Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

Appendix 1 - Screening Report

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Glossary of Acronyms

AC	Alternating Current
AfL	Agreement for Lease
AoO	Advice on Operations
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CIA	Cumulative Impact Assessment
CSCB	Cromer Shoal Chalk Beds
DCO	Development Consent Order
DEFRA	Department for the Environment and Rural Affairs
DEP	Dudgeon Extension Project
DOW	Dudgeon Offshore Wind Farm
EIA	Environmental Impact Assessment
EIFCA	Eastern Inshore Fisheries and Conservation Authority
EMF	Electromagnetic Field
EPP	Evidence Plan Process
ETG	Expert Topic Group
FOCI	Features of Conservation Interest
GBS	Gravity Based Structure
HAT	Highest Astronomical Tide
HDD	Horizontal Directional Drilling
HRA	Habitats Regulations Assessment
HVAC	High Voltage Alternating Current
km	Kilometre
MEEB	Measures of Equivalent Environmental Benefit
MCAA	Marine and Coastal Access Act
MCZ	Marine Conservation Zone
MCZA	Marine Conservation Zone Assessment
MMO	Marine Management Organisation
MPA	Marine Protected Area
MW	Megawatts
PAH	Polycyclic Aromatic Hydrocarbon
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
rMCZ	Recommended Marine Conservation Zone
SACO	Supplementary Advice on Conservation Objectives
SNCB	Statutory Nature Conservation Body
RPP	Risk Profile of Pressures
SEP	Sheringham Extension Project
SSC	Suspended Sediment Concentration
TBT	Tributyl Tin
TWT	The Wildlife Trust
UK	United Kingdom
UXO	Unexploded Ordnance

Glossary of Terms

Array cables	Cables which link the wind turbine generators to the offshore substation platforms.
Dudgeon Offshore Wind Farm Extension site	The Dudgeon Offshore Wind Farm Extension offshore wind farm boundary.
The Dudgeon Offshore Wind Farm Extension Project (DEP)	The Dudgeon Offshore Wind Farm Extension site as well as all onshore and offshore infrastructure.
Interlink cables	Buried offshore cables which link offshore substation platforms.
Landfall	The point at the coastline at which the offshore export cables are brought onshore, connecting to the onshore cables at the transition joint bay above mean high water
Offshore export cables	The cables which would bring electricity from the offshore substation platform(s) to the landfall.
Offshore scoping area	An area that encompasses all planned offshore infrastructure, including landfall options at both Weybourne and Bacton, and allows sufficient room for receptor identification and environmental surveys. This will be refined following further site selection and consultation.
Offshore substation platform	A fixed structure located within the wind farm area, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore.
Sheringham Shoal Offshore Wind Farm Extension site	Sheringham Shoal Offshore Wind Farm Extension offshore wind farm boundary.
The Sheringham Offshore Wind Farm Extension Project (SEP)	The Sheringham Offshore Wind Farm Extension site as well as all onshore and offshore infrastructure.

MARINE CONSERVATION ZONE ASSESSMENT SCREENING REPORT

1 Introduction

1.1 Purpose of this Document

1. This document represents stage 1 of the Marine Conservation Zone Assessment (MCZA) process which comprises up to three stages (**Section 2.1**). The aim of this first stage, screening, is to determine whether or not an activity is capable of affecting (other than insignificantly) the protected features of a marine conservation zone (MCZ), either directly or indirectly. This enables the competent authority, the Marine Management Organisation (MMO), to ensure compliance with the Marine and Coastal Access Act (MCAA) (2009).

2. This MCZA Screening Report presents the findings of the screening process, which supports the Development Consent Order (DCO) application of the proposed Dudgeon Extension Project (DEP) and Sheringham Extension Project (SEP) (hereafter called the Projects) and associated marine licences.

3. The screening considers whether there is potential for a significant effect on the protected features of an MCZ to occur due to the presence of components of, or activities associated with, the Projects. Where it is considered that there is no potential for a significant effect, it is proposed that the MCZ (or relevant feature of the MCZ) is 'screened out' from further consideration. Where the potential for a significant effect cannot be discounted, it remains 'screened in' and further assessment will be undertaken.

4. This document is to be used to inform stakeholder consultation. Agreement on whether sites and features should or should not be screened out will be sought through the Evidence Plan Process (EPP) through the relevant Expert Topic Groups (ETGs).

1.2 Project Description

5. This section provides further detail on the parameters of the proposed Projects. Project design will be ongoing throughout the environmental impact assessment (EIA) and pre-construction phase. Therefore, the description of the Projects provided here is indicative at this stage and is designed to provide context for the wider document. This description focuses on information of relevance to MCZA screening. A more detailed description is available in the Dudgeon and Sheringham Shoal Offshore Wind Farm Extensions Scoping Report (Royal HaskoningDHV, 2019) and further details will be made available in due course to support subsequent assessments.

6. The project design envelope will be developed in parallel with the EIA process and will be influenced by the results of environmental and technical studies and stakeholder consultation.

1.2.1 Wind farm extensions

7. The Projects consist of two extension assets and thus Agreement for Lease (AfL) areas. The DEP wind farm extension area is divided into two parts – Dudgeon North and Dudgeon South. The key characteristics of each area are summarised in **Table** 1-1.

Table 1-1 Dudgeon and Sheringham Extensions Overview

Area	Parameters	Values
SEP	AfL area	92.6km^2
	Closest distance to shore	17.5km
	Water depth	14 - 25m
DEP	AfL area	103.5km^2
	Closest distance to shore	31km
	Water depth	11 - 23m

8. The current wind turbine design envelope for DEP and SEP is outlined in **Table 1-2**.

Table 1-2 Wind Turbine Design Envelope

Parameters	Indicative range
Rotor Diameter	~220 – 300m
Number of wind turbines – DEP	Up to 29 turbines
Number of wind turbines – SEP	Up to 23 turbines
Max Tip Height (HAT)	Up to ~330m
Air Gap above Highest Astronomical Tide (HAT)	Lowest air gap ~26m
Indicative separation distance between turbines (inter-row), DEP and SEP	Shortest distance between turbines ~990m (4.5 rotor diameters)

9. The considered wind turbine foundation types are:

- Monopile/transition piece;
- Mono tower with suction bucket;
- Jacket with piles;
- Jacket with suction buckets; and
- Gravity based structure (GBS).

1.2.2 Electrical system

1.2.2.1 Array cables

10. Array cables connect the turbines to each other and to the offshore substation. The current design includes three additional array cables on DEP and two additional array cables on SEP to be used as links between radials. The array cables are expected to be 66kV alternating current (AC).

11. Array cables will connect DEP to the offshore substation located in the SEP area (in case there is only one offshore substation). The current design accounts for up to six array cables linking DEP to the offshore substation at SEP. Each cable will require its own trench, totalling up to six trenches.

1.2.2.2 Offshore substation(s)

12. The cables from a string of turbines will be brought to an offshore substation, located appropriately to optimise the array cable and export cable lengths. At the substation, the generated power will be transformed to a higher AC voltage. This higher voltage will be determined by detailed studies, but is likely to be ~ 220kV.

13. There will be up to two offshore substations. In the case that two substations are constructed, there will be one substation located in the SEP extension area and one in the DEP extension areas. The offshore substation foundation type will likely be a jacket or a GBS.

1.2.2.3 Interlink cables

14. Should the final design of DEP and SEP include two substations, up to two interlink cables may be installed to link the two substations. The interlink cables will improve the reliability of the transmission system. They will be 220kV AC cables and will be installed in separate trenches.

1.2.2.4 Offshore export cables

15. Two export cables (220kV AC) are likely to run from the offshore substation(s) to a transition joint bay at the landfall. The transition joint bay connects the offshore and onshore export cables. Each export cable will be installed in a separate trench and protected in line with good industry practice.

16. The export cables will be installed in separate installation campaigns as the installation vessel can only install one cable at a time. Installation of offshore cables typically takes place by ploughing or trenching depending on the soil conditions along the cable route. The purpose of cable burial is to ensure that the cables are protected from damage by external factors. In some areas it may be necessary to protect the cables using additional physical infrastructure such as rock or gravel protection, mattresses, protective aprons or coverings, or bagged solutions (e.g. grout bags), installed on top of the cables. Typical cable burial depth is between 0.5 to 1.5m, but shallower burial or surface lay will also be considered in environmentally sensitive areas, including the possibility of surface or near surface lay without installation of additional protection infrastructure. The appropriate level of cable protection will be determined based on an assessment of the risks posed to the project in specific areas. **Table 1-3** describes the main cable parameters.

17. It is likely that the export cables will have to cross other cables and/or pipelines. A number of techniques can be utilised, including (but not limited to):

    - Pre-lay and post lay concrete mattresses;

- Pre-lay and post lay rock placement; or
- Pre-lay steel structures.

Table 1-3 Offshore cable parameters (based on an HVAC export cable system)

Parameters	Indicative range
DEP array cables	One per wind turbine plus potential cables for redundancy between strings
SEP array cables	One per wind turbine plus potential cables for redundancy between strings
Cables connecting DEP and SEP (array or interlink)	Up to 8
Export cables/trenches	Up to 2
Fibre optic cables	Bundled in export cable
Number of cable crossings	Up to 6
Length of cables	
Array cables	Dependent upon distance between turbines
DEP – SEP	Up to 20km
Export cable SEP – Weybourne	~18km
Export cable SEP – Bacton	~30km
Export cable route scoping width	~500m – 1,000m (1,000m through the Cromer Shoal Chalk Beds MCZ)

1.2.2.5 Landfall

18. There are currently two alternative landfall options (Weybourne and Bacton[1]). A preferred landfall will be selected during the EIA process. It is assumed that suitable installation technologies may include open cut trenching or horizontal directional drilling (HDD). The offshore and onshore cables will be jointed in one or two transition bays onshore. **Table 1-4** shows the main construction parameters for the landfall site.

19. Open cut trenching is a well-known installation methodology for underground cabling in relatively unconstrained areas. It can also be used to install cables in a landfall and would require an open trench to be dug out before cables are installed and the trench refilled.

20. If HDD is chosen as the appropriate installation methodology at the landfall, each export cable will require one HDD (i.e. up to two in total). However, an additional HDD is accounted for in the scoping envelope as contingency. The HDD is drilled from an onshore construction compound and will exit the seabed in an exit pit at a suitable site with 8-10m water depth.

[1] Since the draft of this document was issued for consultation a decision has been made to select the Weybourne landfall option. References to the Bacton landfall and export cable route corridor remain in the final draft for context and evidence of the site selection process.

21. The offshore exit pits will be spaced some distance apart, typically 20-50m. However, environmental and technical constraints may guide the actual separation distance to be used. The exit pits are likely to be 3m wide at the bottom to allow collection of drilling fluids. The total length will be approximately 10m, while the depth of the exit pits will reflect the depth at which the export cable will continue further offshore. However, it is likely that depths will be less than 1m. The export cables are generally protected in the HDD exit pits and in the offshore export cable trench. However, there is a section between the HDD exit pit and the cable trench of up to 50m where the export cables are not naturally protected. This stretch may require additional permanent protection measures in the form of rock protection or other protection infrastructure. For the purposes of the EIA, appropriate protective measures will be identified and discussed with key stakeholders prior to submission of the DCO application.

Table 1-4 Landfall construction parameters

Landfall	Indicative parameters
Number of HDD drills	Up to 3
Landfall HDD compound (length x width)	Up to 80 x 80m
Length of HDD	Up to 1,500m

1.3 Legislation, Policy and Guidance

1.3.1 Marine & Coastal Access Act (2009)

22. The UK Marine & Coastal Access Act (2009) establishes a range of measures to manage the marine environment including establishing MCZs. The Marine Conservation Zone Project was established in 2008 by the Joint Nature Conservation Committee and Natural England to work with regional stakeholder led projects to identify and recommend MCZs to Government. The designation of MCZs is now complete.

