



Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

Appendix 4 - Assessment of Potential Impacts on Cromer Shoal
Chalk Beds Marine Conservation Zone Features from Planting of
Native Oyster Beds (Revision B) - Tracked Changes Version

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Glossary of Acronyms

AoO	Advice on Operations
CSBC	Cromer Shoal Chalk Beds
DEP	Dudgeon Offshore Wind Farm Extension Project
INIS	Invasive Non-Indigenous Species
km	Kilometre
m	metre
MCZ	Marine Conservation Zone
MCZA	Marine Conservation Zone Assessment
MEEB	Measures of Equivalent Environmental Benefit
MMO	Marine Management Organisation
SACO	Supplementary Advice on Conservation Objectives
SEP	Sheringham Shoal Offshore Wind Farm Extension Project



Glossary of Terms

Dudgeon Offshore Wind Farm Extension Project (DEP)	The Dudgeon Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
Dudgeon Offshore Wind Farm Extension Project (DEP) offshore site	The Dudgeon Offshore Wind Farm Extension offshore lease area consisting of the DEP wind farm site, interlink cable corridors and offshore export cable corridor (up to mean high water springs).
DEP North array area	The wind farm array area of the DEP offshore site located to the north of the existing Dudgeon Offshore Wind Farm
DEP South array area	The wind farm array area of the DEP offshore site located to the south of the existing Dudgeon Offshore Wind Farm
DEP wind farm site	The offshore area of DEP within which wind turbines, infield cables and offshore substation platform/s will be located. This is also the collective term for the DEP North and South array areas.
Export cable corridor	This is the area which will contain the offshore export cables between offshore substation platform/s and landfall.
Horizontal directional drilling (HDD) zones	The areas within the onshore cable route which would house HDD entry or exit points.
Infield cables	Cables which link the wind turbine generators to the offshore substation platform(s).
Interlink cables	<p>Cables linking two separate project areas. This can be cables linking:</p> <ul style="list-style-type: none"> DEP South array area and DEP North array area DEP South array area and SEP DEP North array area and SEP <p>1 is relevant if DEP is constructed in isolation or first in a phased development.</p> <p>2 and 3 are relevant where both SEP and DEP are built.</p>



Interlink cable corridor	This is the area which will contain the interlink cables between offshore substation platform/s.
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 (OSP)	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 Project (SEP) offshore site	Sheringham Shoal Offshore Wind Farm Extension lease area consisting of the SEP wind farm site and offshore export cable corridor (up to mean high water springs).
Sheringham Shoal Offshore Wind Farm Extension Project (SEP)	The Sheringham Shoal Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
SEP wind farm site	The offshore area of SEP within which wind turbines, infield cables and offshore substation platform/s will be located.
The Applicant	Equinor New Energy Limited

Appendix 4 Assessment of Potential Impacts on Cromer Shoal Chalk Beds Marine Conservation Zone Features from Planting of Native Oyster Bed

1 Revision B Updates at Deadline 1

1. This document has been updated at Deadline 1 to address the following Natural England comment provided within Appendix G of their Relevant Representation [RR-063]: 'Natural England therefore advises against the placement of clutch and restoration of an Oyster bed in the middle of a mixed sediment area. For this to be considered as additionality we advise that it would be better to extend/enhance the area of the mixed sediment on the boundary with impoverished coarse sediment e.g. in the centre of the 'c' shaped mixed sediment area or north/south of the blue rectangle.' **Figure 1** has been updated and the assessment updated to reflect that either mixed and / or coarse sediment feature of the MCZ could potentially be affected by the planting of native oyster bed.

