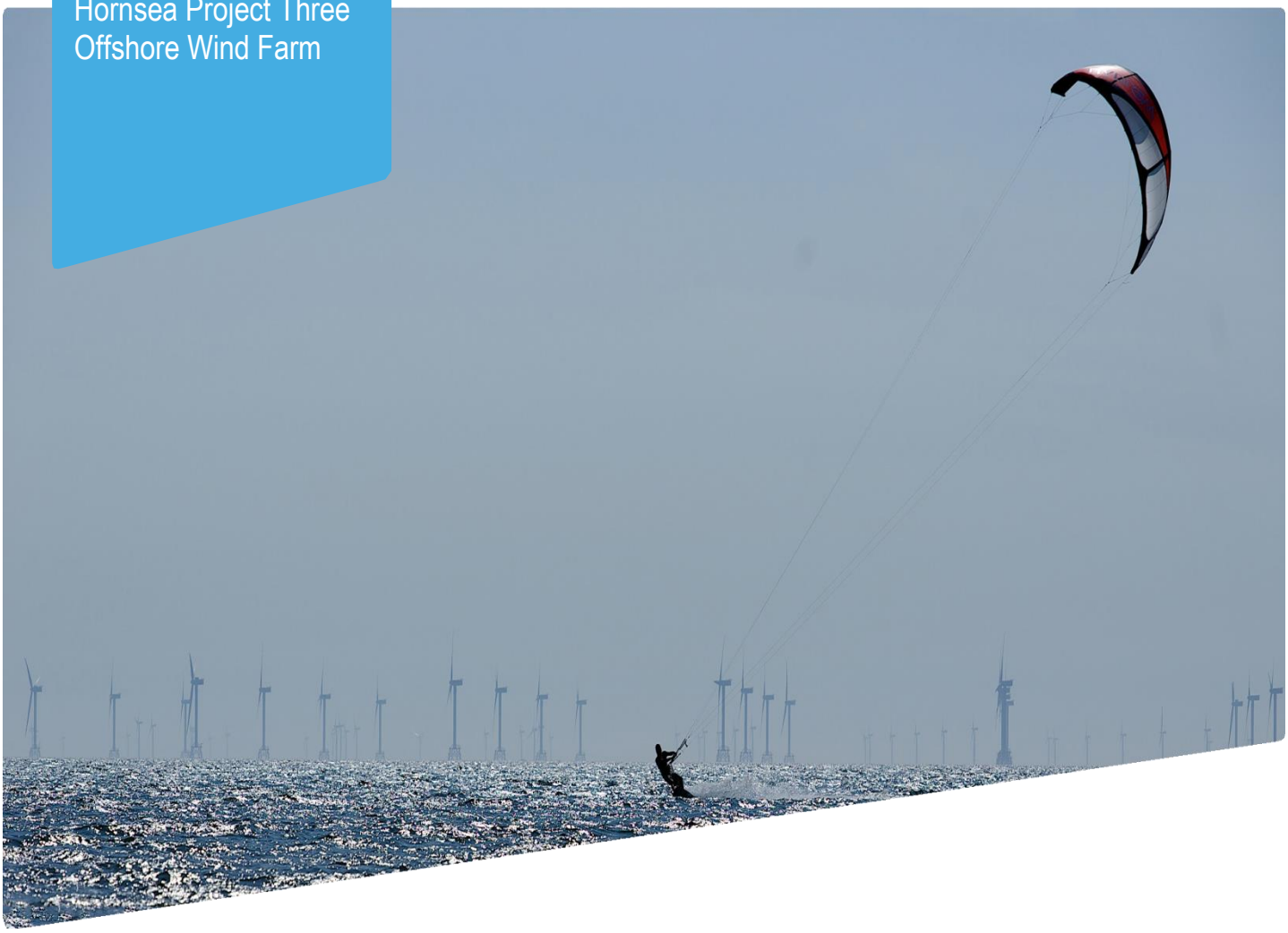
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Response to the Secretary of State's Consultation
Appendix 2: Compensatory Measures

Date: February 2020

Hornsea 3
Offshore Wind Farm

Ørsted

Response to the Secretary of State's Consultation

Appendix 2: Compensatory Measures

Document Control			
Document Properties			
Organisation	Ørsted Hornsea Project Three		
Author	GoBe Consultants and Sian John		
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Approved by	Andrew Guyton		
Title	Appendix 2: Compensatory Measures		
Version History			
Date	Version	Status	Description / Changes
12/02/2020	A	Final	Final for Submission

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Front cover picture: Kite surfer near a UK offshore wind farm © Orsted Hornsea Project Three (UK) Ltd., 2018.

Executive Summary

Introduction

Without prejudice to the Secretary of State's decision on the Hornsea Three Project DCO Application (the "Application") and decision with respect to adverse effects on site integrity, this Report on Compensatory Measures sets out a range of feasible compensation options which, either alone or in combination depending on the applicable impact scenario, are considered to be sufficient by the Applicant to ensure the coherence of the National Site Network (previously known as the *Natura 2000* network) is maintained. Information on the Assessment of Alternative Solutions and Imperative Reasons of Overriding Public Interest ("IROPI") is provided in separate, accompanying reports.

Predicted Effects

The predicted magnitude of the long-term temporary impact from application of cable protection and turbine operation associated with Hornsea Three on the relevant qualifying features of the designated sites (cited within the BEIS letter of 27 September 2019) is presented in Section 4; with a summary provided in the table below. The numbers presented in this table are reflective of the most recent design optimisation work and mitigation commitments as detailed in maximum design scenario ("MDS") documented in Appendix 4 to Applicant's Response.

Summary of Hornsea Three predicted impacts on all designated sites

Impact	Impact Quantification	Impact on Site
NNSSR SAC (designated area of 3,603,410,000 m²)		
Long-term temporary (operational phase) habitat loss due to cable protection.	418,440 m2 (41.8ha) due to up to 6% of the cable length requiring rock protection in the SAC.	The overall impact on the NNSSR SAC sandbank habitat would be 0.01%
WNNC SAC (designated area of 1,077,180,000 m²)		
Long term temporary (operational phase) habitat loss due to cable protection.	27,720 m² (2.77ha) due to up to 6% of the cable length requiring rock protection in the SAC.	The impact on the The WNNC SAC as a whole equates to 0.0026%. For the sub-features this would be: up to 0.0048% of Sublittoral Sand, 0.077% of Subtidal Coarse Sediment and 0.0036% of Subtidal Mixed Sediment.