23. Sections 125 and 126 of the MCAA place specific duties on the MMO relating to MCZs and marine licence decision making. This is because Section 126 applies where;

> *(a) a public authority has the function of determining an application (whenever made) for authorisation of the doing of an act, and*
>
> *(b) the act is capable of affecting (other than insignificantly)*
>
> *(i) the protected features of an MCZ;*
>
> *(ii) any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependent.*

24. Natural England has responsibility under the MCAA to give advice on how to further the conservation objectives for the MCZ, identify the activities that are capable of affecting the designated features and the processes which they are dependent upon.

1.3.2 Guidance

25. The MCZA gives consideration to the following guidance:

- MMO 2013. Marine Conservation Zones and Marine Licensing guidance; and
- Natural England 2020a. Guidance on how to use Natural England's Conservation Advice Packages for Environmental Assessments (Draft).
- Planning Inspectorate (PINS) 2019. Advice Note Seventeen: Cumulative effects assessment.

26. The approach to the screening assessment has also been informed by advice from Natural England and other stakeholders provided through the EPP as well as Supplementary Advice on Conservation Objectives (SACO), namely for the Cromer Shoal Chalk Beds MCZ (Natural England, 2020b).

2 MCZ Assessment Methodology

2.1 MCZ Assessment Process

27. To undertake its marine licensing function, the MMO has introduced a three stage sequential assessment process for considering impacts on MCZs, in order for it to deliver its duties under Section 126 of the MCAA. Section 126 places specific duties on all public bodies in undertaking their licencing activities where they are capable of hindering the conservation objectives of an MCZ. The MCZ assessment process is similar to, but separate from, the Habitats Regulations Assessment (HRA) process. The stages of MCZ assessment are presented below.

2.1.1 Screening (this report)

28. The screening process is required to determine whether Section 126 of the MCAA (2009) should apply to the application. All applications go through an initial screening stage to determine whether:

- the plan, project or activity is within or near to a MCZ;
- the plan, project or activity is capable of significantly affecting (without mitigation) (i) the protected features of a MCZ, or (ii) any ecological or geomorphological processes on which the conservation of the features depends.

Where it has been determined through screening that Section 126 applies, the application is assessed further to determine which subsections of Section 126 should apply through Stage 1 assessment and Stage 2 assessment. The MCZA screening stage is summarised in **Figure 2-1**.

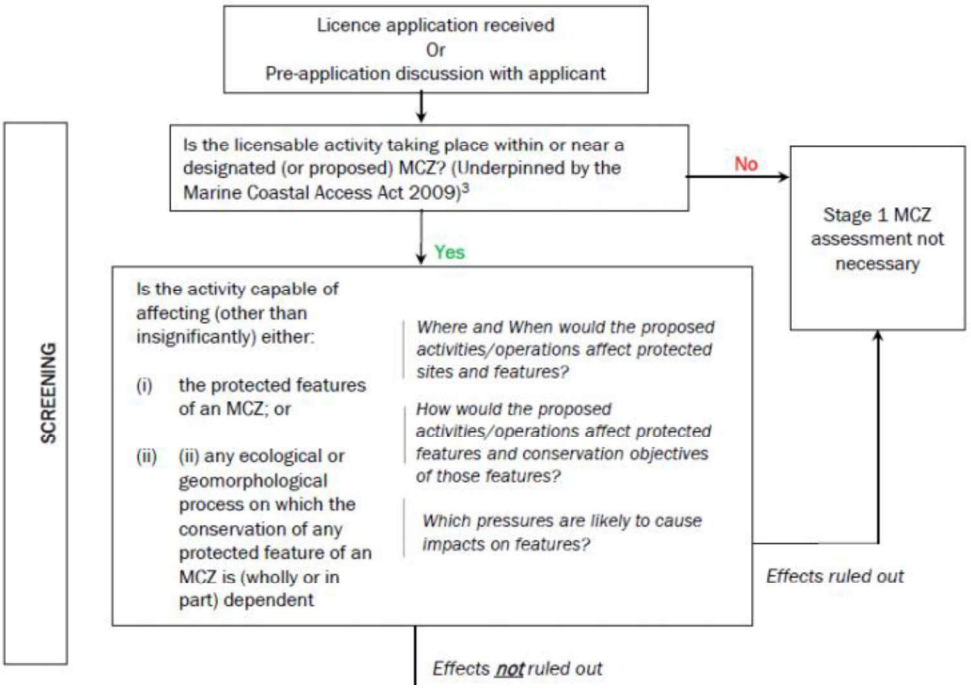


Figure 2-1 MCZA screening flowchart

2.1.2 Stage 1 Assessment

29. The Stage 1 assessment considers the extent of the potential impact of the plan or project on the MCZ in more detail. The Stage 1 assessment looks at whether the plan or project could potentially affect the conservation objectives for the site, that is, impact the site so that the features are no longer in favourable condition, or prevent the features from recovering to a favourable condition. If mitigation to reduce identified impacts cannot be secured, and there are no other alternative locations, then the project will be considered under Stage 2 of the assessment process.

2.1.3 Stage 2 Assessment

30. The Stage 2 assessment considers the socio-economic impact of the plan or project together with the risk of environmental damage. There are two parts to the Stage 2 assessment process:

- Does the public benefit in proceeding with the project clearly outweigh the risk of damage to the environment that will be created by proceeding with it? If so,
- Can the applicant satisfy that they can secure, or undertake arrangements to secure, measures of equivalent environmental benefit (MEEB) for the damage the project will have on the MCZ features?

2.1.4 Cumulative Effects

31. The MCAA does not provide any legislative requirement for explicit consideration of cumulative effects on the protected features of MCZs. However, the MMO guidelines (MMO, 2013) state that the MMO considers that in order for the MMO to fully discharge its duties under section 69 (1) of the MCAA, cumulative effects must be considered.

32. PINS Advice Note Seventeen (PINS, 2019) provides guidance on plans and projects that should be considered in the Cumulative Impact Assessment (CIA) including:

- Projects that are under construction;
- Permitted applications, not yet implemented;
- Submitted applications not yet determined;
- Projects on the PINS's Program of Projects;
- Development identified in relevant Development Plans, with weight being given as they move closer to adoption and recognising that much information on any relevant proposals will be limited; and
- Sites identified in other policy documents as development reasonably likely to come forward.

33. Only projects which are reasonably well described and sufficiently advanced to provide information on which to base a meaningful and robust assessment will be included in the cumulative assessment.

34. Projects that are sufficiently implemented during the site characterisation for DEP and SEP will be considered as part of the baseline for the EIA. Offshore cumulative impacts may come from interactions with the following activities and industries:

- Other wind farms;
- Aggregate extraction and dredging;
- Licensed disposal sites;
- Navigation and shipping;
- Commercial fisheries;
- Sub-sea cables and pipelines
- Potential port/harbour development;
- Oil and gas activities; and
- Fisheries management areas.

35. The assessment will present relevant cumulative effects of projects based on their stage of development using the tiered approach as devised by Natural England (JNCC and Natural England, 2013) and presented in **Table 2-1**.

Table 2-1 Tiers for Undertaking Cumulative/In-combination Assessment (based on JNCC and Natural England, 2013)

Tier	Consenting or Construction Phase	Data Availability
Tier 1	Built and operational projects should be included within the cumulative assessment where they have not been included within the environmental characterisation survey, i.e. they were not operational when baseline surveys were undertaken, and/or any residual impact may not have yet fed through to and been captured in estimates of "baseline" conditions e.g. background" distribution or mortality rate for birds.	Pre-construction (and possibly post-construction) survey data from the built project(s) and environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project).
Tier 2	Tier 1 + projects under construction	As Tier 1 but not including post construction survey data
Tier 3	Tier 2 + projects that have been consented (but construction has not yet commenced)	Environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project) and possibly pre-construction
Tier 4	Tier 3 + projects that have an application submitted to the appropriate regulatory body that have not yet been determined	Environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project)
Tier 5	Tier 4 + projects that the regulatory body are expecting an application to be submitted for determination (e.g. projects listed under the PINS programme of projects), including projects where a Preliminary Environmental Information Report (PEIR) has been undertaken and submitted	Possibly environmental characterisation survey data (but strong likelihood that this data will not be publicly available at this stage.

Tier	Consenting or Construction Phase	Data Availability
Tier 6	Tier 5 + projects that have been identified in relevant strategic plans or programmes (e.g. projects identified in Round 3 wind farm ZAP documents)	Historic survey data collected for other purposes/by other projects or industries or at a strategic level.

36. Projects classified under Tiers 1-4 are included in the MCZA screening. Tier 5 and 6 projects will be considered where sufficient information is available.

37. For this screening assessment, DEP and SEP activities and associated pressures are reviewed to determine whether they are capable of significantly affecting MCZs when combined with equivalent activities and associated pressures from other plans and projects. The potential for projects to act cumulatively on MCZs is considered in the context of the likely spatial and temporal extent of pressures.

2.2 Consultation

38. Consultation of relevance to the MCZA process has been undertaken with Statutory Nature Conservation Bodies (SNCBs) and other stakeholders through scoping and will be ongoing through the EPP, under which a Seabed ETG has been created that includes focussed consideration of MCZs, specifically the Cromer Shoal Chalk Beds (CSCB) MCZ (further details below).

2.2.1 Scoping

39. Consultation has been undertaken with the appropriate authorities as part of the scoping stage of the EIA process. The scoping report for the Projects was submitted to the PINS on 8th October 2019 and a Scoping Opinion received on 18th November 2019. Scoping established the potential effects of the Projects that will be assessed by the EIA (and by association the MCZA).

2.2.2 Evidence Plan

40. The EPP is a non-statutory, voluntary process that aims to encourage upfront agreement on what information an applicant needs to supply to the PINS as part of a DCO application. It aims to ensure EIA, HRA and MCZA requirements are met and to reduce the risk of major infrastructure projects being delayed at (or before) the examination phase of the DCO application process.

41. The EPP includes consultation through a Seabed ETG which focuses on issues related to marine geology, oceanography and physical processes, benthic ecology, and fish and shellfish ecology. The ETG aims to agree the relevance, appropriateness and sufficiency of baseline data, key issues for the EIA, and the impact assessment approach. Stakeholders represented on the Seabed ETG are Natural England, the MMO, the Centre for Environment, Fisheries and Aquaculture Science (Cefas), the Eastern Inshore Fisheries and Conservation Authority (EIFCA), and The Wildlife Trust (TWT).

2.2.3 Summary of relevant consultation responses

42. Through the scoping process stakeholders have advised that the following potential impacts on MCZs be assessed:

- impacts of this development on CSCB MCZ interest features;
- likely significant effects of changes to hydrodynamic and sedimentary processes on the CSCB MCZ;
- likely significant effects to seabed features, particularly in relation to the CSCB MCZ as the geological features cannot reform once damaged;
- likely significant effects from habitat loss (permanent/long term and temporary) for the construction, operation and decommissioning phases, including from cable protection;
- likely significant effects associated with underwater noise and vibration for the construction, operation and decommissioning phases;
- likely significant effects of remobilisation of contaminated sediments during the construction, operation and decommissioning phases; and
- likely significant effects resulting from the loss of habitat due to scour, scour protection and altered sedimentary processes.

43. A draft of this document was made available for consultation through the Seabed ETG on 21st April 2020. Based on the comments received the screening assessment (this version) has been updated.