~~4~~ 2 Introduction

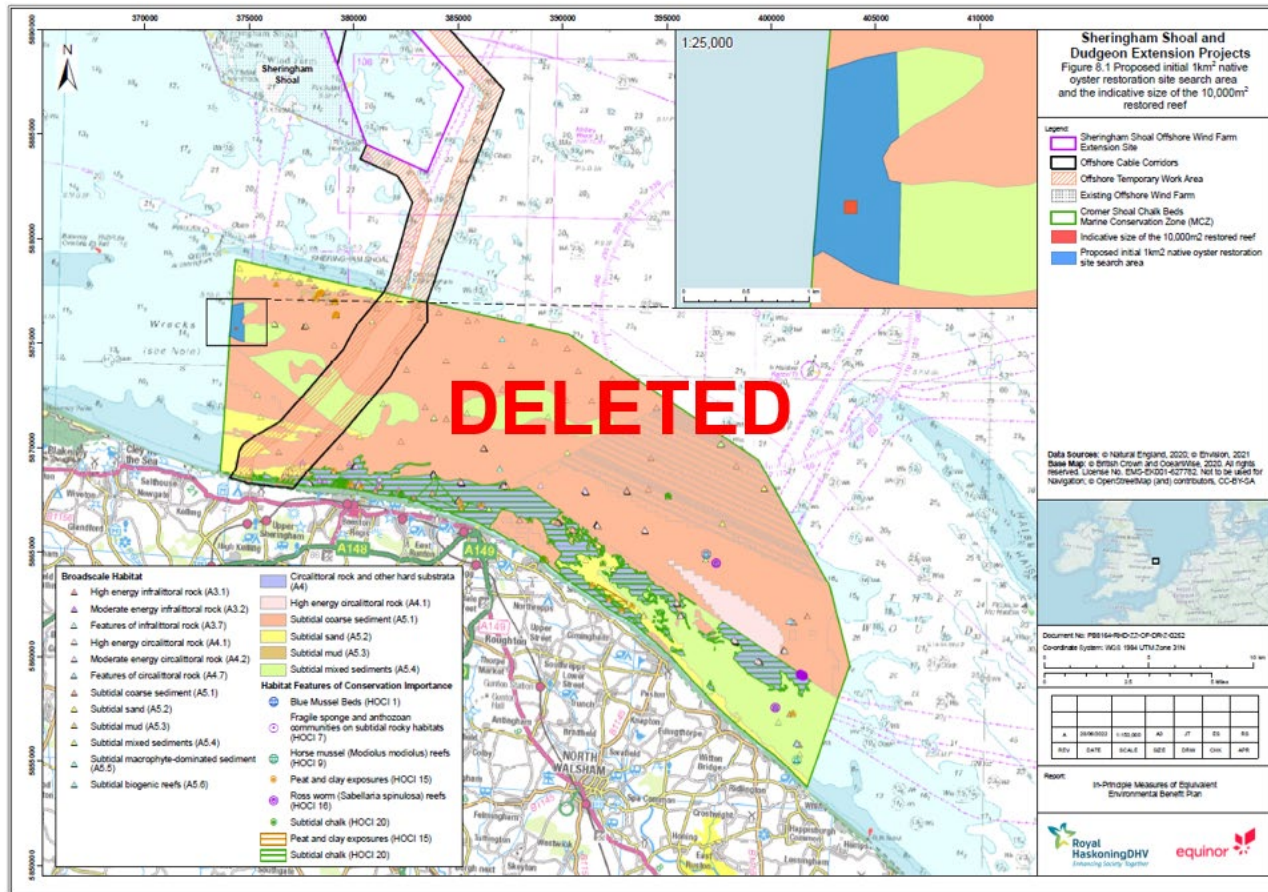
2. This appendix provides a Stage 1 assessment of potential impacts on the subtidal [coarse sediments and](#) mixed sediment feature of the Cromer Shoal Chalk Beds (CSCB) Marine Conservation Zone (MCZ) from the planting of native oyster bed as part of the Sheringham Shoal Offshore Wind Farm Extension Project (SEP) and the Dudgeon Offshore Wind Farm Extension Project (DEP) without prejudice Measures of Equivalent Environmental Benefit (MEEB) proposals.
3. As outlined in the **In-Principle MEEB Plan ([Revision B](#))** [(document reference 5.7.1)] which is provided on a precautionary basis, and without prejudice to the conclusions of the **Stage 1 CSCB MCZ Assessment (MCZA)** (~~document reference 5.6~~)[\[APP-077\]](#), if MEEB is deemed to be required by the Secretary of State, the planting of native oyster bed within the CSCB MCZ would be progressed as the preferred MEEB. Therefore, this assessment is provided to determine whether the planting of oyster bed within the MCZ has potential to hinder the conservation objective of maintaining (or restoring) the MCZ features in favourable conservation status.
4. The preferred location for MEEB in the MCZ is outwith the SEP and DEP order limits (**Figure 1**). It is not anticipated that a lease from The Crown Estate is required to deploy a native oyster bed however a marine licence is likely to be required due to the potential requirement to lay cultch. If MEEB is deemed to be required by the Secretary of State a marine licence application would be submitted to the Marine Management Organisation (MMO).
5. This report provides the Stage 1 Assessment which is a requirement under **Section 126** of the Marine and Coastal Access Act (2009) (MCAA). The MCZA will be undertaken by the MMO with the **Stage 1 CSCB MCZA** [\[APP-077\]](#) and relevant supporting appendices intended to provide the information required for that assessment. The **Stage 1 CSCB MCZA** [\[APP-077\]](#) and its supporting appendices (where relevant) are therefore structured to match the approach that will be taken by the MMO. This document is therefore a 'shadow MCZA'. See the **Stage 1 CSCB MCZA** [\[APP-077\]](#) for more details on guidance and legislation as it relates to MCZs.