Impact	Impact Quantification	Impact on Site
FFC SPA (designated kittiwake population of 44,520 breeding pairs, latest count[1] cites 51,535 breeding pairs)		
Project Collision Risk (Based on 231 WTGs with a lower blade tip height of 40m MSL) (Annex B to Appendix 4 of the Applicant's Response: Updated Ornithological Mitigation Scenario)	Project alone: 4 individuals	The impact equates to 0.01% of the current breeding population.
Project Collision Risk (Based on 231 WTGs with a lower blade tip height of 40m MSL) based on the Examining Authorities requested parameters (Rule 17, 19th March Ref: EN010080)	Project alone: 7-9 individuals	The impact equates to 0.017% of the current breeding population.
Project Collision Risk (Based on 231 WTGs with a lower blade tip height of 40m MSL) based on the Applicant's interpretation of Natural England parameters	Project alone: 65-73 individuals	The impact equates to 0.14% of the current breeding population.

Guidance

The European Commission guidance (EC, 2018[2]) includes a broad range of measures which might be acceptable and appropriate as Compensatory Measures for effects on Natura 2000 sites (including SACs), such as, habitat re-creation, restoration or enhancement in existing European sites; species recovery and reinforcement; reserve creation; incentives (and disincentives) for certain economic activities; and the reduction of other threats. Detail on a suite of measures, mindful of the guidance, potentially applicable to Hornsea Three is provided in Appendices A and B of this report. These measures have been 'screened' in or out of further consideration for the qualifying features of concern, based on their feasibility and acceptability to key stakeholders, having regard to the guidance.

[1] Latest colony census (2017) identified a population of 51,535 breeding pairs
[2] EC, 2018: Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. Brussels, 21.11.2018 C(2018) 7621 final

Compensation Measures

Habitat measures

The package of compensation measures developed by the Applicant for the long-term temporary habitat loss (from the application of cable protection) within the Annex I sandbank features of The WNNC and NNNSSR SACs, is:

- 'Habitat improvement and species recovery' comprised of blue mussel bed restoration and biosecurity measures within The WNNC SAC; and
- 'Habitat restoration' comprised of marine litter removal within and near to The WNNC SAC and measures to increase the recovery of future lost gear (within the Eastern Inshore Fisheries and Conservation Agency's (EIFCA) district), focused on lost/abandoned fishing gear within the Annex I sandbank habitat feature.

Habitat improvement and species recovery: blue mussel beds

Discussions with Natural England and the EIFCA have indicated that restoration of the blue mussel beds within The WNNC SAC is an action that would have significant conservation value and enhance ecosystem function.

This measure would comprise the identification of specific location(s) for mussel bed restoration, followed by the implementation of a restoration plan to establish up to 44.57ha of mussel bed within The WNNC SAC. It is proposed that this measure would be developed and delivered with the EIFCA. Regular monitoring of the establishment of mussel beds would be undertaken in conjunction with the EIFCA with adaptive management implemented (including appropriate biosecurity measures) as and when necessary based on mussel establishment confirmed through monitoring.

Habitat restoration: the removal of nearshore marine litter

It is understood through discussions with the EIFCA that damage to The WNNC SAC from lost and abandoned fishing gear is a likely pressure on designated features and the wider ecosystem functioning. Targeted removal of marine litter (predominantly expected to constitute abandoned or lost fishing gear) within or on sandbank habitats adjacent to The WNNC would serve to help restore the wider ecosystem functioning of the designated habitats.

This measure would entail liaison with the fishing industry and EIFCA to identify areas where lost/abandoned gear is most prevalent, followed by a campaign to identify and remove marine litter. Alongside this process, the identification of a practicable solution for the reporting and rapid identification and retrieval of lost gear would be developed with EIFCA and local fishing and conservation stakeholders. The implementation of the solution would then be delivered by a suitably qualified delivery partner. The success of litter removal would be self-evident and the effectiveness of the gear retrieval solution would be evidenced through the reporting of up take by the local fishing fleets.

Contingency habitat measures

The Applicant is confident that these measures would be sufficient to compensate for the potential maximum extent of Hornsea Three's adverse effect (should an adverse effect be determined). However, further measures which could be adopted, should initial establishment and management not succeed to the target extent, have also been considered. These contingency measures are summarised below.

Species reintroduction: eelgrass restoration

If required (in the instance that the two primary measures failed to deliver), 'species reintroduction' could be undertaken in The WNNC SAC for eelgrass (*Zostera*). Eelgrass is a component of the designated habitat of the SAC (specifically 'mudflats and sandflats not covered by seawater at low tide') which has suffered significant losses[3] in the recent past and its restoration would provide significant biodiversity benefits. Furthermore, the species captures carbon from the atmosphere up to 35 times faster than tropical rainforests, making it effective as climate change mitigation.

Habitat restoration: the removal of marine litter/debris (nearshore and/or offshore)

If required, and as an alternative to the eelgrass establishment, it is proposed that an area of up to 20 ha of the spatial extent of the residual adverse effect deemed necessary to provide for, would be ground truthed for marine litter/debris, following stakeholder consultation to identify likely litter/debris hot-spots nearshore and offshore.

The precise nature of the litter/debris present in the designated sites or nearby sandbanks habitat would be ascertained following ground truthing. It is expected that any litter to be removed would predominantly constitute abandoned or lost fishing gear, and that any debris to be removed would predominantly constitute abandoned infrastructure or dropped objects. The exact nature of the litter/debris to be removed would be subject to technical feasibility, HSE, legal and industry acceptability (for example, oil and gas platforms, installed subsea infrastructure and pipelines are excluded) and developed further in the Sandbanks Compensation Plan.

As nearshore litter, within or near The WNNC SAC, is addressed as part of the primary package, nearshore areas would be search for and remove debris only as part of this measure. Offshore, within or near the NNSSR SAC, this measure would cover marine litter and/or debris as reasonable and proportionate.

Seabird measures

For kittiwake, the developed compensatory measure is (invasive mammalian) 'predator eradication' at a UK island(s) where kittiwake form part of the breeding seabird assemblage. This measure would be undertaken in conjunction with 'biosecurity measures' to prevent re-infestation. This would remove an additional pressure on

[3] 92% loss of the feature has occurred within the UK over the last century: https://www.swansea.ac.uk/press-office/news-events/news/2019/09/one-million-seeds-to-be-planted-in-uks-biggest-seagrass-restoration-scheme.php

the UK population that may constrain population growth and productivity at a local level thereby maintaining the overall coherence of the network. The measure would also serve to benefit the wider seabird assemblage.

The process would initially comprise the identification of suitable island(s) whose kittiwake populations are affected by invasive mammalian predators, followed by the development and implementation of an appropriate eradication programme and associated biosecurity measures. A monitoring programme targeted at demonstrating eradication success and changes to productivity would be implemented.

Securing and Ensuring Compensation

Should they be deemed necessary, the Compensatory Measures developed by the Applicant could be secured through additional Requirements that the Secretary of State could add to the DCO. Draft wording for these Requirements has been provided as part of the Applicant's Response.

