lower eulittoral rock	Medium	Medium	Medium
A1.327	*Fucus ceranoides* on reduced salinity eulittoral rock	Medium	Medium	Medium
A1.411	Coralline crust-dominated shallow eulittoral rockpools	Medium	Low	Medium

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.4111	Coralline crusts and *Corallina officinalis* in shallow eulittoral rockpools	Medium	Low	Medium
A1.412	Fucoids and kelp in deep eulittoral rockpools	Medium	Medium	Medium
A1.221	*Mytilus edulis* and *Fucus vesiculosus* on moderately exposed mid eulittoral rock	Medium	Medium	Medium
A1.222	*Mytilus edulis*, *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	Medium	Medium	Medium
A1.311	*Pelvetia canaliculata* on sheltered littoral fringe rock	Medium	Medium	Medium
A1.312	*Fucus spiralis* on sheltered upper eulittoral rock	Low	Medium	High
A1.3121	*Fucus spiralis* on full salinity sheltered upper eulittoral rock	Low	Medium	High
A1.3122	*Fucus spiralis* on full salinity upper eulittoral mixed substrata	Low	Medium	High
A1.446	Sponges and shade-tolerant red seaweeds on overhanging lower eulittoral bedrock and in cave entrances	Low	Medium	High
A1.4461	Sponges, shade-tolerant red seaweeds and *Dendrodoa grossularia* on wave-surged overhanging lower eulittoral bedrock and caves	Low	Medium	High
A1.447	Sponges, bryozoans and ascidians on deeply overhanging lower shore bedrock or caves	Low	Medium	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.448	Faunal crusts on wave-surged littoral cave walls	Low	Medium	High
A1.443	*Audouinella purpurea* and *Pilinia maritima* crusts on upper and mid-shore cave walls and ceilings	Low	Medium	High
A1.444	*Audouinella purpurea* and *Cladophora rupestris* on upper to mid-shore cave walls	Low	Medium	High
A1.451	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock	Low	Low	High
A1.452	*Porphyra purpurea* or *Enteromorpha* spp. on sand-scoured mid or lower eulittoral rock	Low	Low	High
A1.111	*Mytilus edulis* and barnacles on very exposed eulittoral rock	Low	Medium	High
A1.413	Seaweeds in sediment-floored eulittoral rockpools	Low	Medium	High
A1.421	Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in shallow upper shore rockpools	Low	Low	High
A1.315	*Fucus serratus* on sheltered lower eulittoral rock	Low	Medium	High
A1.3151	*Fucus serratus* on full salinity sheltered lower eulittoral rock	Low	Medium	High
A1.3152	*Fucus serratus* on full salinity lower eulittoral mixed substrata	Low	Medium	High
A1.214	*Fucus serratus* on moderately exposed lower eulittoral rock	Low	Medium	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.2141	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	Low	Medium	High
A1.2142	*Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders	Low	Medium	High
A1.212	*Fucus spiralis* on full salinity exposed to moderately exposed upper eulittoral rock	Low	Medium	High
A1.125	*Mastocarpus stellatus* and *Chondrus crispus* on very exposed to moderately exposed lower eulittoral rock	Low	Medium	High
A1.126	*Osmundea pinnatifida* on moderately exposed mid eulittoral rock	Low	Medium	High
A1.215	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock	Not sensitive	High	High
A1.122	*Corallina* officinalis on exposed to moderately exposed lower eulittoral rock	Not sensitive	High	High
A1.1221	*Corallina officinalis* and *Mastocarpus stellatus* on exposed to moderately exposed lower eulittoral rock	Not sensitive	High	High
A1.1222	*Corallina officinalis*, *Himanthalia elongata* and *Patella ulyssiponensis* on very exposed lower eulittoral rock	Not sensitive	High	High
A1.123	*Himanthalia elongata* and red seaweeds on exposed lower eulittoral rock	Not sensitive	High	High
A1.445	*Verrucaria mucosa* and/or *Hildenbrandia rubra* on upper to mid shore cave walls	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A1.449	Sparse fauna (barnacles and spirorbids) on sand/pebble-scoured rock in littoral caves	Not sensitive	High	High
A1.44A	Barren and/or boulder-scoured littoral cave walls and floors	Not sensitive	High	High
A1.441	*Chrysophyceae* and *Haptophyceae* on vertical upper littoral fringe soft rock	Not relevant (NR)	Not relevant (NR)	Not relevant (NR)
A1.442	Green algal films on upper and mid-shore cave walls and ceilings	Not relevant (NR)	Not relevant (NR)	Not relevant (NR)