~~6~~ Background and Native Oyster Restoration Project Description

2.1

- ~~7.6~~ 6. The restoration of a native oyster bed is required to deliver equivalent environmental benefit to up to 1,800m² long term habitat loss on subtidal coarse sediment, subtidal mixed sediments and subtidal sand features of the MCZ. For the purposes of the **In-Principle MEEB Plan ([Revision B](#))** [(document reference 5.7.1)], the aim would be to deploy and maintain an oyster bed of 10,000m² with an average density of 5 live oysters per m². This would provide a greater than 1:5 ratio of MEEB, offering long term enhanced ecological function to the habitat being lost and would restore a historic feature of the region. This scale of restoration effort has also been selected because once fully functioning, it is expected that the native oyster bed would become self-sustaining. This would restore the status of native oyster in the CSCB MCZ to that of a healthy native oyster population

- ~~8.7.~~ Following a site selection exercise (see **Annex C** of the **In-Principle MEEB Plan**), the area shown in **Figure 1** has been identified as an initial native oyster restoration site search area.
- ~~9.8.~~ This provides a 1km² area, within which the 10,000m² bed (see **Section 5.4** of **Annex C**) could be planted. This 1km² area will be the area surveyed post-consent to confirm the suitability of the site for native oyster restoration.



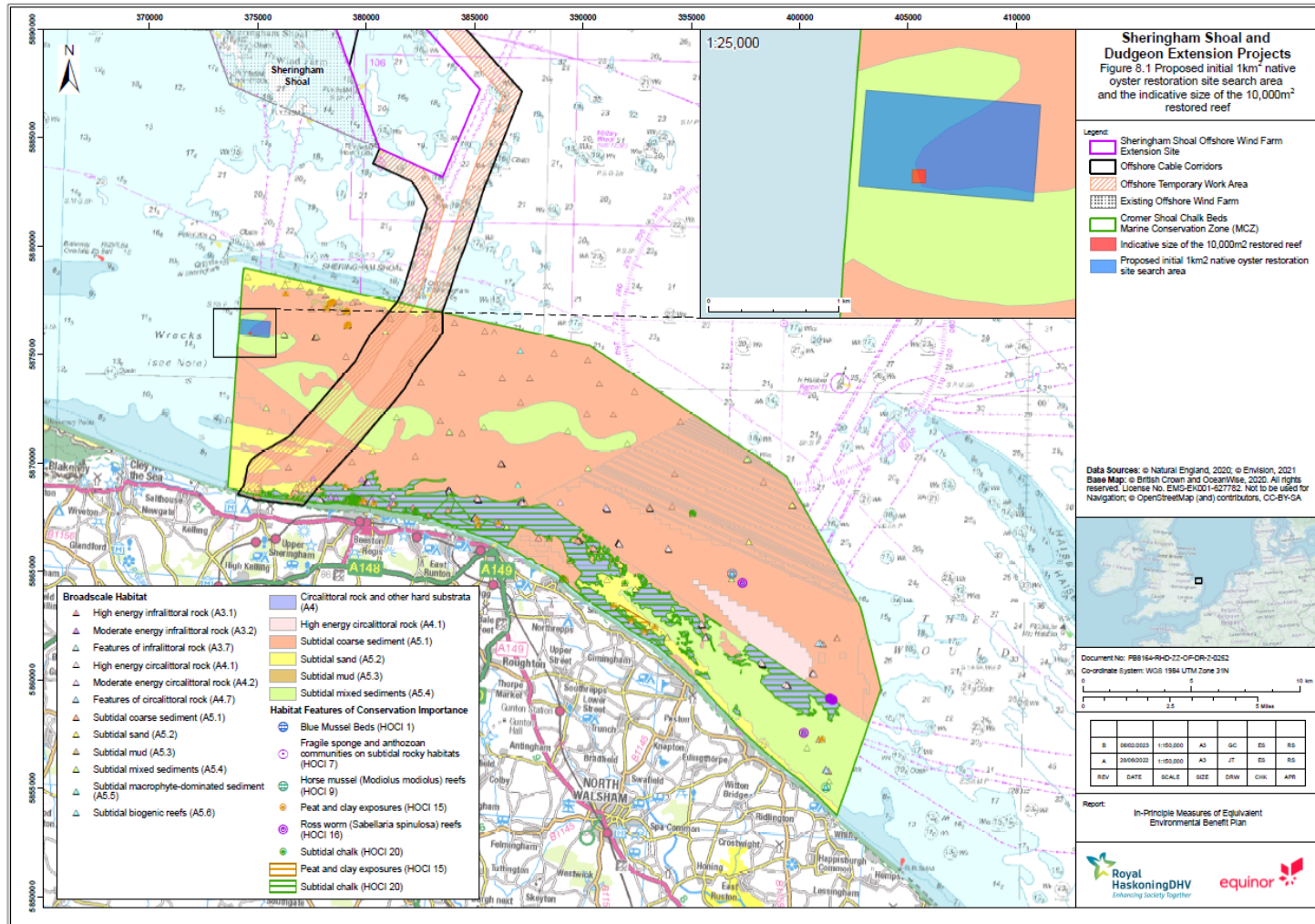


Figure 1 The proposed initial 1km² (light blue polygon) native oyster restoration site search area and the indicative size of the 10,000m² restored reef (red square within blue polygon) in the north-western section of the CSCB MCZ



- ~~10.9.~~ 11.10. Planting of native oyster bed within the CSCB MCZ would provide enhanced ecological function to the habitat which is being lost and would restore a historic feature of the region.
- ~~11.10.~~ 12.11. As discussed in **Annex C** of the (**In-Principle MEEB Plan ([Revision B](#))**) [(document reference 5.7.1)] cultch may be required to enhance the substrate suitability for planting of oyster. For example, the Essex Native Oyster Restoration Initiative (NORI) project used a mixture of aggregate pebbles from an onshore source and waste oyster shell from local markets;¹ and the Dornoch Environmental Enhancement Project (DEEP)² used waste shell from the scallop and mussel industry.