The risks associated with the failure of the developed measures have been considered and would be mitigated through monitoring and adaptive management, as appropriate, or through the delivery of contingency measures, where any one measure could be scaled to resolve any deficit in another. Central to the promotion of these measures is a commitment to monitor their implementation and outcomes, and to have in place an adaptive management plan.

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Acronyms

Acronyms	Description
AOS	Area of Search (pre-pSAC)
BEIS	Department for Business, Energy and Industrial Strategy
CFP	Common Fisheries Policy
cSAC	candidate SAC (pre-SCI)
CSIP	Cable Specification and Installation Plan
DCO	Development Consent Order
EC	European Commission
EEZ	Exclusive Economic Zone
EIFCA	Eastern Inshore Fisheries and Conservation Agency
EU	European Union
FFC	Flamborough and Filey Coast SPA
FID	Financial Investment Decision
FOCI	Features of Conservation Importance
ha	Hectare
HDD	Horizontal Direct Drilling
IFCA	Inshore Fisheries and Conservation Agency
INNS	Invasive non-native species
JNCC	Joint Nature Conservation Committee
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
NFFO	National Federation of Fishermen's Organisations
NGOs	Non-Governmental Organisations
Nm	Nautical mile
NNNSI	Norfolk Non-Native Species Initiative
NNSSR	North Norfolk Sandbanks and Saturn Reef SAC
pSAC	proposed SAC (pre-cSAC)

Acronyms	Description
PVA	Population Viability Analysis
RIAA	Report to Inform Appropriate Assessment
ROV	Remotely Operated Vehicle
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SCI	Site of Community Importance (pre-SAC)
SNCB	Statutory Nature Conservation Body
SPA	Special Protection Area

1. Introduction

1.1 Hornsea Three is a proposed offshore wind farm located within the southern North Sea being promoted by Orsted Hornsea Project Three (UK) Limited ("the Applicant"). A Development Consent Order (DCO) for the project was submitted by the Applicant (in accordance with the Planning Act, 2008) in May 2018 and its examination (by the Planning Inspectorate) completed in April 2019. On 27 September 2019, the Secretary of State for the Department for Business, Energy and Industrial Strategy (BEIS) issued a Request for Information relating to the Application (REF: EN010080-003103-H3WF – 190924 - Hornsea Project Three Further Consultation Letter Dated 27 September 2019).

1.2 In respect of the North Norfolk Sandbanks and Saturn Reef (NNSSR) Special Area of Conservation (SAC) and The Wash and North Norfolk Coast (WNNC) SAC, in relation to the feature "sandbanks which are slightly covered by sea water all the time", and the Flamborough and Filey Coast (FFC) Special Protection Area (SPA) in relation to in-combination impacts on the assemblage (kittiwake) feature, the Applicant (in consultation with Natural England as necessary) was invited to provide further evidence on the matters set out in regulations 64 and 68 of the Conservation of Habitats and Species Regulations 2017, and regulations 29 and 36 of the Conservation of Offshore Marine Habitats and Species Regulations 2017, namely:

- whether there are any feasible alternative solutions to the project which could avoid or lessen any adverse effects on the integrity of the sites;
- any imperative reasons of overriding public interest for the project to proceed;
- any compensatory measures proposed to ensure that the overall coherence of the network of European sites is protected.

1.3 Without prejudice to the Secretary of State's determination of the application and decision with respect to adverse effect on site integrity, this document has been produced to describe the compensatory measures that could be implemented to ensure the coherence of the National Site Network.

1.4 Information on the Assessment of Alternative Solutions and Imperative Reasons of Overriding Public Interest is provided in separate, accompanying reports (see Appendix 1 to the Applicant's Response).

1.5 This document is structured as follows:

- Section 1: Introduction
- Section 2: Relevant European sites. This section identifies and describes the sites and designated features for which potential compensation measures have been requested (further details for the FFC SPA are provided in Annex A).
- Section 3: Principles of compensatory measures. This section identifies the guiding principles around which compensatory measures should be developed and provides the framework for the screening of potential measures for The WNNC and NNSSR SACs and the FFC SPA, as presented in Annex B and C respectively.

- Section 4: Predicted effects from Hornsea Three. This section identifies the potential predicted adverse effects for which compensation measures have been requested by the Secretary of State.
- Section 5: Compensatory measures. This section presents and discusses the compensation measures developed by the Applicant and introduces the Sandbanks Compensation Strategy and the Kittiwake Compensation Strategy provided in Appendix 2A and Appendix 2B of the Applicant's Response, respectively, that set out how the measures screened in as part of the process described in Section 3 would be delivered. The strategy documents would form certified documents in the DCO.
- Section 6: Conclusion.

2. Relevant Natura 2000 Sites

Introduction

2.1 This section provides an overview of the NNSSR SAC, The WNNC SAC and the FFC SPA in turn and provides a summary of the features relevant to the Consultation and their conservation status.

The North Norfolk Sandbanks and Saturn Reef SAC

2.2 The NNSSR SAC was designated in 2017 and covers 360,341 ha in UK offshore waters. The site is designated under article 4.4 of the Habitats Directive as it hosts the following Annex I habitats:

- Sandbanks which are slightly covered by sea water all the time; and
- Reefs.

2.3 The conservation objectives for the NNSSR SAC are for its features to be in a favourable condition, ensuring site integrity in the long term. This would be achieved, subject to natural change, by maintaining or restoring:

- the extent and distribution of the qualifying habitats in the site;
- the structure and function of the qualifying habitats in the site; and
- the supporting processes on which the qualifying habitats rely.

2.4 The letter from BEIS of 27th September 2019 refers specifically and only to the Sandbanks feature of the site in the context of derogation.

2.5 The JNCC advise that Annex I Sandbanks which are slightly covered by sea water all of the time, are currently believed to be in unfavourable condition and, consequently, need to be restored to favourable condition (although it is noted within the Supplementary Advice provided on the Conservation Objectives that better evidence would improve confidence in this assessment[4]). The activities listed below have been identified as exerting pressures capable of affecting the qualifying features of the site and, therefore, these activities should be managed (by minimising further impacts on features) to restore the qualifying features (JNCC, 2017):

[4] http://archive.jncc.gov.uk/pdf/NNSSR_SACO_v1_0.pdf

- demersal fishing;
- aggregate extraction;
- cabling; and
- oil and gas operations.

2.6 Further relevant supplementary advice on the conservation objectives for the Sandbanks feature is set out in Table 2.1.