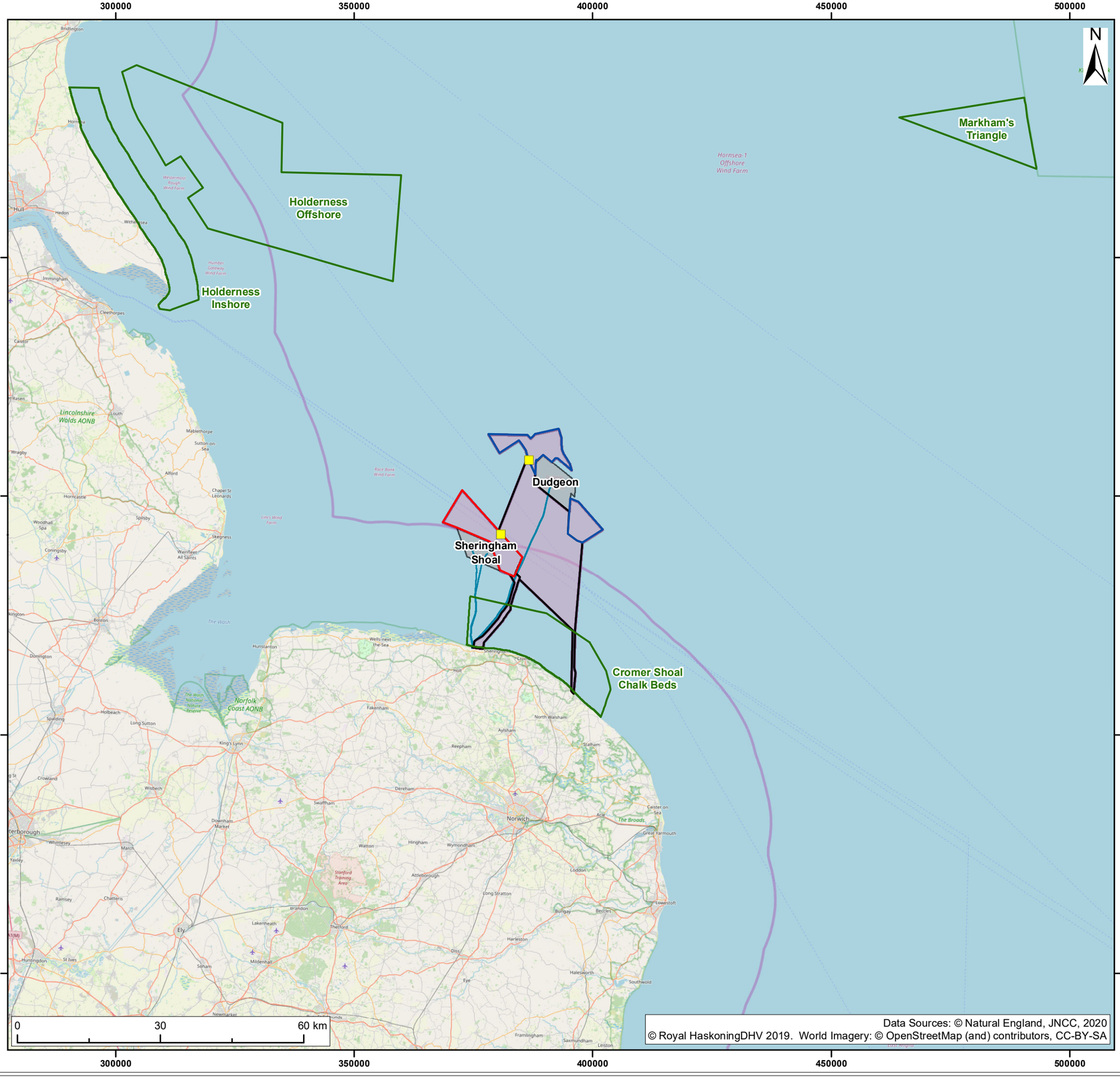
3 Is the Activity Within or Near to a MCZ?

44. The first stage of the screening assessment is to determine whether the Projects and associated activities take place within or near a MCZ. The location of the Projects in relation to MCZs is illustrated in **Figure 3-1**.

45. Both of the Project's export cable corridor options route through the CSCB MCZ. Therefore it is possible that project activities would be capable of significantly affecting the protected features of this MCZ and it is screened in for further assessment. However, neither of the proposed offshore wind farm arrays are within the MCZ, with the SEP array area being 6.1km to the north of the MCZ boundary at its closest point.

46. Holderness Offshore is the next closest MCZ to the Projects, located approximately 37.8km northwest of DEP at its nearest point (Figure 3-1). The protected features of Holderness Offshore MCZ are sediment habitats ranging from subtidal sand to subtidal coarse and mixed sediments, and a glacial tunnel valley. Given the distance to Holderness Offshore MCZ, the Projects are not considered capable of significantly affecting its protected features. Evidence suggests that the maximum extent of effects from the Projects, associated with increased suspended sediment concentrations, is approximately 10km (see **Section 5**). Therefore, Holderness Offshore and all other MCZs are proposed to be screened out on account of their distance to Projects.

47. The Wash Approach recommended MCZ (rMCZ) was located to the northwest of the Projects. Following formal consultation on Tranche Three of the Marine Conservation Zone Project in 2018, Defra chose not to designate the Wash Approach rMCZ. Tranche Three completed the Marine Protected Area (MPA) network in English inshore and English, Welsh and Northern Irish offshore waters, and therefore the Wash Approach is no longer a rMCZ.



Legend:

- Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ)
- Dudgeon Extension Project AfL Area
- Sheringham Extension Project AfL Area
- Offshore Cable Corridor
- Offshore Scoping Area
- Indicative Offshore Substation Location
- Existing Offshore Wind Farm
- Existing Offshore Wind Farm Export Cable

SUI	REV	DATE	DESCRIPTION	DRW	CHK	APR
S1	P01	02/04/2020	Suitable for information	AZ	RS	AP

Title:

Location of Projects Scoping Area in Relation to MCZs

Figure: 3-1

Drawing No: PB8164-RHD-ZZ-OF-DR-Z-0050

Co-ordinate system: WGS 1984 UTM Zone 31N

Page Size: A3

Scale: 1:800,000

Project: Dudgeon and Sheringham Shoal Offshore Wind Farm Extensions

Report: Marine Conservation Zone Assessment Screening Report

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4 Cromer Shoal Chalk Beds MCZ

48. As the only site screened into the assessment (**Section 3**), this section provides a description of the CSCB MCZ, its protected features and conservation objectives.

49. The site is located off the Norfolk coastline, extending from east of Weybourne to Happisburgh, and covers an area of 315.64km^2. The site begins 200m off the North Norfolk Coast and extends up to 10km out to sea.

4.1 Protected Features

50. The CSCB MCZ is designated for seven broadscale marine habitat features, two habitat features of conservation interest (FOCI) and one feature of geological interest (**Table 4-1**).

Table 4-1 Cromer Shoal Chalk Beds MCZ designated features (Natural England, 2020b).

Protected feature	Type of feature
High energy circalittoral rock	Broadscale marine habitat
High energy infralittoral rock	Broadscale marine habitat
Moderate energy circalittoral rock	Broadscale marine habitat
Moderate energy infralittoral rock	Broadscale marine habitat
Subtidal coarse sediment	Broadscale marine habitat
Subtidal mixed sediments	Broadscale marine habitat
Subtidal sand	Broadscale marine habitat
Peat and clay exposures	Marine habitat (FOCI)
Subtidal chalk	Marine habitat (FOCI)
North Norfolk Coast assemblage of subtidal sediment features and habitats	Feature of geological interest

51. Whereas broadscale marine habitats represent a range of similar habitats and associated species grouped together, FOCI are specific habitats and species that are known to be threatened, rare or declining in our seas.

52. Protecting examples of broadscale habitats across the Marine Protected Area network aims to ensure that the full range of marine biodiversity in our seas is conserved. FOCI species and habitats may be more sensitive to pressures and hence need targeted protection (JNCC, 2016).

4.1.1 Feature Maps

53. The distribution of protected features within the MCZ, as depicted in the 'Cromer Shoal Chalk Beds MCZ Feature Maps' (Defra, 2016), are shown in **Figure 4-1** and **Figure 4-2**. These feature maps are based on the Site Assessment Document (SAD) submitted to Natural England and the JNCC as part of Net Gain's final recommendations for a suite of MCZs within the English North Sea, in August 2011 (Net Gain, 2011).

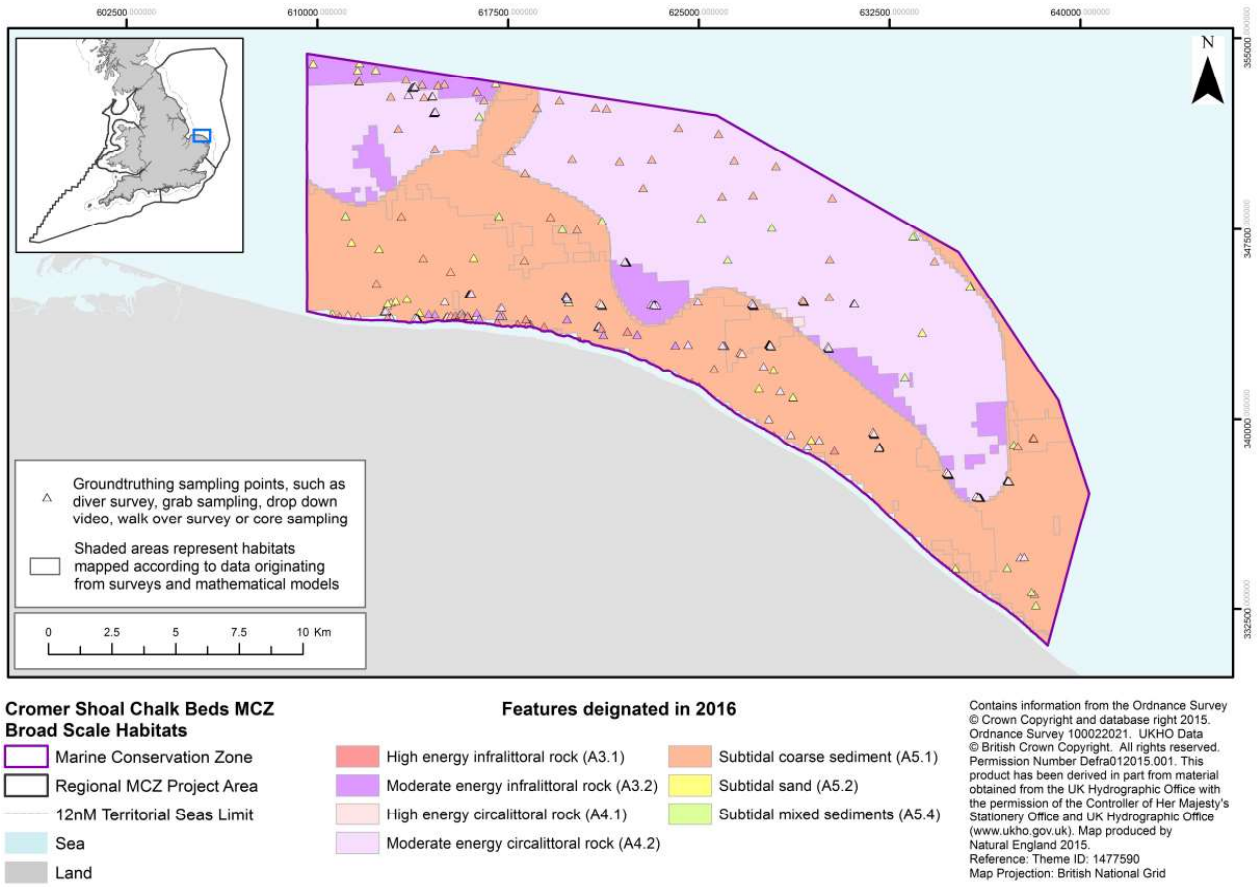


Figure 4-1 Cromer Shoal Chalk Beds MCZ Broad Scale Habitats (Defra, 2016)