- ~~12.11.~~ 13.12. Following a more detailed site selection exercise, including a survey of the existing habitat, the requirement for cultch would be determined and suitable sources identified.
- ~~13.12.~~ 14.13. If MEEB is deemed to be required by the Secretary of State for SEP and DEP, a phased and adaptive approach to oyster bed restoration is recommended, starting with a pilot project introducing 300 – 1,000 adult oysters to several potential suitable locations within the initial oyster restoration site search area. These oysters would be deployed in cages or bags. If acceptable survival is achieved after one year at least one of the locations, then the project can enter the reef restoration phase:
- **Phase 1** (first year) would involve the deployment of 1,000m³ of cultch being spread over a 5,000m² area, followed by the reintroduction of 52,500 oysters on the cultch. Survival would be monitored prior to Phase 2.
 - **Phase 2** (second year) would involve a further deployment of 1,000m³ cultch within the remaining 5,000m² of the restoration area, followed by reintroduction of 52,500 oysters over the remaining 5,000m² area. This would give a combined total area for Phase 1 and Phase 2 of 10,000m², with 105,000 oysters reintroduced. With ongoing monitoring, lessons learnt during Phase 1 deployment can be captured during Phase 2, with deployment adapted accordingly.
- ~~14.13.~~ 14.13. Justification for the area and number of native oyster required is provided in the **In-Principle MEEB Plan ([Revision B](#))** [(document reference 5.7.1)]. The appropriate season for deployment of the reef restoration (Phases 1 to 2) will be determined through the MEEB Implementation and Monitoring Plan in consultation with oyster restoration specialists, taking into account the age and condition of the seed oysters; optimal temperature, lunar cycle and food availability; and periods of minimal predator abundance to maximise the survival rates of deployed oyster. However, late spring to early summer (April/May) is expected to be the optimal native oyster reintroduction period.