Table 2.1: Supplementary advice on conservation objectives for the NNSSR SAC (JNCC, 2017)

Annex I Sandbanks
Attribute: Extent and Distribution
Objective: Restore The JNCC understands that the site has been subjected to activities that have resulted in a change to the extent and distribution of the feature within the site. Installation and/or removal of infrastructure may have a continuing effect on extent and distribution. As such, JNCC advise a restore objective which is based on expert judgment; specifically, our understanding of the feature's sensitivity to pressures which can be exerted by ongoing activities (i.e. oil and gas sector activities and cabling). Our confidence in this objective would be improved with longer term monitoring and access to better information on the activities taking place within the site. Activities must look to minimise, as far as is practicable, changes in substratum and the biological assemblages within the site to minimise further impact on feature extent and distribution.
Attribute: Structure and function
Objective: Restore The JNCC understands that the site has been subjected to activities that have resulted in a change to the structure and function of the feature within the site. Installation and/or removal of infrastructure may have a continuing effect on structure and function, specifically the finer scale topography, sediment composition and distribution of characteristic communities. As such, JNCC advise a restore objective which is based on expert judgment; specifically, our understanding of the feature's sensitivity to pressures which can be exerted by ongoing activities (i.e. demersal fishing, oil and gas sector activities and cabling). Our confidence in this objective would be improved with longer-term monitoring, access to better information on the activities taking place within the site and a better understanding of the species which can play key and influential roles in determining the feature's function and health. Activities must look to minimise, as far as is practicable, disturbance and changes to the sediment composition, finer scale topography and biological communities within the site.
Attribute: Supporting processes
Objective: Maintain A maintain objective is advised for supporting processes based on expert judgment; specifically, our understanding of the feature's sensitivity to pressures which can be exerted by ongoing activities. Our confidence in this objective would be improved with long-term monitoring, specifically of contaminant levels within the site and a better understanding of the hydrodynamic regime within the site. Activities must look to avoid, as far as is practicable, impairing the hydrodynamic regime within the site and exceeding Environmental Quality Standards set out in the relevant section below.

The Wash and North Norfolk Coast SAC

2.7 The WNNC SAC was designated in April 2015 and encompasses an area of 107,761 ha in UK waters. The site is designated under article 4.4 of the Habitats Directive as it hosts the following Annex I habitats and Annex II species:

- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);
- Coastal lagoons;
- Harbour (common) seal (*Phoca vitulina*);
- Large shallow inlets and bays;
- Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*);
- Mudflats and sandflats not covered by seawater at low tide;
- Otter (*Lutra lutra*);
- Reefs;
- *Salicornia* and other annuals colonising mud and sand; and
- **Sandbanks which are slightly covered by sea water all the time**.

2.8 The letter from BEIS of 27 September 2019 refers specifically and only to the Sandbanks feature of the site in the context of derogation.

2.9 The conservation objectives of the site are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its 'qualifying features', by maintaining or restoring:

- the extent and distribution of qualifying natural habitats and habitats of the qualifying species;
- the structure and function (including typical species) of qualifying natural habitats;
- the structure and function of the habitats of the qualifying species;
- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- the populations of each of the qualifying species; and
- the distribution of qualifying species within the site.

2.10 In March 2019, Natural England released an updated vulnerability assessment for The WNNC SAC; on which the Applicant provided detailed comments at Deadline 6 of the Hornsea Three Examination (REP6-019). With reference to 'sandbanks which are slightly covered by sea water all the time' and condition, the updated assessment noted the following:

- 72% Favourable and 28% Unfavourable recovering.

2.11 For 'sandbanks which are slightly covered by seawater all the time' the relevant sub-features are Subtidal Sand, Subtidal Coarse Sediments and Subtidal Mixed Sediments (Table 2.2 of REP6-019), the latter two of which are deemed to be in unfavourable condition. These sub-features fail due to impacts from fisheries, however, confidence in the condition assessment is "low" (REP6-019).

2.12 The relevant targets in the context of the Project and the two sub-features considered to be in unfavourable condition are:

- Hab_Att_3.01: Maintain/Recover the species composition of component communities; and

2.13 Hab_Att_2: Maintain/Recover the presence and spatial distribution of Subtidal Coarse Sediment/Subtidal Mixed Sediment communities according to the map.

Flamborough and Filey Coast SPA

2.14 The Flamborough Head and Bempton Cliffs SPA was classified in August 1998. In August 2018, the site was extended and re-named the Flamborough and Filey Coast SPA. The site qualifies under article 4.2 of the Habitats Directive (2009/147/EC) by supporting over 1% of the biogeographical populations of four regularly occurring migratory species and a breeding seabird assemblage of European importance (see Table 2.2).

Table 2.2: Qualifying features of the FFC SPA

Species	Count (period)	% of subspecies or population (pairs)
Black-legged kittiwake *Rissa tridactyla*	44,520 pairs 89,040 breeding adults (2008-2011)	2% North Atlantic
Northern gannet *Morus bassanus*	8,469 pairs 16,938 breeding adults (2008-2012)	2.6% North Atlantic
Common guillemot *Uria aalge*	41,607 pairs 83,214 breeding adults (2008-2011)	15.6% (*Uria aalge albionis*)
Razorbill *Alca torda*	10,570 pairs 21,140 breeding adults (2008-2011)	2.3% (*Alca torda islandica*)
	Count period	Average number of individuals
Seabird assemblage	2008-2012	216.730

2.15 The site's conservation objectives apply to the site and the individual species and/or assemblage of species for which the site has been classified. The objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

- the extent and distribution of the habitats of the qualifying features;
- the structure and function of the habitats of the qualifying features;
- the supporting processes on which the habitats of the qualifying features rely;
- the populations of each of the qualifying features; and
- the distribution of qualifying features within the site.

2.16 Natural England recently (19 September 2019) released Supplementary Advice on the Conservation Objectives for the site (detail presented in Annex A). The letter from BEIS of 27 September 2019 refers specifically to the assemblage (kittiwake) features of the site in the context of derogation.

3. Principles

Natura 2000 Compensatory Measures: Habitats Directive, Regulations and Guidance

Overview

3.1 As set out in The Conservation of Habitats and Species Regulations 2017 and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (the "Habitats Regulations"), the appropriate authority must ensure that any necessary compensatory measures are secured (without prejudice to other requirements first being met[5]), where an adverse effect on the integrity of a European site (or sites) cannot be avoided, after the application of available, viable mitigation[6]. Compensatory measures must be independent of the project (including any mitigation) and are intended to offset the residual negative effects of the plan or project so that the overall ecological coherence of the National Site Network is maintained.

3.2 The principle guidance documents relating to compensatory measures for UK projects are:

- Defra 2012 Guidance[7];
- EC 2018 Managing *Natura 2000* sites[8]; and
- the Planning Inspectorate's Advice Note Ten[9].
- Tyldesley and Chapman's Habitats Regulations Assessment (HRA) Handbook[10].