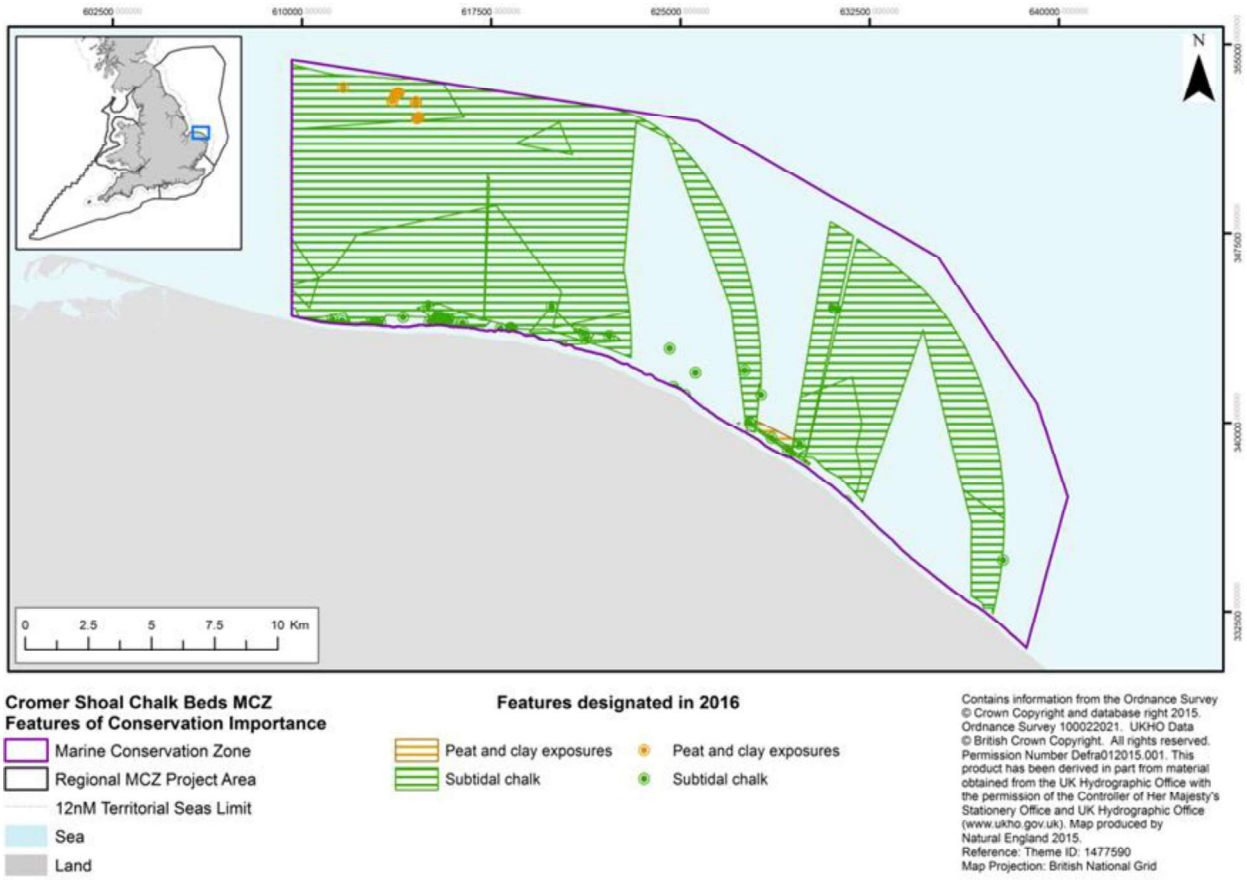
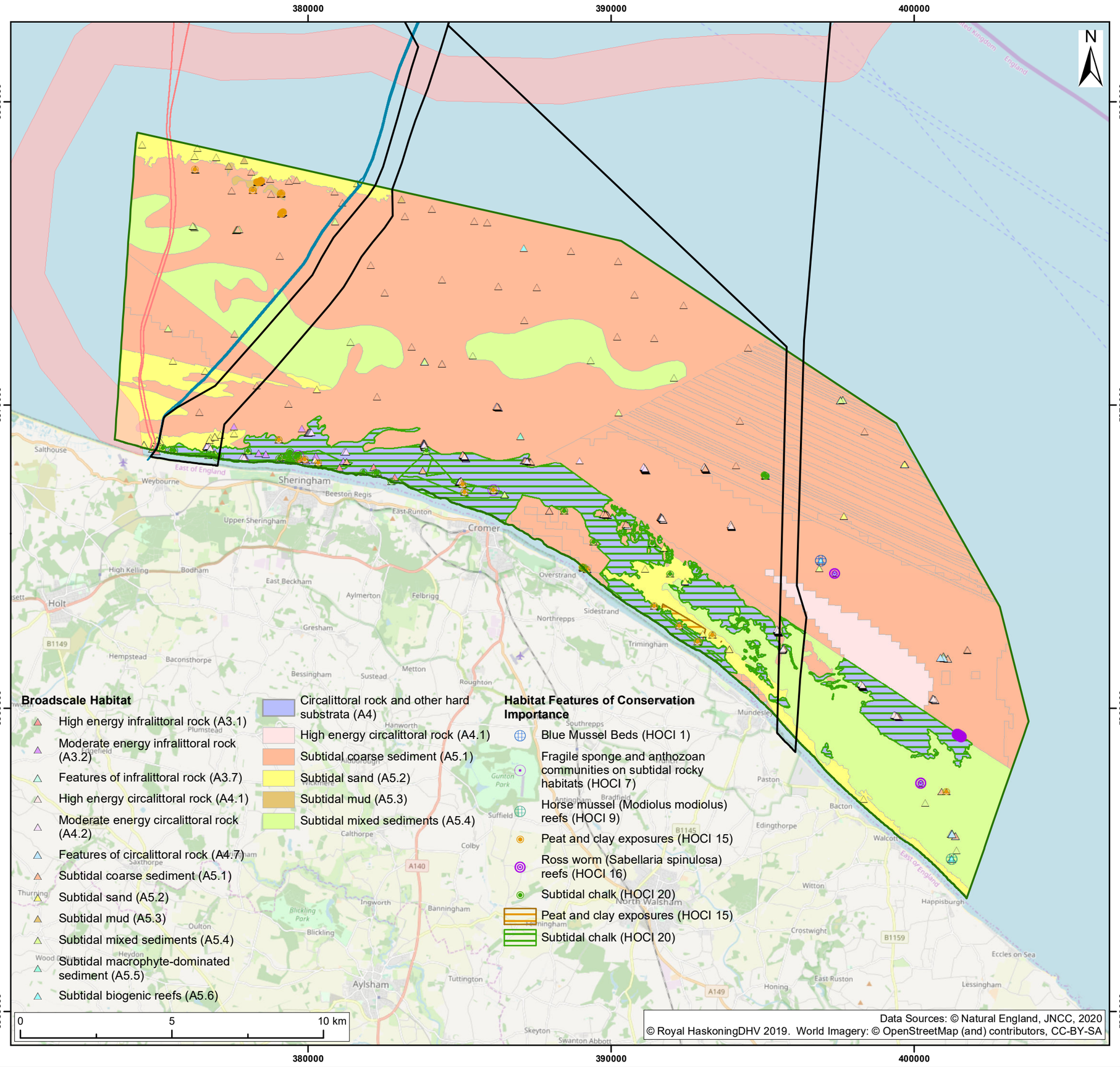


Figure 4-2 Cromer Shoal Chalk Beds MCZ FOCI (Defra, 2016)

54. It should be noted that these feature maps have been updated/amended using information from more recent dedicated acoustic and ground truthing surveys of the MCZ, published in a Cromer Shoal Chalk Beds rMCZ Post-survey Site Report (Defra, 2015). The updated map is shown in **Figure 4-3** below, along with the locations of the proposed export cable corridor options.



Legend:

- Offshore Cable Corridor
- Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ)
- Existing Dudgeon Offshore Wind Farm Export Cable
- Existing Sheringham Shoal Offshore Wind Farm Export Cable
- Hornsea P3 Corridor

SUI	REV	DATE	DESCRIPTION	DRW	CHK	APR
S1	P01	02/04/2020	Suitable for information	AZ	RS	AP

Title:

Project Scoping Area and MCZ Protected Features

Figure: 4-3

Drawing No: PB8164-RHD-ZZ-OF-DR-Z-0051

Co-ordinate system: WGS 1984 UTM Zone 31N

Page Size: A3

Scale: 1:125,000

Project: Dudgeon and Sheringham Shoal Offshore Wind Farm Extensions

Report: Marine Conservation Zone Assessment Screening Report

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55. **Figure 4-3** indicates that the export cable corridors traverse the protected features shown in **Table 4-2**.

Table 4-2 MCZ protected features the spatially coincide with the export cable corridor (✓)

Protected feature (EUNIS Code)	Weybourne	Bacton
High energy circalittoral rock (A4.1)	✓	✓
Moderate energy circalittoral rock (A4.2)	✓	×
High energy infralittoral rock (A3.1)	✓	×
Moderate energy infralittoral rock (3.2)	×	×
Subtidal coarse sediment (A5.1)	✓	✓
Subtidal sand (A5.2)	✓	✓
Subtidal mixed sediments (A5.4)	✓	✓
Peat and clay exposures	×	×
Subtidal chalk	✓	✓
North Norfolk Coast assemblage of subtidal sediment features and habitats	✓	✓

56. Based on currently available evidence, all the protected features of the CSCB MCZ have the potential to be directly affected by cable installation except for the peat and clay exposures FOCI and moderate energy infralittoral rock, existing records of which are located outside of the cable corridors or outside the MCZ (**Table 4-2**).

57. The nearest records of MCZ peat and clay exposures are located approximately 1.9km (east and west) from the Weybourne export cable corridor and approximately 0.5km west of Bacton export cable corridor. This is supported by the results of a geophysical survey of the export cable corridors undertaken by Gardline in 2019 which did not identified clay peat and clay exposures (Gardline, 2020).

58. The nearest record of moderate energy infralittoral rock in the MCZ is located approximately 0.3km east of the Weybourne export cable corridor (described as chalk reef) and approximately 4.1km from the Bacton export cable corridor. There are several records within the Weybourne corridor that are close to landfall, less than 200m from the coast and therefore outside the MCZ.

59. The absence of these protected habitat features from the cable corridors cannot be confirmed until further offshore survey data is acquired and analysed. A targeted benthic survey using benthic grabs and underwater photography is planned for summer 2020. The results of this will be used to interpret the geophysical survey data and classify benthic habitats and will be reported on at a later stage. Furthermore, habitats located outside of the cable corridors still have potential to be affected indirectly.

4.2 Conservation Objectives

60. The site's conservation objectives apply to the MCZ and its individual protected features. The MCZ conservation objective is that the protected habitats:

1. are maintained in favourable condition if they are already in favourable condition
2. be brought into favourable condition if they are not already in favourable condition

61. For each protected feature, favourable condition means that, within a zone:

1. its extent is stable or increasing
2. 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

62. For the feature of geological interest, favourable condition means that, within a zone:

1. its extent, component elements and integrity are maintained
2. its structure and functioning are unimpaired
3. its surface remains sufficiently unobscured for the purposes of determining whether the conditions in paragraphs (1) and (2) are satisfied.