¹ <https://noraeeurope.eu/laying-cultch-a-case-study-from-the-essex-native-oyster-initiative/>

² <https://nativeoysternetwork.org/portfolio/deep/>

~~15.~~14. The method for deployment will be established post consent as the MEEB Implementation and Monitoring Plan (see the **In-Principle MEEB Plan** ([Revision B](#)) [~~document reference 5.7.1~~]) develops, following commissioning of contractor(s), vessel(s) and equipment for deployment. The approach is likely to utilise a boat-based chute to direct the oysters to the selected sea bed location. This may require a diver or ROV survey following placement of the oysters on the sea bed to ensure the appropriate density of oysters deployed from the vessel.

4.1.12.2 Stage 1 Assessment

4.1.12.2.1 Disturbance of the Substrate on the Surface of the Sea Bed from Native Oyster Bed Restoration

~~16.~~15. The initial oyster restoration site search area (**Figure 1**) is composed of subtidal mixed sediment and subtidal coarse sediment which is appropriate for native oyster larval settlement (and therefore long-term persistence of the reintroduced bed). Therefore, only the broadscale marine habitat features (i.e. Subtidal mixed sediments - A5.4 and subtidal coarse sediment – A5.1) ~~have~~ the potential to be affected by habitat loss / physical disturbance. Disturbance of the substrate on the surface of the sea bed could occur as a result of cultch and native oyster deployment.

~~17.~~16. Up to 2,000m³ of cultch and 105,000 native oysters would be deployed during Phase 1 and Phase 2 and the worst case maximum area of sea bed within the CSCB MCZ which could be affected, would be 10,000m². It is important to note that whilst disturbance of the sea bed would occur, the potential for adverse impacts are limited since cultch (i.e. shell material which would be subject to biosecurity protocols and likely sourced from the local area – see **Section 1.3.2.1**) would be deployed on a mixture of coarse and mixed sediment which is likely to include shell. This therefore does not represent the introduction of a wholly new substrate type. In addition, the target is for 5 oysters per m² (which aligns with the OSPAR definition of a native oyster bed (OSPAR, 2009)). Therefore, the native oyster bed would not affect the entirety of or occur uniformly over the 10,000m² area.

17. Subtidal mixed sediments - A5.4 has an estimated spatial extent within the MCZ of 49km². Therefore, up to 0.02% of the feature could potentially be subject to disturbance by the restoration works.

18. Subtidal coarse sediments – A5.1 has an estimated spatial extent within the MCZ of 148km². Therefore, up to 0.007% of the feature could potentially be subject to disturbance by the restoration works.

19. The impact of disturbance of the substrate on the surface of the sea bed from the introduction of native oyster bed has been defined using the pressures identified by Natural England's Advice on Operations (AoO) for the CSCB MCZ (Natural England, 2021). Since the introduction of native oyster is not listed as an activity in Natural England's Supplementary Advice on Conservation Objectives (SACO), shellfish aquaculture: bottom culture has been selected as a proxy. The following physical pressures have been assessed:

- Disturbance of the substrate on the surface of the sea bed

20. The remainder of this section assesses the impact of disturbance of the substrate on the surface of the sea bed from the introduction of native oyster bed against the attributes and targets of the protected feature as provided by the SACO.

~~4.1.1.1~~ 2.2.1.1 Physical attributes

21. The following physical attributes of subtidal mixed sediment [and subtidal coarse sediment](#) are relevant to disturbance of the substrate on the surface of the sea bed:

- Extent and distribution
- Sediment composition and distribution

22. The extent, distribution and sediment composition of the subtidal [coarse/mixed sediment](#) feature would largely be maintained across the CSCB MCZ. The added cultch and native oyster would settle onto the subtidal [coarse/mixed sediment](#) and, over time, become incorporated within it forming a biogenic reef structure similar to subtidal [coarse/mixed sediment](#) but with an enhanced ecological function.