3.3 EC guidance on article 6(4) of the Habitats Directive suggests that, in order to ensure the coherence of Natura 2000, compensation should (EC, 2012; 2018):

- Refer to the sites' conservation objectives and address in comparable proportions the habitats and species negatively affected in terms of number and status.
- Ensure the maintenance of the contribution of a site to the conservation of the natural habitat types and habitats of species, within the biogeographical region concerned.

[5] Including demonstrating that the need for the Project cannot be delivered through alternative solutions and that IROPI exists.
[6] Mitigation measures, as distinct from compensation, are those measures that aim to minimise, or even eliminate, the negative impacts likely to arise from the implementation of a plan or project so that the site's integrity is not adversely affected. These measures are an integral part of the specifications of a plan or project or conditional to its authorisation (EC, 2019).
[7] Defra (2012), *Habitats and Wild Birds Directives: Guidance on the application of article 6(4) - alternative solutions, imperative reasons of overriding public interest (IROPI) and compensatory measures.* December 2012.
[8] EC (2018). *Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*. Brussels, 21.11.2018 C(2018) 7621 final.
[9] Planning Inspectorate (2017). *Advice Note Ten: Habitat Regulations Assessment relevant to Nationally Significant Infrastructure Projects*. November 2017, Version 8.
[10] Tyldesley, D. and Chapman C. (2013-2019). The Habitats Regulations Assessment Handbook, 2019 edition UK: DTA Publications Limited. Note that this publication is an on-line handbook that is updated periodically.

- Provide properties and functions comparable to those which justified the selection criteria of the original site, particularly regarding the adequate geographical distribution of the features concerned. However, distance between the original site and the compensatory measures is not necessarily considered to be an obstacle so long as it does not affect the functionality of the site, its role in the geographical distribution and the reasons for its initial selection.

3.4 The Birds Directive does not provide for biogeographical regions or selection at EU level. However, the EC guidance suggests that, by analogy, it could be considered that the overall coherence of the network is ensured if:

- compensation fulfils the same purposes that motivated the site's classification under Article 4(1) and 4(2) of the Birds Directive;
- compensation fulfils the same function e.g. along the same migration path; and
- the compensation areas are accessible with certainty by the birds usually occurring on the site affected by the project.

Measures

3.5 The EC 2012 and 2018 guidance includes a broad range of measures which might be acceptable and appropriate as compensatory measures. These include:

- Habitat re-creation – creating a habitat on a new or enlarged site to be incorporated into *Natura 2000*.
- Habitat restoration or improvement in existing European sites, in proportion to the loss due to the plan or project.
- Species recovery and reinforcement, including reinforcement relating to prey species.
- Species reintroduction.
- In association with other works, land purchase/rights acquisition and reserve creation/provision a new site of sufficient quality under the Habitats or Birds Directive and establishing/implementing conservation measures for this new site (e.g. restrictions on activities that can be undertaken).
- Incentives for certain economic activities that sustain key ecological functions.
- The reduction of other threats (e.g. wildfowling, fishing, poor water quality), usually to species, either through action on a single source or through coordinated action on all threat factors.

3.6 It acknowledges that measures (2) to (7) might be more appropriate (or even preferred) to (1) habitat creation/re-creation, taking into consideration the specific circumstances of the plan or project in question and the nature and scale of its effects (DTA Ecology, 2016[11]). Defra guidance on the application of article 6(4) also accepts that 'other things', beyond habitat creation or re-creation, could also protect the overall coherence of the network (Defra, 2012[12]).

3.7 Hence the Habitats Directive is not prescriptive and does not require that compensation should be "like for like". The conservation objectives of European sites can often be met and enhanced in other ways; albeit where 'like for like' compensation would be important for the conversation objectives of the affected European site(s) to be met, where possible, it should be sought.

Location

3.8 The EC 2018 guidance suggests a series of preferences for the location of compensatory measures which are, in order:

- Compensation within the affected Natura 2000 site.
- Compensation outside the affected Natura 2000 site but within a common topographical or landscape unit, provided the same contribution to the ecological structure and/or network function is feasible.
- Compensation outside the affected Natura 2000 site in a different topographical or landscape unit.

3.9 In 2010 DECC[13] reported that, in the UK, the established practice is to locate 'like for like' compensation within the same geographical area or ecological system (following EC priorities 1 and 2). This reduces the risk that the measures will fail to protect coherence, as they act within the same part of the geographical distribution of the habitat or species. As set out in sub-section 3, distance is not considered to be an obstacle for compensation (within the biogeographical region). However, with distance uncertainty may increase (and this is may have consequences for the subsequent ratio applied, as discussed further below in paragraph 3.10 *et seq.*).

Replacement ratios

3.10 In defining the requirements for the provision of compensatory habitats, replacement ratios should be based on a number of factors that relate both to the type and extent of the impacts and the nature of the compensation proposed. With respect to the impacts predicted, whether they are expected to be direct and indirect (and of major or minor significance) or are precautionary, will have a significant influence on the extent of compensatory habitat determined to be required. That is, the ratio of required compensation to impact amount should be determined on a case by case basis,

[11] DTA Ecology (2016). *Advice regarding the approach to the derogation provisions under the Habitats Regulations relevant to tidal lagoon proposals*. Report to Tidal Lagoon Power, Natural England and Natural Resources Wales. Doc. Ref. 1003 Tidal Lagoons, 1 February 2016.

[12] Defra (2012). *Habitats and Wild Birds Directives: guidance on the application of Article 6(4)*. December 2012.

[13] DECC (2010). Severn Tidal Power Report on Possible Compensatory Measures under Article 6(40 Habitats Directive. DECC, May 2010.

based on the value and function of the habitat to be affected and created, and on Defra compensation parameters (Defra, 2012), as follows:

- Location – it is preferable, but not necessary, for the compensatory habitat to be located as closely as possible to the site to be compensated for, given that the habitat is intended to provide at least an equivalent function to that which is impacted by development. The further away from the impact site the compensatory habitat is, the more likely a higher ratio of new or enhanced habitat for old will be required.
- Habitat type and conditions – should replace the qualifying habitats and species and replicate critical features (e.g. low levels of disturbance).
- Sustainability – an assured life, likely exceeding the old, is required and typically demonstrable through modelling.
- Timing – as a general principle, a site should not be irreversibly affected by a project before the compensation is in place. However, there may be situations where it will not be possible to meet this condition (EC, 2018). That is, no requirement exists in the Directive to have compensatory habitat in place at the same time as implementation of the development, but it is desirable to have created a functioning compensatory habitat by the time that there is an adverse effect on the impacted European site; otherwise the compensation requirement may be scaled to account for additional impact (noting that delivery may not represent functionality). Hence the programme for the implementation of compensatory measures in the context of the development proposed needs to be considered carefully. It is also relevant to note that whilst delivery does not necessarily equate to functionality; but site functionality will develop once the compensation is in place. For example, it would take many years for a recreated forest habitat to achieve the same function as the habitat negatively affected by a project. Therefore, best efforts should be made to ensure that compensation is in place before the European site is affected but, where this is not fully achievable, the competent authorities may wish to consider additional compensation for the interim losses that would occur in the meantime.
- Uncertainty – does confidence exist around the ability of the new habitat to support the qualifying features? Greater uncertainty is (again) likely to lead to a higher ratio of new for old.