63. A condition assessment has not been undertaken yet for the CSCB MCZ.

4.2.1 Supplementary Advice on Conservation Objectives

64. Natural England has provided SACOs for the CSCB MCZ (Natural England, 2020b). The SACOs provide further detail about the protected features' extent and distribution, structure, function and supporting processes. For these attributes, targets are provided and where possible quantified.

65. The implications of the DEP and SEP on the specific attributes and targets for Cromer Shoal Chalk Beds MCZ protected features will be used to inform Stage 1 of the MCZA.

5 Screening

66. The CSCB MCZ has been identified as having the potential to be affected by the Projects. This MCZ screening assessment aligns with Natural England's guidance on the use of marine conservation advice for MCZ assessments (Natural England, 2020).

5.1 Potential pressures (source)

67. The potential impacts from the proposed Projects have been identified within the Scoping Report (Equinor, 2019) and the Scoping Opinion (PINS, 2019). This section summarises the sources of pressures with the potential to have significant effects on MCZ protected features.

5.1.1 Construction

68. During construction of the Projects, the installation of export cables will have direct effects on the seabed habitats within the CSCB MCZ. It is expected that cables will be installed by ploughing or trenching along the cable route, although laying them on the surface without protection where burial is not possible has not been ruled out. It is also expected that the export cables will cross the disused Stratos telecommunications cable inside the MCZ, and it is possible that cable protection using rock or concrete mattresses will be required at the crossing and in some other areas where the cables cannot be sufficiently buried and additional protection is required. HDD will be employed on the approach to landfall, requiring the creation of HDD exit pits in the MCZ. Preparatory works may include unexploded ordnance (UXO) and boulder clearance. These activities would have direct effects on seabed habitats including physical disturbance and habitat loss where the seabed substrate type is changed. The introduction of artificial hard substrates will be avoided if possible or minimised if it is necessary.

69. Indirect effects of seabed disturbance are increased suspended sediment concentrations (SSC) and sediment deposition, and where sediments are remobilised there is potential to release sediment-bound contaminants into the water. Sources of these indirect effects could include construction activities outside of the MCZ such as seabed preparation, foundation installation, and jack-up activities, potentially transported to the MCZ by tides and currents. The dispersion and deposition of sediment arising from cable laying was modelled for the Dudgeon and Sheringham Shoal offshore wind farms. The worst case extent of suspended sediment dispersion was from ploughing chalk during a spring tide, where the dispersion footprint extended up to 10km to the west and less to the east, with concentrations dropping to less that 1mg/l above background within a single tidal excursion. However chalk fines are not expected to settle (DOW, 2009; Scira Offshore Energy, 2006). For other seabed types (sediment with a high proportion of fines) the dispersion footprint was expected to extend less than 1km from Dudgeon (DOW, 2009) and less than 2km from Sheringham Shoal (Scira Offshore Energy, 2006). The footprint of silt deposition was over a wide area but at an undetectable rate. Even under slack water conditions, the maximum rate of deposition was 0.5mm over a small area close to source. Coarser sediment such as sand will only be carried a few metres from the point of disturbance (DOW, 2009; Scira Offshore Energy, 2006).

70. Similarly, there is a potential pathway for underwater noise and vibration effects from construction activities, including from foundation piling and UXO clearance.

71. The use of vessels during the construction phase has the potential to introduce invasive species.

5.1.2 Operation

72. During the operational period the physical presence of any installed artificial hard substrates (e.g. the export cable or cable protection) on the seabed will result in a lasting change to existing habitats. Interruption of sediment transport by structures on the seabed is possible, including seabed scour where the sediment is fine enough to be mobilised.

73. Maintenance activities during the operational phase may also result in localised, direct and indirect effects, similar to those observed during construction but lower in magnitude.

74. Turbine operation is a source of underwater noise and vibration, conducted through the tower and foundations into the water. The magnitude of underwater noise and vibration from wind farm operation is much lower than for activities like piling and UXO clearance during construction.

75. Electromagnetic fields (EMF) are generated around offshore cables when the wind farm is generating an electrical current. EMFs are localised around the cable strongly attenuated and decrease as an inverse square of distance from the cable (Gill and Barletta, 2010).

5.1.3 Decommissioning

76. It is anticipated that the decommissioning effects would be similar in nature to those of construction, although the magnitude of effects is likely to be lower. The extent of removal of artificial substrates during decommissioning will determine how much habitat loss will be lasting / long term and how much may be permanent.

5.1.4 Summary of pressures identified through scoping

77. Pressures associated with construction, operation and decommissioning of the Projects as a whole, identified through scoping, as having potential for a likely significant effect on MCZ features are shown in **Table 5-1**.

Table 5-1 Summary of potential pressures, and those scoped in (✓) and scoped out (✗)

Potential Pressure	Construction	Operation	Decommissioning
Temporary physical disturbance	✓	✓	✓
Temporary habitat loss	✓	✓	✓
Permanent/long term habitat loss	✗	✓	✓
Increased suspended sediment concentrations	✓	✓	✓
Re-mobilisation of contaminated sediments	✓	✓	✓
Effects on bedload sediment transport	✓	✓	✓
Underwater noise and vibration	✓	✓	✓
Colonization of foundations and cable protection	✗	✓	✗
Invasive species	✓	✓	✓
Electromagnetic fields	✗	✗	✗

5.2 Natural England's Conservation Advice

78. Natural England has a statutory duty to provide conservation advice for MPAs in England's inshore waters (up to 12 nautical miles) under regulation 37 of The Conservation of Habitats and Species Regulations 2017 amended) and section 127 of the Marine and Coastal Access Act 2009. This conservation advice applies to MCZs as well as other types of MPA (Natural England, 2020a). Conservation advice packages have been developed and made available online to assist environmental assessments to determine if activities, plans or projects will impact on habitats and species within MPAs. This MCZ screening assessment makes reference to the advice provided specifically for the Cromer Shoal Chalk Beds MCZ (Natural England, 2020b).

79. The conservation advice packages comprise the following components:

- Site information;
- Feature and sub feature descriptions;
- Background information and geography;
- Site maps;
- Conservation Objectives and SACOs;
- Advice on Operations (AoO);
- Advice on Seasonality;
- Feature condition;
- Management measures; and
- Further information.

5.2.1 Advice on Operations

80. The AoO component identifies pressures associated with the most commonly occurring marine activities, and provides a detailed assessment of the feature/subfeature or supporting habitat sensitivity to these pressures. This information is presented in a sensitivity assessment matrix for each activity.

81. For each activity, the AoO identifies associated pressures and classifies the risk profile of pressures (RPP) as either 'Medium-High Risk' or 'Low Risk' as described in **Table 5-2**.

Table 5-2 AoO RPP classifications and recommendations

Risk Profile of Pressure	Recommendation
Medium-High Risk	Pressure is commonly induced by activity at a level that needs to be considered further as part of an assessment
Low Risk	Unless there are evidence-based case or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, this pressure generally does not occur at a level of concern and should not require consideration as part of an assessment

82. A review of project activities, associated pressures and their risk can be used to inform screening as described below (Natural England, 2020a):

- Any features/subfeatures/supporting habitats where there is no realistic pathway of interaction e.g. due to distance from proposed works or isolated nature of the feature can be screened out of the assessment.
- Any low risk pressures where there is no case-specific reason where the risk would be increased for the plan/project in question can also be screened out.

5.2.2 Screening of Activities and Pressures

83. Activities that will occur inside the Cromer Shoal Chalk Beds MCZ are:

- Cable HDD;
- Power cable laying, burial and protection (installation, including ploughing, trenching, rock placement, anchor placement, grapnel run, boulder clearance and UXO detonation activities);
- Power cable operation and maintenance (operation); and
- Power cable decommissioning.

Pressures from these activities can be expected to have effects on the MCZ features.

84. Activities that will occur outside the Cromer Shoal Chalk Beds MCZ are:

- Offshore wind: during construction;
- Offshore wind: operation and maintenance; and
- Offshore wind: decommissioning.

85. Pressures from these activities may not have a pathway of interaction with the MCZ features due to the distance from proposed works. The proposed SEP and DEP arrays are located approximately 6.1km and 16.5km from the MCZ boundary at their nearest points, respectively.

86. Some low risk pressures may become medium-high risk pressures as a consequence of these additional site-specific factors. Conversely, in specific cases pressures assessed as generically posing medium to high risk to features may be screened out on the basis of activity and/or site-specific knowledge/evidence. The generic RPP classifications have been reviewed with reference to the relevant AoO Activity Pressure justification and advice from consultation. No justification has been identified for increasing generic low risk pressures to medium-high risk. However three low risk pressures have been 'scoped in' for assessment because they relate to potential impacts scoped in by the EIA scoping process (re-mobilisation of contaminated sediments; and invasive species).

5.2.2.1 Sensitivity Matrix for Project Activities

87. Natural England's AoO provides sensitivity assessment matrices that include information on the sensitivity of features to specific pressures. AoO classifies the sensitivity of protected features as: Sensitive; Insufficient Evidence to Assess; Not Assessed; Not Sensitive; or Not Relevant, as defined in **Table 5-3**.

Table 5-3 AoO sensitivity categories (Natural England, 2020b)

Interaction Type		Sensitivity category description
Direct	Indirect	
S	S*	SENSITIVE: The evidence base suggests the feature is sensitive to the pressure at the benchmark. This activity-pressure-feature combination should therefore be taken to further assessment.
IE	IE*	INSUFFICIENT EVIDENCE TO ASSESS: The evidence base is not considered to be developed enough for assessments to be made of sensitivity at the pressure benchmark. This activity-pressure-feature combination should therefore be taken to further assessment. The best available evidence, relevant to the activity in question, at the time of application, should be sourced and considered in any further assessment.
NA	NA*	NOT ASSESSED: A sensitivity assessment has not been made for this feature to this pressure. However, this activity-pressure-feature combination should not be precluded from consideration. The best available evidence, relevant to the activity in question, at the time of application, should be sourced and considered in any further assessment.
NS	NS*	NOT SENSITIVE AT THE BENCHMARK: The evidence base suggests the feature is not sensitive to the pressure at the benchmark. However, this activity-pressure-feature combination should not be precluded from consideration (e.g. thought needs to be given to activity specific variations in pressure intensity and exposure, in-combination and indirect effects). The best available evidence, relevant to the activity in question, at the time of application, should be sourced and considered in any further assessment.
		NOT RELEVANT: The evidence base suggests that there is no interaction of concern between the pressure and the feature OR the activity and the feature could not interact.

88. **Table 5-4** shows the combined sensitivity assessment matrix for the Cromer Shoal Chalk Beds MCZ. It lists all pressures associated with cable activities (HDD, installation, operation and decommissioning) and offshore wind construction, operation and decommissioning activities which are classed as medium to high risk plus three low risk pressures 'scoped in' for assessment as set out in the Scoping Opinion. Individual matrices for these activities are provided in Appendix A.

89. Pressures from non-cable related offshore wind construction, operation and maintenance, and decommissioning sources with a 'Medium-High Risk' RPP not already identified from cable sources, are:

- Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)
- Physical loss (to land or freshwater habitat)
- Underwater noise changes
- Visual disturbance
- 'Water flow (tidal current) changes, including sediment transport considerations.

These are included in **Table 5-4**.

90. The combined sensitivity assessment matrix (**Table 5-4**) categorises the sensitivity of MCZ protected features as potentially sensitive (S) (which includes both 'Sensitive' and 'Insufficient Evidence to Assess' AoO categories); or Not Assessed (NA). Where the feature is categorised as 'Not sensitive at the pressure benchmark' the matrix pressure-feature interaction cell is greyed out and labelled NS. 'Not relevant' interactions are left blank (grey).