~~4.1.1.2~~ 2.2.1.2 Biological attributes

23. The following biological attributes of subtidal mixed sediment [and subtidal coarse sediment](#) are relevant to disturbance of the substrate of the sea bed from native oyster restoration:

- Distribution - presence and spatial distribution of biological communities
- Structure and function: presence and abundance of key structural and influential species
- Species composition of component communities

24. Areas of mixed sediments in the proposed initial oyster restoration site search area (**Figure 1**) conforms mostly to 'Offshore circalittoral mixed sediment' (SS.SMx.Omx) in the Marine Habitat Classification scheme (Connor et al., 2004), in that it supports a diverse faunal community, given the heterogeneous sediment, with large amounts of both infauna and epifauna. Connor *et al.* (2004) characterise the community as being dominated by a rich community of attached Hydrozoa, Bryozoa and sponges. The loose rocky structures have potential to host a high diversity of scaleworms and syllid worms while encrusting keel worms *Spirobranchus lamarcki* are also common. The rocky substratum also allows the settlement of large numbers of ascidians, particularly the baked bean ascidian *Dendrodoa grossularia* which can occur in dense accumulations. The underlying soft sediments would be composed of a heterogeneous mix of mud / gravel and sand, which can support a wide range of infauna due to the mix of sediment types available. Also supported are a wide range of infauna such as burrowing amphipods and bivalves but also numerous mobile predators such as squat lobsters *Galatheidae* and the long clawed porcelain crab *Pisidia longicornis*. Loose aggregations of the reef-building worm *Sabellaria spinulosa* are also likely to be present.

25. Native oyster is thought to have been a historic feature in the north Norfolk coast (see **Annex C** of the **In-Principle MEEB Plan (Revision B)** [(document reference 5.7.1)]) and therefore oyster bed planting is considered to contribute to the restore target for the MCZ. Deployment of cultch and native oysters could, in the immediate short term, result in localised disturbance and disrupt the presence, species composition and spatial distribution of the existing biological communities, but would not represent the introduction of a wholly different substrate that would lead to the development of an alternate community. In addition, over time, establishment of the oyster bed would restore a key structural and influential species once widespread throughout the region, providing wider biodiversity benefits (Didderen et al. 2020).
26. Based on the relevant pressures, receptor sensitivity, and assessment of impacts against the attributes of subtidal mixed **and coarse** sediment, it can be concluded that the conservation objective of maintaining or restoring the protected features of the CSCB MCZ in a favourable condition **will not be hindered** by disturbance of the substrate on the surface of the sea bed from the planting of native oyster bed.

1.1.2.2.2 Potential Introduction or Spread of Microbial Pathogens and Invasive Non-Indigenous Species (INIS)

1.1.2.2.2.1 Background and Embedded Mitigation

27. Following detailed site selection, including a survey of the existing habitat, the requirement for cultch would be determined and suitable sources identified. As discussed in **Annex C** of the **In-Principle MEEB Plan (Revision B)** [(document reference 5.7.1)], 50,000 oyster are estimated to be required to maintain a sufficient effective population size over the long term.
28. There are a number of oyster hatcheries throughout the UK which could be used to source seed oyster and it is likely that multiple sources will be used to establish the numbers required. The Applicant would, as far as possible, seek to use suppliers and partners from within the Norfolk region, minimising the potential for spread of INIS.
29. Biosecurity of the cultch and oyster sources will be a key consideration in the selection process to ensure no pathogens or INIS are spread with the cultch material or native oysters. If cultch is required, it would be stored in an outdoor area close to where it would be deployed from for weathering for 12 months before being placed on the sea bed. This would limit the potential for spread of pathogens. The MEEB Implementation and Monitoring Plan will incorporate mitigation protocols to secure biosecurity measures once the source of cultch and oyster are confirmed.
30. Actions that would be implemented to minimise risks of introducing and spreading disease are listed below:
- Identification and use of reliable sources of stock.
 - Application of good management practices.
 - Effective disease recognition and diagnosis.

- Identification of effective measures to adopt in the event of a disease outbreak or other unknown mortality.

31. If required, the Applicant would work with the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) to develop a biosecurity measures plan.

~~1.1.2.2~~ 2.2.2.2 Biological attributes

32. The following biological attributes of subtidal mixed sediment and subtidal coarse sediment are relevant to Potential Introduction or Spread of Microbial Pathogens and INIS:

- Structure: non-native species and pathogens (habitat).

~~1.1.2.2.1~~ 2.2.2.2.1 Introduction of microbial pathogens

33. A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi. The import or rearing of cultivated stock can introduce a range of pathogens and parasites into the marine environment which could be deemed damaging (Murray and Peeler, 2005).