Effect duration

3.11 The nature and, specifically, the duration of the adverse effect is also relevant to determining the requirement for compensation, i.e. would the predicted effect of concern be temporary or long-term?

Condition

3.12 Compensatory measures should be additional to the actions that are normal practice under the Habitats and Birds Directives or obligations laid down in EU law. For example, the proposal/designation of a new area already inventoried as being of Community importance, constitute 'normal' measures for a Member State. Thus, compensatory measures should go beyond the normal/standard measures required for the designation, protection and management of Natura 2000 sites (EC, 2019).

3.13 Given this, compensation should not be used to address issues that have been formally identified as causing habitats or species to be in an unfavourable condition by the SNCB responsible for the site (in this case demersal fishing, aggregate extraction, cabling and oil & gas operations). That is, Member States have existing duties to address the causes of unfavourable condition and compensatory measures should provide additional benefits.

3.14 'Like for like' compensation for losses of some habitats, particularly those which are subtidal, can be very difficult if not impossible to achieve through the creation of new habitats outside of existing sites. Furthermore, in Member States where most or all of the estuaries are already Natura 2000 sites, designation of additional areas as a form of compensation may also not be possible, and therefore measures within existing sites may have to be considered.

3.15 In this context it is important to demonstrate 'additionality' as part of a compensation package (in addition to any existing requirements on the SNCB). The key issue regarding additionality is whether the improvement would have happened anyway without further intervention. If not, or if not within a reasonable timeframe, then additionality can be determined, and the measures considered to be compensation for the effects of a project. Discussions held by Hornsea Three with Natural England have established that none of the developed measures are being actively pursued as part of the ongoing management of the relevant sites.

Application to Hornsea Three

3.16 Detailed consideration and screening of potential compensatory measures based on the Habitats Regulations and guidance has been undertaken and the outcomes are presented in Annex B for the SAC sandbank habitats and Annex C for the kittiwake feature of the FFC SPA.

3.17 From this screening exercise and consultation with relevant stakeholders (Appendix 8 to Applicant's Response), a number of compensatory measures have been shortlisted that are considered to be both technically feasible and deliverable for Hornsea Three[14]. These measures, as detailed in full in Section 5, comprise:

- For The WNNC SAC and NNSSR SAC sandbank feature: blue mussel bed restoration and biosecurity measures in The WNNC SAC and the removal of marine litter in The WNNC SAC. In addition, eelgrass (*Zostera*) restoration in The WNNC SAC or debris removal in The WNNC and/or litter/debris removal in the NNSSR SAC are also described as contingency options (see Section 5 for further detail).
- For the FFC SPA kittiwake feature: predator eradication and biosecurity measures on one or more UK islands that support a kittiwake colony (outside the FFC SPA).

3.18 Other potential compensatory measures assessed as less suitable for technical or other deliverability reasons are explored in Annexes B and C of this document.

[14] It is important to note that in screening other measures out it does not imply that they are not compensation, rather that they are not considered deliverable by Hornsea Three or that they would not be proportionate to the scale of the Hornsea Three impacts.

4. Predicted Effects

Impact Assessment

4.1 In order to frame the consideration of Compensatory Measures, it is important to first consider the manner in which Hornsea Three would interact with the designated site(s). The Applicant has submitted a comprehensive and robust Report to Inform Appropriate Assessment (RIAA) (APP-051) that considered all potential impacts on the relevant European sites from the construction, operation and decommissioning of Hornsea Three. Throughout the examination phase, further clarifications were provided where necessary to provide validation of, and or further justification for, the conclusions reached within the original RIAA. Furthermore, additional mitigation and design optimisation work has enabled Hornsea Three to reduce its impact on the designated site features in question since the completion of the examination of Hornsea Three by the Planning Inspectorate (Appendix 4 to the Applicant's Response).

4.2 The RIAA concludes that an adverse effect would not arise due to Hornsea Three's predicted interaction with relevant features of the European sites. However, in light of the Request for Information from BEIS (dated 27 September 2019) on any compensatory measures developed to ensure that the overall coherence of the network is protected, clear objectives and target values for compensatory measures, should they be deemed necessary, need to be set. For the purposes of this report, the maximum values for cable protection are set on a precautionary basis as the Applicant's worst-case assessment of where cable protection could be needed within the SACs The Applicant considers this to be a long-term temporary impact as decommissioning of cable protection is committed to in the draft DCO, but should the Secretary of State conclude that this is a permanent impact the developed compensatory measures, applied in the same extent, meet the requirements of derogation. The maximum values for collision risk impacts have been set based on the Applicant's understanding of the position taken by SNCBs during the Hornsea Three DCO process thus far. All compensatory measures are based on worst case assumptions but can be scaled to reflect the outcome of the Appropriate Assessment undertaken by the Secretary of State. Where impacts have reduced due to additional mitigation committed to within the Decision period, this is clearly indicated.

The North Norfolk Sandbanks and Saturn Reef SAC

4.3 The qualifying feature of the NNSSR SAC for which further information has been sought is the Annex I sandbank feature, including both sandbanks as defined features themselves and their supporting habitat[15,16].

4.4 The predicted long term impacts (from cable protection) on the Annex I sandbank features of the NNSSR SAC are summarised in Table 4.1 and reflect the latest project mitigation and design refinements detailed in Appendix 4 to Applicant's Response.

Table 4.1: Summary of Hornsea Three predicted impacts on the Sandbanks feature of the NNSSR SAC

[15] http://jncc.defra.gov.uk/page-1452
[16] http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf

Impact	Impact Quantification	Impact on SAC
NNSSR SAC (designated area of 3,603,410,000m^2)		
Long-term temporary (operational phase) habitat loss due to cable protection	418,440 m2 due to up to 6% of the cable length requiring rock protection in the SAC	The overall impact on the SAC sandbank habitat would be 0.01%

4.5 The RIAA concludes that an adverse effect on the integrity of the NNSSR SAC would not arise due to Hornsea Three because of the limited scale of the impact on the designated feature, the mitigation and control measures put in place to ensure the potential worst case impacts are minimised throughout the pre-construction and construction phase, and the commitment to recover any remedial cable protection material within designated sites as part of the decommissioning of Hornsea Three. However, the Secretary of State has requested further information on compensatory measures that could ensure overall coherence of the network of European sites should an adverse effect on site integrity be determined. In order to determine what would constitute viable compensatory measures, therefore, the nature and extent of the effect to be compensated needs to be defined. According to EC (2019) compensatory measures should aim to offset the negative impact of a plan or project on the species or habitats concerned.