Table C-5 Biotopes / species comprising infralittoral rock in the Flamborough Head SAC and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Natural England, 2024b; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A3.2112	*Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders	Low	Medium	High
A3.222	Mixed kelp with foliose red seaweeds, sponges and ascidians on sheltered tide-swept infralittoral rock	Low	Medium	High
A3.223	Mixed kelp and red seaweeds on infralittoral boulders, cobbles and gravel in tidal rapids	Low	Medium	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A3.312	Mixed *Laminaria hyperborea* and *Laminaria saccharina* on sheltered infralittoral rock	Low	Medium	High
A3.3121	Mixed *Laminaria hyperborea* and *Laminaria saccharina* forest on sheltered upper infralittoral rock	Low	Medium	High
A3.713	Crustose sponges and colonial ascidians with *Dendrodoa grossularia* or barnacles on wave-surged infralittoral rock	Low	Medium	High
A3.714	*Dendrodoa grossularia* and *Clathrina coriacea* on wave-surged vertical infralittoral rock	Low	Medium	High
A3.715	Crustose sponges on extremely wave-surged infralittoral cave or gully walls	Low	Medium	High
A3.716	Coralline crusts in surge gullies and scoured infralittoral rock	Not sensitive	High	High
A3.7162	Coralline crusts and crustaceans on mobile boulders or cobbles in surge gullies	Not sensitive	High	High
A3.313	*Laminaria saccharina* on very sheltered infralittoral rock	Not sensitive	High	High
A3.3131	*Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock	Not sensitive	High	High
A3.3133	*Laminaria saccharina* park on very sheltered lower infralittoral rock	Not sensitive	High	High
A3.212	*Laminaria hyperborea* on tide-swept, infralittoral rock	Not sensitive	High	High
A3.2121	*Laminaria hyperborea* forest, foliose red seaweeds and a diverse fauna on tide-swept upper infralittoral rock	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A3.213	*Laminaria hyperborea* on tide-swept infralittoral mixed substrata	Not sensitive	High	High
A3.2131	*Laminaria hyperborea* forest and foliose red seaweeds on tide-swept upper infralittoral mixed substrata	Not sensitive	High	High
A3.2132	*Laminaria hyperborea* park and foliose red seaweeds on tide-swept lower infralittoral mixed substrata	Not sensitive	High	High
A3.214	*Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock	Not sensitive	High	High
A3.2141	*Laminaria hyperborea* forest and foliose red seaweeds on moderately exposed upper infralittoral rock	Not sensitive	High	High
A3.2142	*Laminaria hyperborea* park and foliose red seaweeds on moderately exposed lower infralittoral rock	Not sensitive	High	High
A3.2143	Grazed *Laminaria hyperborea* forest with coralline crusts on upper infralittoral rock	Not sensitive	High	High
A3.2144	Grazed *Laminaria hyperborea* park with coralline crusts on lower infralittoral rock	Not sensitive	High	High
A3.2145	*Sabellaria spinulosa* with kelp and red seaweeds on sand-influenced infralittoral rock	Not sensitive	High	High
A3.215	Dense foliose red seaweeds on silty moderately exposed infralittoral rock	Not sensitive	High	High
A3.216	*Laminaria hyperborea* on moderately exposed vertical rock	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A3.111	*Alaria esculenta* on exposed sublittoral fringe bedrock	Not sensitive	High	High
A3.1112	*Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock	Not sensitive	High	High
A3.115	*Laminaria hyperborea* with dense foliose red seaweeds on exposed infralittoral rock	Not sensitive	High	High
A3.1151	*Laminaria hyperborea* forest with dense foliose red seaweeds on exposed upper infralittoral rock	Not sensitive	High	High
A3.116	Foliose red seaweeds on exposed lower infralittoral rock	Not sensitive	High	High
A3.1161	Foliose red seaweeds with dense *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed lower infralittoral rock	Not sensitive	High	High
A3.121	*Saccorhiza polyschides* and other opportunistic kelps on disturbed upper infralittoral rock	Not sensitive	High	High
A3.123	*Laminaria saccharina, Chorda filum* and dense red seaweeds on shallow unstable infralittoral boulders and cobbles	Not sensitive	High	High
A3.124	Dense D*esmarestia* spp. with filamentous red seaweeds on exposed infralittoral cobbles, pebbles and bedrock	Not sensitive	High	High
A3.125	Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A3.211	*Laminaria digitata* on moderately exposed sublittoral fringe rock	Not sensitive	High	High
A3.2111	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock	Not sensitive	High	High

Table C-6 Biotopes / species comprising circalittoral rock in the Flamborough Head SAC and MarESA sensitivity classification to smothering and siltation rate changes (Light) (taken from Natural England, 2024b; www.marlin.ac.uk)

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.231	Piddocks with a sparse associated fauna in sublittoral very soft chalk or clay	Medium	Medium	Medium
A4.233	*Hiatella*-bored vertical sublittoral limestone rock	Medium	Low	Medium
A4.241	*Mytilus edulis* beds with hydroids and ascidians on tide-swept exposed to moderately wave-exposed circalittoral rock	Medium	Medium	Medium
A4.134	*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Low	Medium	High
A4.1341	*Polyclinum aurantium* and *Flustra foliacea* on sand-scoured tide-swept moderately wave-exposed circalittoral rock	Low	Medium	High
A4.1343	*Flustra foliacea* and colonial ascidians on tide-swept exposed circalittoral mixed substrata	Low	Medium	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.137	*Flustra foliacea* and *Haliclona oculata* with a rich faunal turf on tide-swept circalittoral mixed substrata	Low	Medium	High
A4.2141	*Flustra foliacea* on slightly scoured silty circalittoral rock	Low	Medium	High
A4.2142	*Alcyonium digitatum*, *Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock	Not sensitive	High	High
A4.2143	*Alcyonium digitatum* with *Securiflustra securifrons* on tide-swept moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.2145	Faunal and algal crusts with *Pomatoceros triqueter* and sparse *Alcyonium digitatum* on exposed to moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.215	*Alcyonium digitatum* and faunal crust communities on vertical circalittoral bedrock	Not sensitive	High	High
A4.22	*Sabellaria* reefs on circalittoral rock	Not sensitive	High	High
A4.221	*Sabellaria* spinulosa encrusted circalittoral rock	Not sensitive	High	High
A4.2211	*Sabellaria* spinulosa with a bryozoan turf and barnacles on silty turbid circalittoral rock	Not sensitive	High	High
A4.138	*Molgula manhattensis* with a hydroid and bryozoan turf on tide-swept moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.213	*Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock	Not sensitive	High	High

EUNIS 2007 Code	EUNIS 2007 Name	Sensitivity	Resistance	Resilience
A4.214	Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock	Not sensitive	High	High
A4.71	Communities of circalittoral caves and overhangs	Not sensitive	High	High
A4.232	*Polydora* sp. tubes on moderately exposed sublittoral soft rock	Not sensitive	High	High

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