34. When new species are brought into a country and quarantining controls are weak the risks of transfer of pathogens or contamination of material by alien invasive species are high (Occhipinti Ambrogi et al., 2008). The oysters selected for the restoration site will be sourced from a reputable cultivating company based in the United Kingdom. Biosecurity protocols will be followed throughout the restoration process to reduce the likelihood of any pathogens potentially being introduced and/or spread. Therefore, it is considered that these risks can be minimised.

35. The impact of microbial pathogens has been defined using the following 'medium to high risk' pressure identified by Natural England's AoO for the CSCB MCZ:

- Introduction of microbial pathogens.

36. The sensitivity to this pressure is not defined for subtidal mixed sediments however for subtidal coarse sediment and subtidal sand is defined as low sensitivity. Therefore, it is expected that subtidal mixed sediments are also likely to be of low sensitivity

37. Based on the relevant pressures, receptor sensitivity, and the embedded mitigation regarding the sourcing of native oyster and biosecurity protocols (**Section 1.3.2.1**), it can be concluded that the conservation objective of maintaining the subtidal mixed sediment and subtidal coarse sediment features of the CSCB MCZ in a favourable condition or restoring it to a favourable condition **will not be hindered** by the risks of introduction and spread of microbial pathogens related to the planting of native oyster bed.

~~1.1.2.2.2~~ 2.2.2.2.2 *Introduction or spread of invasive non-indigenous species (INIS)*

38. Hard substrate introduced by the proposed oyster bed and resulting biogenic reef could act as potential ‘stepping stones’ or vectors for INIS, as well as supporting species non-native to otherwise softer/mixed substrate habitats. This assessment considers the effects of the proposed initial oyster restoration site search area and resulting colonisation by faunal communities on [subtidal coarse sediments and the subtidal mixed sediment features](#) which could be affected by the introduction of INIS.
39. The relevant attribute for subtidal mixed sediments [and subtidal coarse sediments](#) for this potential impact is:
- Structure: non-native species and pathogens.
40. The impact of the introduction of INIS has been defined using the following ‘medium to high risk’ pressure identified by Natural England’s AoO for the CSCB MCZ:
- Introduction or spread of INIS.
- ~~41.~~ 42. The sensitivity of subtidal mixed sediments to INIS is medium.
- ~~41.42.~~ 43. [The sensitivity of subtidal coarse sediments to INIS is high.](#)
- ~~42.43.~~ 44. The native oysters selected for the restoration site will be sourced from a reputable cultivating company based in the United Kingdom. Biosecurity protocols will be followed throughout the restoration process to reduce any INIS that could potentially be introduced and/or spread (**Section 1.3.2.1**).
- ~~43.44.~~ 45. Based on the relevant pressures, receptor sensitivity, and assessment of impacts against the attributes of subtidal mixed sediment [and subtidal coarse sediments](#) features, it can be concluded that the conservation objective of maintaining the ~~subtidal mixed sediment~~ features of the CSCB MCZ in a favourable condition or restoring it to a favourable condition **will not be hindered** by the risks of introduction and spread of INIS from the planting of native oyster bed.

1.2.2.3 Summary

- ~~44.45.~~ 46. The introduction of cultch and native oyster has potential to impact an area of 10,000m² ~~of the~~ [covering both subtidal coarse sediment and](#) subtidal mixed sediment features of the CSCB MCZ however the deployment would result in a patchy distribution and would not be uniform throughout the 10,000m² area. Native oyster is thought to have been a historic feature along the north Norfolk coast (see **Annex C** of the **In-Principle MEEB Plan (Revision B)** (~~document reference 5.7.1~~)) and therefore oyster bed planting is considered to contribute to the restore target for the MCZ. Deployment of cultch and native oysters could, in the immediate short term, result in localised disturbance and disrupt the presence, species composition and spatial distribution of the existing biological communities but would not represent the introduction of a wholly different substrate that would lead to the development of an alternate community. Over time, establishment of the oyster bed would restore a key structural and influential species once widespread throughout the region, providing wider biodiversity benefits.

- ~~45.~~46. Introduction of cultch and native oyster has potential to increase the risk of the introduction and spread of microbial pathogens and INIS. However, stringent biosecurity protocols would be put in place to minimise this risk.
- ~~46.~~47. Therefore, it can be concluded that the conservation objective of maintaining the protected features of the CSCB MCZ in a favourable condition or restoring them to a favourable condition **will not be hindered** by disturbance to the substrate of the sea bed or the risk of introduction or spread of microbial pathogens and INIS from the planting of native oyster bed.

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