4.6 In this case, it is understood that the compensation measures under investigation only need to focus on the predicted long-term temporary impact on the Sandbanks feature (constituting 418,440 m^2 of the NNSSR SAC) from the deployment of cable protection (as confirmed in the correspondence between the Applicant and the Secretary of State dated 8 October 2019 and 31 October 2019 (respectively)). Temporary habitat loss due to cable installation and repair would recover through natural processes following the works. The Environmental Statement and RIAA for Hornsea Three predict that full recovery of the habitat following installation would occur during and within a number of years following the construction phase (as the effect arises); as summarised in Tables 9.1 – 9.4 of the RIAA (APP-051). Hence the spatial distribution and species composition of the affected component communities would be maintained and would recover.

4.7 For the reasons set out above, therefore, the appraisal of compensation measures for subtidal habitat provided below focuses on the predicted 'long-term temporary' habitat loss.

The Wash and North Norfolk Coast SAC

4.8 The qualifying feature of The WNNC SAC for which further information has been sought is also the Annex I sandbank feature and the predicted sources of impact from the construction, operation, maintenance and decommissioning of Hornsea Three are as set out above for the NNSSR SAC.

The predicted long-term impacts (from cable protection) on the Annex I sandbank features of The WNNC SAC are summarised in

4.9 Table 4.2 and reflect the latest mitigation and design refinements (as detailed in Appendix 4 to Applicant's Response) for Hornsea Three.

Table 4.2: Summary of Hornsea Three predicted impacts on the Sandbanks feature of the WNNC SAC

Impact	Impact Quantification	Impact on SAC
WNNC SAC (designated area of 1,077,180,000 m^2)		
Long term temporary (operational phase) habitat loss due to cable protection	27,720 m^2 due to up to 6% of the cable length requiring rock protection in the SAC	The impact on the SAC as a whole equates to 0.0026% For the sub-features this would be: up to 0.00048% of Sublittoral Sand, 0.077% of Subtidal Coarse Sediment and 0.0036% of Subtidal Mixed Sediment

4.10 The RIAA concludes that an adverse effect on the integrity of the WNNC SAC would not arise due to Hornsea Three because of the limited scale of the impact on the designated feature, the mitigation and control measures put in place to ensure the potential worst case impacts are minimised throughout the pre-construction and construction phase, and the commitment to recover any remedial cable protection material within designated sites as part of the decommissioning of Hornsea Three.

4.11 In this case, as for the NNSSR SAC, it is understood that the compensation measures under investigation only need to focus on the long-term temporary loss of subtidal habitat, i.e. 27,720 m^2 in The WNNC SAC from the deployment of cable protection (as confirmed in the correspondence between the Applicant and the Secretary of State dated 8 October 2019 and 31 October 2019 (respectively)). Temporary habitat loss due to cable installation and repair would recover through natural processes following the works..

Flamborough and Filey Coast SPA

4.12 Predicted impacts on the kittiwake and, consequently, the seabird assemblage features of the FFC SPA relate to collision risk. The findings of the RIAA are summarised in Table 4.3 and reflect the latest project mitigation and design refinements as detailed in Appendix 4 to Applicant's Response.

Table 4.3: Summary of Hornsea Three predicted impacts on the kittiwake feature of the FFC SPA

Impact	Quantification of the effect
Project Collision Risk (at 40m above MSL) (Annex B to Appendix 4 of the Applicant's Response: Updated Ornithology Mitigation Scenario)	Project alone: 4 individuals
Project Collision Risk (at 40m above MSL) Based on the Examining Authorities requested parameters (Rule 17, 19th March Ref: EN010080)	Project alone: 7-9 individuals

Impact	Quantification of the effect
Project Collision Risk (at 40m above MSL) based on the assumed position of Natural England	Project alone: 65-73 individuals

4.13 The RIAA concludes that an adverse effect on integrity would not arise because the resulting predicted levels of alone or in-combination mortality would not be sufficient for the population to decline below the levels included in the FFC SPA citation for this species. Specifically, the RIAA notes that the Population Viability Analysis (PVA) modelling[17] predicted (without taking into account any density dependence which would almost certainly operate) that the population of kittiwake at FFC SPA would continue to increase in size. However, over the lifetime of Hornsea Three the resultant population size would be 2-5% (when factoring in latest mitigation commitments cited in Table 4.3) lower than the population that would occur without the predicted in-combination mortality; but would remain above the cited population size.

5. Compensatory Measures for Hornsea Three

Introduction

5.1 The preferred compensation measures for the predicted effects on subtidal sandbank habitats, should compensation be determined to be required, are discussed further (in Pages 15 to 22) in the following terms:

- 'Habitat improvement and species recovery' comprised of blue mussel bed restoration and biosecurity measures within The WNNC SAC.
- 'Habitat restoration' comprised of marine litter removal within and near to The WNNC SAC and measures to increase the recovery of future lost gear (within the EIFCA's district), focused on lost/abandoned fishing gear within the Annex I sandbank feature.

5.2 The Applicant is confident that the above measures would compensate for the maximum extent of Hornsea Three's adverse effect (should an adverse effect be determined) and are deliverable. However, further measures which could be adopted should initial establishment and management not succeed to the target extent have also been considered. These are eelgrass (*Zostera*) restoration in The WNNC SAC or debris removal in The WNNC SAC and/or litter/debris removal in the NNSSR SAC (see paragraph 5.50 *et seq*. and paragraph 5.60 *et seq*. below).

5.3 Together these measures comprise a package which all have relevance to the Annex I sandbanks feature (and sub-features) and are intended, collectively, to provide an appropriate level of compensation for the predicted impact on The WNNC and or NNSSR SACs.

5.4 The seabird colony management measures are relevant to the FFC SPA kittiwake and, by association, the FFC SPA seabird assemblage.

[17] Given the in-combination impacts are greater (and inclusive of) the Project alone impacts, PVA was only carried out at the in-combination scale.

5.5 The EC 2018 guidance advises that the following should be provided:

- A description of the compensatory measures and an explanation of how they will effectively compensate for the negative effects of Hornsea Three on the species and habitats affected, in light of the site's conservation objectives, and how they will ensure that the overall coherence of *Natura 2000* is protected.
- Demonstration of the technical feasibility of the measures in relation to their objectives.
- Demonstration of the legal and/or financial feasibility of the measures according to the timing required.
- Analysis of suitable locations and (if applicable) acquisition of the land (asset) to be used for the compensatory measures.
- Explanation of the timeframe in which the compensation measures are expected to achieve their objectives.
- A timetable for implementation and co-ordination with the schedule for the plan or project implementation.
- Specific monitoring and reporting schedules based on progress indicators according to the objectives of compensation measures.