Table 5-4 Combined Cromer Shoal Chalk Beds MCZ sensitivity assessment matrix for cable and offshore wind activities (S: Potentially sensitive, NA: Not assessed, NS: Not sensitive)

Pressure Name	North Norfolk Coast	Peat and clay exposures	High energy infralittoral rock	Moderate energy infralittoral rock	Subtidal chalk	Subtidal coarse sediment	Subtidal mixed sediments	Subtidal sand	High energy circalittoral rock	Moderate energy circalittoral rock
Above water noise	NA									
Abrasion/disturbance of the substrate on the surface of the seabed	NA	S	S	S	S	S	S	S	S	S
Barrier to species movement	NA		NS	NS		NS		NS		S
Changes in suspended solids (water clarity)	NA	NS	S	NS	S	NS	NS	S	S	S
Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	NA									
Habitat structure changes - removal of substratum (extraction)	NA	S			S	S	S	S	S	S
Introduction of other substances (solid, liquid or gas)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	NA	S			S	S	S	S	S	S
Physical change (to another seabed type)	NA	S	S	S		S	S	S	S	S
Physical change (to another sediment type)	NA	S				S	S	S	S	S
Physical loss (to land or freshwater habitat)	NA	S	S	S	S	S	S	S		S
Smothering and siltation rate changes (Light)	NA	S	NS	NS	NS	S	S	S	S	S
Underwater noise changes	NA							NS	NS	
Vibration	NA									
Visual disturbance	NA	NS			NS					NS
Water flow (tidal current) changes, including sediment transport considerations	NA	NS	NS	NS	NS	NS	NS	NS	NS	S

Pressure Name	North Norfolk Coast	Peat and clay exposures	High energy infralittoral rock	Moderate energy infralittoral rock	Subtidal chalk	Subtidal coarse sediment	Subtidal mixed sediments	Subtidal sand	High energy circalittoral rock	Moderate energy circalittoral rock
Hydrocarbon & PAH contamination (Low Risk – to inform 'Re-mobilisation of contaminated sediments' risk)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Introduction or spread of invasive non-indigenous species (INIS) (Low Risk)	NA	S	NS	NS		S	S	S	IE	S
Transition elements & organo-metal (e.g. TBT) contamination (Low Risk– to inform 'Re-mobilisation of contaminated sediments' risk)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2.2.2 Screening of pressures

91. The screening outcome for each pressure-feature interaction, is summarised **in Table 5-5**. Pressures screened 'in' are proposed to be taken forward to the Stage 1 assessment.

Table 5-5 Screening list of pressures on the Cromer Shoal Chalk Beds MCZ and its protected features

Pressure Name	Screening Outcome	Justification
Above water noise	Out	• AoO classifies the pressure as Medium-High Risk only for offshore wind farm (non-cable) decommissioning which will be a minimum 6.1km from the MCZ. • MCZ protected features are not sensitive to this pressure.
Abrasion/disturbance of the substrate on the surface of the seabed	In	• Medium-High Risk pressure from cable activities in the MCZ. • All MCZ protected habitat features are potentially sensitive.
Barrier to species movement	Out	• AoO classifies the pressure as Medium-High Risk for offshore wind farm (non-cable) operation which will be a minimum 6.1km from the MCZ, and HDD activities. • Activity Pressure justification for HDD states this pressure is relevant to cables carrying electricity, and that at the exit point the cable can be in shallow enough waters for EMFs to be exacerbated by the movement of seawater. • However, sensitive receptors are migratory fish species. • The only MCZ protected feature that AoO classes as sensitive to this pressure is moderate energy circalittoral rock (Not sensitive-Low). This is based on physical barriers to recruitment of larvae to this habitat from source populations and would not apply to EMFs. • The PINS Scoping Opinion states that likely significant effects of EMFs on impact benthic species and habitats can be scoped out.
Changes in suspended solids (water clarity)	In	• Medium-High Risk pressure from cable activities in the MCZ. • Several MCZ protected habitat features are potentially sensitive.
Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	Out	• AoO classifies the pressure as Medium-High Risk only for offshore wind farm (non-cable) operation and maintenance which will be a minimum 6.1km from the MCZ. • MCZ protected features are not sensitive to this pressure.
Habitat structure changes - removal of substratum (extraction)	In	• Medium-High Risk pressure from HDD creation of exit pits. • Several MCZ protected habitat features are potentially sensitive.

Pressure Name	Screening Outcome	Justification
Introduction of other substances (solid, liquid or gas)	In	• Medium-High Risk pressure from discharge of HDD drilling fluid. • A sensitivity assessment has not been made for MCZ featured to this pressure. However, this activity-pressure-feature combination should not be precluded from consideration and will be assessed as part of the Stage 1 assessment.
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	In	• Medium-High Risk pressure from cable activities in the MCZ. • Several MCZ protected habitat features are potentially sensitive.
Physical change (to another seabed type)	In	• Medium-High Risk pressure from external protection of cables. • AoO states all MCZ protected habitat features are potentially sensitive except for subtidal chalk. However, this assessment also screens in the potential for significant impacts on subtidal chalk.
Physical change (to another sediment type)	In	• Medium-High Risk pressure from external protection of cables • AoO states all MCZ protected sediment habitat features are potentially sensitive
Physical loss (to land or freshwater habitat)	Out	• AoO classifies the pressure as Medium-High Risk only for placement of structures on the seabed (including turbine foundations, meteorological masts, substations and scour protection) during offshore wind farm (non-cable) construction, operation and maintenance which will be a minimum 6.1km from the MCZ. • There will be no loss of habitat (to land) in the MCZ.
Smothering and siltation rate changes (Light)	In	• AoO classifies the pressure as Medium-High Risk for HDD, cable installation, operation and maintenance activities when sediment re-suspension will occur then subsequent re-deposition on the seabed. • Several MCZ protected habitat features are potentially sensitive to light deposition of up to 5cm of fine material added to the habitat in a single, discrete event.
Underwater noise changes	Out	• AoO classifies the pressure as Medium-High Risk only during offshore wind farm (non-cable) construction and decommissioning which will be a minimum 6.1km from the MCZ. • Sensitive receptors are marine mammals and fish. • MCZ protected features are not sensitive to this pressure.
Vibration	Out	• AoO classifies the pressure as Medium-High Risk for HDD sheet piling for installation of coffer dams where used and dredging/ excavation works for exit pits.

Pressure Name	Screening Outcome	Justification
		• The evidence base suggests that there is no interaction of concern between vibration and the MCZ protected features.
Visual disturbance	Out	• AoO classifies the pressure as Medium-High Risk only during offshore wind farm (non-cable) construction, operation and decommissioning which will be a minimum 6.1km from the MCZ. • Sensitive receptors are mobile species such as marine mammals and seabirds. • MCZ protected features are not sensitive to this pressure.
Water flow (tidal current) changes, including sediment transport considerations	In	• AoO classifies the pressure as Medium-High Risk only during offshore wind farm (non-cable) operation which will be a minimum 6.1km from the MCZ. • The physical presence of wind turbines could lead to diffraction or funneling of waves and currents between the turbines, reductions in the wave energy reaching the coast and changes in local wave patterns leading to the development of scour pits adjacent to turbine foundations. • Any shift from a high to a low energy environment (or vice versa) would change the habitat (the substratum, sediment supply/transport), and therefore associated biota. • Tidal current flows across the DEP and SEP sites are directed approximately northwest and southeast, and are parallel to the coastline nearshore. Nearshore wave conditions are less severe than around the array extensions due to the influence of banks such as Sheringham Shoal. Tidal currents are therefore the dominant driver of sediment transport in the region (RHDHV, 2019). Guidance suggests that changes to tidal currents are in a zone that typically extends 6 to 10 cylinder diameters downstream of turbine structures (DOW, 2009; Whitehouse, 1998). No interaction with the MCZ is anticipated. • AoO classifies this pressure from cable activities (inside the MCZ) as Low Risk. The use of external cable protection which sits proud of the seabed in the MCZ can potentially result in localised changes in water flow and the possible formation of scour pits around the structure. The impact of this is expected to be localised and limited. • The only MCZ protected feature that AoO classes as sensitive to this pressure is moderate energy circalittoral rock (Not sensitive-Medium). All moderate energy circalittoral rock biotopes have been assessed as not sensitive except for (A4.241) *Mytilus edulis* (blue mussel) beds with hydroids and ascidians on tide-swept exposed to moderately wave-exposed circalittoral rock. This is due to the sensitivity of blue mussel bed to changes in water flow. This biotope has not been identified in the export cable corridors (subject to further project surveys). Any impacts would be medium (loss <25% of the species or habitat component), potentially within a localised and limited area around external cable protection.

Pressure Name	Screening Outcome	Justification
		• For the reasons stated above, Natural England's AoO suggests that water flow (tidal current) changes, including sediment transport considerations should be screened out of further assessment. However, Natural England disagreed that effects on bedload sediment transport should be screened out in their consultation response to the draft MCZA Screening Report. On this basis this pressure is screened in for further assessment. Furthermore, the presence of biotope identified as potentially sensitive to this pressure within the project's area of influence cannot be ruled out until the results of the project benthic survey are available.
Hydrocarbon & PAH contamination	Out	• AoO classifies the pressure from cable activities inside the MCZ as Low Risk. • The Activity Pressure justification is concerned with discharges of oil or oil/water mixtures from ships, but the sensitivity assessment may be useful for assessing the risk from re-mobilisation of any such contamination in sediments. • Sediment analysis undertaken at the Dudgeon and Sheringham Shoal offshore wind farms indicate low levels of contamination (DOW, 2009; Scira, 2006). The potential for historical contamination in the project area is limited given the prevailing sedimentary and hydrodynamic regime and the lack of fine material to which contaminants could bind. • The sensitivity of MCZ protected features to this pressure has not been assessed. • Given the low risk, significant effects are ruled out.
Introduction or spread of invasive non-indigenous species (INIS) (Low Risk)	In	• AoO classifies the pressure from activities inside the MCZ as Low Risk. • Several MCZ protected habitat features are potentially sensitive to the introduction or spread of INIS, ranging from Not sensitive to High sensitivity. • Although the risk is considered low, due the potential high sensitivity of some MCZ receptors, significant effects cannot be entirely ruled out at this stage.
Transition elements & organo-metal (e.g. TBT) contamination	In	• AoO classifies the pressure from activities inside the MCZ as Low Risk. • The Activity Pressure justification is concerned with discharges of oil or oil/water mixtures, and with antifouling compounds like TBT and copper wash from ships operating in the area, but the sensitivity assessment may be useful for assessing the risk from re-mobilisation of any such contamination in sediments. • Sediment analysis undertaken at the Dudgeon and Sheringham Shoal offshore wind farms indicate low levels of contamination (DOW, 2009; Scira, 2006). The potential for historical contamination in the project area is limited given the prevailing sedimentary and hydrodynamic regime and the lack of fine material to which contaminants could bind. • The sensitivity of MCZ protected features to this pressure has not been assessed. • For the reasons stated above, Natural England's AoO suggests that impacts associated with transition elements & organo-metal (e.g. TBT) contamination should be screened out of further assessment. However, the MMO has recommended that TBT contamination should be screened in due to nearby shellfisheries sensitivity (MMO, 2020). Although TBT contamination is not expected to occur at levels of concern with the project areas, selected sediment samples from the project benthic survey will be analysed for organotins to inform the MCZ assessment.

5.3 Cumulative Effects

92. Projects, plans and activities that exist at the time of DEP and SEP data collection (field surveys etc.) are considered part of the baseline and are screened out of the cumulative assessment. With respect to the CSCB MCZ, this includes commercial fishing activity within the MCZ.

93. A review of the other currently planned projects in the vicinity of the CSCB MCZ shows four projects that have the potential to interact with the proposed DEP and SEP activities. These are:

- Dudgeon Offshore Wind Farm;
- Sheringham Shoal Offshore Wind Farm;
- Bacton Gas Terminal Coastal Defence Scheme; and the
- Hornsea Project Three Offshore Wind Farm.

94. The projects are screened for cumulative effects with reference to their likely spatial and temporal extent and potential for interaction with DEP and SEP project effects. The operational lifetime of DEP and SEP for this purpose is assumed to be a minimum of 30 years.

5.3.1 Dudgeon and Sheringham Shoal Offshore Wind Farms

95. The Dudgeon and Sheringham Shoal export cables route through the CSCB MCZ. The Dudgeon export cable route runs along the western boundary of the Weybourne corridor option and is approximately 21km from the Bacton corridor. The Sheringham Shoal export cable route is approximately 0.1km west of the Weybourne corridor option and approximately 21km from the Bacton corridor (**Figure 4-3**).

96. There is currently no specific information about planned operation and maintenance (O&M) activities associated with the Dudgeon or Sheringham Shoal offshore wind farms. However as part of marine licence applications for O&M activities, MCZAs have been prepared for both wind farms (Royal HaskoningDHV, 2020a, 2020b). These assessed the impacts on the CSCB MCZ from the possibility of cable repair and replacement, cable remedial burial and installation of a new landfall HDD (at Dudgeon).

97. The assessments identified the following effects as having potential to negatively impact the conservation objectives of the MCZ:

- temporary seabed disturbance;
- increased SSC and deposition;
- temporary habitat loss; and
- permanent/long term habitat loss (from possible installation of new HDD exit points at Dudgeon).

98. The assessments concluded that the activities would not have a significant effect alone or cumulatively with other projects, plans and activities, although Natural England has stated that it does not agree with this conclusion (Natural England, 2020c).

99. Although the currently installed Dudgeon and Sheringham Shoal infrastructure is considered part of the baseline, cumulative impacts on the Cromer Shoal Chalk Beds MCZ from maintenance and decommissioning activities, and the possibility of legacy impacts from infrastructure installation when combined with DEP and SEP activities, are screened in for Stage 1 assessment. These include temporary impacts associated with seabed disturbance, increased SSC and deposition, temporary habitat loss; and impacts of permanent/lasting habitat loss.

5.3.2 Bacton Gas Terminal Coastal Defence Scheme

100. The Bacton Gas Terminal Coastal Defence Scheme overlaps with the boundary of the Cromer Shoal Chalk Beds MCZ and is located close to the western boundary of the Bacton offshore cable corridor at landfall (the defence scheme extends from the north-western end of the terminal south to Walcott). The scheme is now operational with sand having been deposited on the beach, therefore the only potential for cumulative effects would be in relation to operational impacts. The MCZA in support of the scheme determined there would be no impact to the MCZ as a result of the operational phase of the scheme. Modelling work for post construction impacts has shown that sediment transport will be in a south westerly direction and would not extend further offshore into the MCZ (Royal HaskoningDHV, 2018). Therefore, it is considered that the DEP and SEP activities would not have a cumulative effect when considered with the Bacton Gas Terminal Coastal Defence Scheme.

5.3.3 Hornsea Project Three Offshore Wind Farm

101. The proposed Hornsea Project Three offshore export cable corridor is within the Cromer Shoal Chalk Beds MCZ and is located approximately 325m to the west of the Weybourne offshore export cable corridor (**Figure 3-1**). At the time of writing a DCO application has been submitted for Hornsea Project Three but has not yet been determined. As part of the DCO application a MCZ assessment has been drafted that assesses the impact of cable installation within the MCZ (Ørsted, 2020).

102. The assessment identified the following effects as having potential to negatively impact the conservation objectives of the Cromer Shoal Chalk Beds MCZ:

- Construction phase:
  - Temporary habitat loss/disturbance due to export cable installation; and
  - Increases in SSC and associated deposition due to export cable installation.
- Operation and maintenance phase:
  - Lasting habitat loss due to export cable protection;
  - Maintenance operations during the operational phase, resulting in temporary seabed disturbances;

- Colonisation of export cable protection; and
- Increased risk of introduction or spread of INNS due to presence of subsea infrastructure and vessel movements.

- Decommissioning phase:
  - Temporary habitat loss/disturbance due to export cable removal;
  - Increases in SSC and associated deposition due to export cable removal; and
  - Permanent habitat loss due to presence of export cable protection left in situ post decommissioning.

103. The assessment considers the potential for cumulative effects from operation and maintenance activities associated with the Dudgeon or Sheringham Shoal export cables within the MCZ, and from the Bacton Gas Terminal Coastal Defence Scheme but does not make an assessment, citing a lack of detailed information for these projects (Orsted, 2020).

104. The Hornsea Project Three MCZA concludes that there is no significant risk of cable installation hindering the achievement of the conservation objectives of the Cromer Shoal Chalk Beds MCZ. However, it is acknowledged that there may be lasting/permanent loss of up to 0.016% of the subtidal sand broadscale habitat within the MCZ due to placement of cable protection (if required) (Orsted, 2020). Natural England does not agree with this assessment, and in its recommendation, PINS agreed that that "there would be a small but permanent loss to the extent and distribution of one of the designated features and that this would be contrary to the stated conservation objectives" requiring a Stage 2 assessment (PINS, 2020).

105. However, the decision of the Secretary of State for Business, Energy and Industrial Strategy was that the "stage 1 assessment on the Cromer Shoal Chalk Banks MCZ has ruled out beyond reasonable scientific doubt, significant risk of the activity hindering the achievement of the conservation objectives stated for the MCZ on the basis that although the potential impacts are long term (for the duration of the project), they will have a temporary (reparable effect) and therefore not affect the conservation objectives of the site" (BEIS, 2020).

106. Cumulative impacts on the Cromer Shoal Chalk Beds MCZ from construction, operation and maintenance, and decommissioning activities, when combined with DEP and SEP activities are possible and are screened in for Stage 1 assessment. These include temporary impacts associated with seabed disturbance, increased SSC and deposition, and temporary habitat loss. Lasting/permanent habitat loss from export cable protection is also screened in.

6 Screening Conclusions

107. The MCZA screening exercise proposes screening in the CSCB MCZ because the Project's export cable corridor options route through the site. No other MCZs are screened in, primarily on account of their distance to the Projects and the range of potential effects.

108. All of the CSCB MCZ protected features are proposed to be screened in at this stage. Subject to the results of the site surveys, these will be taken forward to the Stage 1 assessment, with respect to the particular activities and associated pressures as set out in **Table 6-1** below.

Table 6-1 Summary of pressures screened in, and relationship to impacts identified through scoping

Potential Pressure (Scoping)	Pressure Name (Advice on Operations)	Project alone	Cumulative
Temporary physical disturbance	Abrasion/disturbance of the substrate on the surface of the seabed	✓	✓
	Habitat structure changes - removal of substratum (extraction)	✓	✓
	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	✓	✓
Temporary habitat loss	Physical change (to another seabed/sediment type)	✓	✓
Permanent/long term habitat loss	Physical change (to another seabed/sediment type)	✓	✓
Increased suspended sediment concentrations	Changes in suspended solids (water clarity)	✓	✓
	Smothering and siltation rate changes (Light)	✓	✓
Re-mobilisation of contaminated sediments	Introduction of other substances (solid, liquid or gas) Transition elements & organo-metal (e.g. TBT) contamination (There is no directly equivalent RPP. Advice on Operations for this pressure relates to contamination by other sources).	✓	✓
Effects on bedload sediment transport	Water flow (tidal current) changes, including sediment transport considerations	✓	✓
Invasive species	Introduction or spread of invasive non-indigenous species (INIS)	✓	✓

109. Significant effects from a number of activities and associated pressures can be ruled out (**Table 6-2**).

Table 6-2 Summary of pressures screened out, and relationship to impacts identified through scoping

Potential Pressure (Scoping)	Pressure Name (Advice on Operations)
Re-mobilisation of contaminated sediments (There is no directly equivalent RPP. Advice on Operations for this pressure relates to contamination by other sources)	Hydrocarbon & Polycyclic Aromatic Hydrocarbon (PAH) contamination
	Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)
Underwater noise and vibration	Underwater noise changes
	Vibration
Electromagnetic fields	Barrier to species movement

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Appendix A

Advice on Operations sensitivity assessment matrices for the following activities (Natural England, 2020b):

- Cable horizontal directional drilling (HDD) (**Table A 1**)
- Power cable laying, burial and protection (installation) **(Table A 2**)
- Power cable operation and maintenance (operation) (**Table A 3**)
- Power cable decommissioning (**Table A 4**)
- Offshore wind: during construction (**Table A 5**)
- Offshore wind: operation and maintenance (**Table A 6**)
- Offshore wind: decommissioning (**Table A 7**)

Table A 1 AoO matrix for Cables: Horizontal Directional Drilling (HDD).

Pressure Name	Geological	Habitat								
	North Norfolk coast	Peat and clay exposures	High energy infralittoral rock	Moderate energy infralittoral rock	Subtidal chalk	Subtidal coarse sediment	Subtidal mixed sediments	Subtidal sand	High energy circalittoral rock	Moderate energy circalittoral rock
Abrasion/disturbance of the substrate on the surface of the seabed	NA	S	S	S	S	S	S	S	S	S
Barrier to species movement	NA		NS	NS		NS		NS		S
Changes in suspended solids (water clarity)	NA	NS	S	NS	S	NS	NS	S	S	S
Habitat structure changes - removal of substratum (extraction)	NA	S			S	S	S	S	S	S
Introduction of other substances (solid, liquid or gas)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	NA	S			S	S	S	S	S	S
Smothering and siltation rate changes (Light)	NA	S	NS	NS	NS	S	S	S	S	S
Vibration	NA									
Above water noise	NA									
Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	NA									
Collision BELOW water with static or moving objects not naturally found in the marine environment	NA									
Deoxygenation	NA	IE	IE	IE	NS	S	S	S	S	IE
Emergence regime changes, including tidal level change considerations	NA	S				NS		NS		
Hydrocarbon & PAH contamination	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Introduction of light	NA	IE	NS	NS	NS	IE	IE	S	NS	IE
Introduction or spread of invasive non-indigenous species (INIS)	NA	S	NS	NS		S	S	S	IE	S
Litter	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nutrient enrichment	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS
Organic enrichment	NA	IE	NS	NS	NS	NS	IE	S	S	IE
Physical change (to another seabed type)	NA	S	S	S	S	S	S	S	S	S
Physical change (to another sediment type)	NA	S				S	S	S	S	S
Smothering and siltation rate changes (Heavy)	NA	S	S	S	S	S	S	S	S	S
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Transition elements & organo-metal (e.g. TBT) contamination	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Underwater noise changes	NA						NS	NS	NS	
Visual disturbance	NA	NS			NS					NS
Water flow (tidal current) changes, including sediment transport considerations	NA	NS	NS	NS	NS	NS	NS	NS	NS	S
Wave exposure changes	NA	NS	NS	NS	NS	NS	NS	NS	NS	S

Table A 2 AoO matrix for Cables: Power cable: laying, burial and protection

	Geological	Habitat								
Pressure Name	North Norfolk coast	Peat and clay exposures	High energy infralittoral rock	Moderate energy infralittoral rock	Subtidal chalk	Subtidal coarse sediment	Subtidal mixed sediments	Subtidal sand	High energy circalittoral rock	Moderate energy circalittoral rock
Abrasion/disturbance of the substrate on the surface of the seabed	NA	S	S	S	S	S	S	S	S	S
Changes in suspended solids (water clarity)	NA	NS	S	NS	S	NS	NS	S	S	S
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	NA	S			S	S	S	S	S	S
Physical change (to another seabed type)	NA	S	S	S		S	S	S	S	S
Physical change (to another sediment type)	NA	S				S	S	S		
Smothering and siltation rate changes (Light)	NA	S	NS	NS	NS	S	S	S	S	S
Above water noise	NA									
Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	NA									
Collision BELOW water with static or moving objects not naturally found in the marine environment	NA									
Deoxygenation	NA	IE	IE	IE	NS	S	S	S	S	IE
Habitat structure changes - removal of substratum (extraction)	NA	S			S	S	S	S	S	S
Hydrocarbon & PAH contamination	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Introduction of light	NA	IE	NS	NS	NS	IE	IE	S	NS	IE
Introduction or spread of invasive non-indigenous species (INIS)	NA	S	NS	NS		S	S	S	IE	S
Litter	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nutrient enrichment	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS
Physical loss (to land or freshwater habitat)	NA	S	S	S	S	S	S	S	S	S
Smothering and siltation rate changes (Heavy)	NA	S	S	S	S	S	S	S	S	S
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Transition elements & organo-metal (e.g. TBT) contamination	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Underwater noise changes	NA						NS	NS	NS	
Vibration	NA									
Visual disturbance	NA	NS			NS					NS
Water flow (tidal current) changes, including sediment transport considerations	NA	NS	NS	NS	NS	NS	NS	NS	NS	S

Table A 3 AoO matrix for Cables: Power cable: operation and maintenance

	Geological	Habitat								
Pressure Name	North Norfolk coast	Peat and clay exposures	High energy infralittoral rock	Moderate energy infralittoral rock	Subtidal chalk	Subtidal coarse sediment	Subtidal mixed sediments	Subtidal sand	High energy circalittoral rock	Moderate energy circalittoral rock
Abrasion/disturbance of the substrate on the surface of the seabed	NA	S	S	S	S	S	S	S	S	S
Changes in suspended solids (water clarity)	NA	NS	S	NS	S	NS	NS	S	S	S
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	NA	S			S	S	S	S	S	S
Physical change (to another seabed type)	NA	S	S	S		S	S	S	S	S
Physical change (to another sediment type)	NA	S				S	S	S		
Smothering and siltation rate changes (Light)	NA	S	NS	NS	NS	S	S	S	S	S
Above water noise	NA									
Barrier to species movement	NA		NS	NS		NS		NS		S
Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	NA									
Collision BELOW water with static or moving objects not naturally found in the marine environment	NA									
Deoxygenation	NA	IE	IE	IE	NS	S	S	S	S	IE
Electromagnetic changes	NA	IE	IE	IE	IE	IE	IE	IE	IE	IE
Hydrocarbon & PAH contamination	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Introduction of light	NA	IE	NS	NS	NS	IE	IE	S	NS	IE
Introduction or spread of invasive non-indigenous species (INIS)	NA	S	NS	NS		S	S	S	IE	S
Litter	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nutrient enrichment	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS
Physical loss (to land or freshwater habitat)	NA	S	S	S	S	S	S	S	S	S
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Temperature decrease	NA	NS	NS	NS	NS	S	NS	S	S	NS
Temperature increase	NA	S	NS	NS	NS	S	NS	S	S	NS
Transition elements & organo-metal (e.g. TBT) contamination	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Underwater noise changes	NA						NS	NS	NS	
Vibration	NA									
Visual disturbance	NA	NS			NS					NS
Water flow (tidal current) changes, including sediment transport considerations	NA	NS	NS	NS	NS	NS	NS	NS	NS	S

Table A 4 AoO matrix for Power cable: Decommissioning

Pressure Name	Geological	Habitat								
	North Norfolk coast	Peat and clay exposures	High energy infralittoral rock	Moderate energy infralittoral rock	Subtidal chalk	Subtidal coarse sediment	Subtidal mixed sediments	Subtidal sand	High energy circalittoral rock	Moderate energy circalittoral rock
Abrasion/disturbance of the substrate on the surface of the seabed	NA	S	S	S	S	S	S	S	S	S
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	NA	S			S	S	S	S	S	S
Physical change (to another seabed type)	NA	S	S	S		S	S	S	S	S
Physical change (to another sediment type)	NA	S				S	S	S		
Above water noise	NA									
Changes in suspended solids (water clarity)	NA	NS	S	NS	S	NS	NS	S	S	S
Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	NA									
Collision BELOW water with static or moving objects not naturally found in the marine environment	NA									
Deoxygenation	NA	IE	IE	IE	NS	S	S	S	S	IE
Habitat structure changes - removal of substratum (extraction)	NA	S			S	S	S	S	S	S
Hydrocarbon & PAH contamination	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Introduction of light	NA	IE	NS	NS	NS	IE	IE	S	NS	IE
Introduction or spread of invasive non-indigenous species (INIS)	NA	S	NS	NS		S	S	S	IE	S
Litter	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nutrient enrichment	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS
Smothering and siltation rate changes (Light)	NA	S	NS	NS	NS	S	S	S	S	S
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Transition elements & organo-metal (e.g. TBT) contamination	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Underwater noise changes	NA						NS	NS	NS	
Vibration	NA									
Visual disturbance	NA	NS			NS					NS
Water flow (tidal current) changes, including sediment transport considerations	NA	NS	NS	NS	NS	NS	NS	NS	NS	S

Table A 5 AoO matrix for Offshore wind: during construction

Pressure Name	Geological	Habitat								
	North Norfolk coast	Peat and clay exposures	High energy infralittoral rock	Moderate energy infralittoral rock	Subtidal chalk	Subtidal coarse sediment	Subtidal mixed sediments	Subtidal sand	High energy circalittoral rock	Moderate energy circalittoral rock
Abrasion/disturbance of the substrate on the surface of the seabed		S	S	S	S	S	S	S		S
Habitat structure changes - removal of substratum (extraction)		S			S	S	S	S		S
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion		S			S	S	S	S		S
Physical change (to another seabed type)		S	S	S		S	S	S		S
Physical change (to another sediment type)		S				S	S	S		
Physical loss (to land or freshwater habitat)		S	S	S	S	S	S	S		S
Smothering and siltation rate changes (Light)		S	NS	NS	NS	S	S	S		S
Underwater noise changes							NS	NS		
Visual disturbance		NS			NS					NS
Barrier to species movement			NS	NS		NS		NS		S
Changes in suspended solids (water clarity)		NS	S	NS	S	NS	NS	S		S
Hydrocarbon & PAH contamination		NA	NA	NA	NA	NA	NA	NA		NA
Introduction of light		IE	NS	NS	NS	IE	IE	S		IE
Introduction of other substances (solid, liquid or gas)		NA	NA	NA	NA	NA	NA	NA		NA
Introduction or spread of invasive non-indigenous species (INIS)		S	NS	NS		S	S	S		S
Litter		NA	NA	NA	NA	NA	NA	NA		NA
Smothering and siltation rate changes (Heavy)		S	S	S	S	S	S	S		S
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)		NA	NA	NA	NA	NA	NA	NA		NA
Transition elements & organo-metal (e.g. TBT) contamination		NA	NA	NA	NA	NA	NA	NA		NA
Water flow (tidal current) changes, including sediment transport considerations		NS	NS	NS	NS	NS	NS	NS	NS*	S

Table A 6 AoO matrix for Offshore wind: operation and maintenance

Pressure Name	Geological	Habitat								
	North Norfolk coast	Peat and clay exposures	High energy infralittoral rock	Moderate energy infralittoral rock	Subtidal chalk	Subtidal coarse sediment	Subtidal mixed sediments	Subtidal sand	High energy circalittoral rock	Moderate energy circalittoral rock
Barrier to species movement	NA		NS	NS		NS		NS		S
Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	NA									
Habitat structure changes - removal of substratum (extraction)	NA	S			S	S	S	S		S
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	NA	S			S	S	S	S		S
Physical change (to another seabed type)	NA	S	S	S		S	S	S		S
Physical change (to another sediment type)	NA	S				S	S	S		
Physical loss (to land or freshwater habitat)	NA	S	S	S	S	S	S	S		S
Smothering and siltation rate changes (Light)	NA	S	NS	NS	NS	S	S	S		S
Visual disturbance	NA	NS			NS					NS
Water flow (tidal current) changes, including sediment transport considerations	NA	NS	NS	NS	NS	NS	NS	NS	NS*	S
Above water noise	NA									
Abrasion/disturbance of the substrate on the surface of the seabed	NA	S	S	S	S	S	S	S		S
Changes in suspended solids (water clarity)	NA	NS	S	NS	S	NS	NS	S		S
Collision BELOW water with static or moving objects not naturally found in the marine environment	NA									
Hydrocarbon & PAH contamination	NA	NA	NA	NA	NA	NA	NA	NA		NA
Introduction of light	NA	IE	NS	NS	NS	IE	IE	S		IE
Introduction of other substances (solid, liquid or gas)	NA	NA	NA	NA	NA	NA	NA	NA		NA
Introduction or spread of invasive non-indigenous species (INIS)	NA	S	NS	NS		S	S	S		S
Litter	NA	NA	NA	NA	NA	NA	NA	NA		NA
Smothering and siltation rate changes (Heavy)	NA	S	S	S	S	S	S	S		S
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NA	NA	NA	NA	NA	NA	NA	NA		NA
Transition elements & organo-metal (e.g. TBT) contamination	NA	NA	NA	NA	NA	NA	NA	NA		NA
Underwater noise changes	NA						NS	NS		
Vibration	NA									
Wave exposure changes	NA	NS	NS	NS	NS	NS	NS	NS	NS*	S

Table A 7 AoO matrix for Offshore wind: decommissioning

Pressure Name	Geological	Habitat								
	North Norfolk coast	Peat and clay exposures	High energy infralittoral rock	Moderate energy infralittoral rock	Subtidal chalk	Subtidal coarse sediment	Subtidal mixed sediments	Subtidal sand	High energy circalittoral rock	Moderate energy circalittoral rock
Above water noise	NA									
Abrasion/disturbance of the substrate on the surface of the seabed	NA	S	S	S	S	S	S	S		S
Habitat structure changes - removal of substratum (extraction)	NA	S			S	S	S	S		S
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	NA	S			S	S	S	S		S
Physical change (to another seabed type)	NA	S	S	S		S	S	S		S
Physical change (to another sediment type)	NA	S				S	S	S		
Smothering and siltation rate changes (Light)	NA	S	NS	NS	NS	S	S	S		S
Underwater noise changes	NA						NS	NS		
Visual disturbance	NA	NS			NS					NS
Barrier to species movement	NA		NS	NS		NS		NS		S
Changes in suspended solids (water clarity)	NA	NS	S	NS	S	NS	NS	S		S
Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	NA									
Collision BELOW water with static or moving objects not naturally found in the marine environment	NA									
Hydrocarbon & PAH contamination	NA	NA	NA	NA	NA	NA	NA	NA		NA
Introduction of light	NA	IE	NS	NS	NS	IE	IE	S		IE
Introduction of other substances (solid, liquid or gas)	NA	NA	NA	NA	NA	NA	NA	NA		NA
Introduction or spread of invasive non-indigenous species (INIS)	NA	S	NS	NS		S	S	S		S
Litter	NA	NA	NA	NA	NA	NA	NA	NA		NA
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NA	NA	NA	NA	NA	NA	NA	NA		NA
Transition elements & organo-metal (e.g. TBT) contamination	NA	NA	NA	NA	NA	NA	NA	NA		NA
Vibration	NA									
Water flow (tidal current) changes, including sediment transport considerations	NA	NS	NS	NS	NS	NS	NS	NS		S