5.6 These items are discussed in the following sections. How the measures would be secured and ensured is also important and is covered in Section 6. Furthermore, the Sandbanks Compensation Strategy (as presented at Appendix 2A) and the Kittiwake Compensation Strategy (as presented at Appendix 2B) provide greater detail on the delivery steps for these measures.

Habitat Measure 1: Blue mussel bed restoration and biosecurity

Description and feasibility

5.7 Blue mussel beds (*Mytilus edulis*) occur within the sandbank habitats of The WNNC SAC and are of high conservation value due to the diversity of species they support. As identified within the Supplementary Advice for The WNNC SAC[18], blue mussel beds may be found on areas of mixed mud, sand and pebbles throughout the site and have been previously identified within The Wash, and off the coasts of Norfolk and Lincolnshire (Jessop and Maxwell, 2011). A 2011 site survey identified blue mussel beds towards the south-east corner of The Wash (APEM, 2013). Where and when mussel beds do exist, they attract a distinct biological community and so should be considered an important component of the wider sandbank feature. 'Blue mussel beds on sediment' are also formally recognised as biogenic reefs (Holt *et al.*, 1998; Maddock, 2008[19]) under the EU Habitats Directive (European Commission, 2013[20]).

[18] https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK0017075&SiteName=&SiteNameDisplay=The+Wash+and+North+Norfolk+Coast+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=2

[19] Maddock, A. (ed.). 2008. UK Biodiversity Action Plan; Priority Habitat Descriptions. UK Biodiversity Action Plan, 94pp

[20] European Commission. 2013. Interpretation manual of European Union habitats. EUR 28.

5.8 Mussels are a key structuring component of the intertidal sand and gravel communities and they play an important role in the functioning of The Wash ecosystem. Silt, organic detritus and shell debris accumulate within the bed. In this way, blue mussel beds modify sedimentary habitats and provide a habitat for a diverse community of animals and plants; living on, within or under the bed (Buschbaum *et al*., 2009[21]; Holt *et al*., 1998[22]; Fariñas-Franco *et al*., 2014[23]). A range of age classes is an important indicator of mussel recruitment and growth, which supports birds and other wildlife which feed selectively on different sizes of mussels.[24] The mussel beds create a distinctive multi-layered framework that stabilises the sediments and can extend over several hectares (beds of up to 60 ha are known to occur within The Wash[25]).

5.9 The conservation objectives of the SAC include ensuring that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its 'qualifying features', by maintaining or restoring the structure and function (including typical species) of its qualifying natural habitats. The restoration of mussel beds would help in the recovery of the species composition of component communities of the sandbanks feature (Hab_Att_3.01).

5.10 Consultation with Natural England and the EIFCA has identified support for this measure. Conservation objectives for The WNNC SAC include restoring the extent of mussel beds to 500 ha. However, the current extent of mussel beds is only 464 ha and stocks are declining. Discussion with the EIFCA has established that in 2014 and 2016 efforts were made (by the EIFCA) to restore mussel beds within The Wash, however, the success of this is thought (by the EIFCA) to have been constrained by a number of factors including:

[21] Buschbaum, C., Dittmann, S., Hong, J.S., Hwang, I.S., Strasser, M., Thiel, M., Valdivia, N., Yoon, S.P. & Reise, K. 2009. Mytilid mussels: Global habitat engineers in coastal sediments. Helgoland Marine Research, 63: 47-58.
[22] Holt, T.J., Rees, E.I.S. & Seed, R. 1998. Biogenic Reefs (Volume IX). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. SAMS.
[23] Fariñas-Franco, J.M., Pearce, B., Porter, J., Harries, D., Mair, J.M., Woolmer, A.S. & Sanderson, W.G. 2014. Marine Strategy Framework Directive indicators for biogenic reefs formed by Modiolus modiolus, Mytilus edulis and Sabellaria spinulosa Part 1: Defining and validating the indicators. JNCC Report No. 523. JNCC Peterborough.
[24] Natural England, 2000. Wash and North Norfolk Coast European marine site English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994
[25] R. Jessop *Pers comms* January 2020

- parasitic infestation;
- environmental conditions; and
- ability to deliver restoration at a substantive scale.

5.11 It is understood that with the appropriate method of restoration (such as bringing in new mussel seed rather than relying on recruitment from adjacent mussel beds), locations that have environmental conditions that are more likely to be conducive to supporting strong and healthy beds can be selected, meaning that mussel restoration within The Wash is considered (by the EIFCA) to represent a viable proposition. A number of options exist in terms of bringing in mussel seed; use of suspected collectors, hatchery production or harvesting from wild beds (such as Siloth, Beckford Flats, Morecambe Bay, Caernarfon Bay, South Wales and The Wash[26]).

5.12 With regard to biosecurity measures, if monitoring identified a threat, appropriate measures (targeted at the reduction / removal of that threat) would be undertaken.

Ability to deliver sufficient scale

5.13 According to the JNCC[27], sandbanks which are slightly covered by sea water all the time can be categorised into four main sub-types:

- gravelly and clean sands;
- muddy sands;
- eelgrass *Zostera* marina beds;
- maerl beds (composed of free-living *Corallinaceae*).

5.14 The latter two sub-types are particularly distinctive and are of high conservation value because of the diversity of species they may support and their general scarcity in UK waters. For Hornsea Three the affected sandbanks are not particularly distinctive, whilst *Mytilus* (like *Zostera* and maerl) clearly has higher distinctiveness.

5.15 Individual established mussel beds within The Wash are known to vary in size from 1.5 ha to 60 ha. The predicted long-term impacts on sandbank habitats from Hornsea Three within The WNNC SAC are 2.77 ha and within the NNSSR SAC are 41.8 ha (assuming worst case assumptions on cable protection). Hence, spatially, through the establishment and management of a 44.57 ha blue mussel bed a 1:1 replacement ratio could be achieved; but the high biodiversity value of these mussel beds is relevant, and this measure would not be delivered in isolation (see Habitat Measure 2, paragraph 5.29 *et seq*.).

[26] Suarel. C., Gascoigne. J., Kaiser. M.J. 2004. The Ecology of Seed Mussel Beds. Literature Review.
[27] https://sac.jncc.gov.uk/habitat/h1110/

Location

5.16 As described above, blue mussel beds are known to occur in the Wash and off the North Norfolk coast on areas of mixed mud, sand and pebbles throughout the designated site[28]. Such beds do not occur within the NNSSR SAC (conditions are not suitable) and therefore this measure can only be delivered within The WNNC SAC. Given that the mussel bed features are linked to Annex I sandbank habitat, it is considered that restoration of this feature will enhance the quality of designated sandbank habitat at a network level and therefore, is appropriate compensation for the long term temporary impacts within the NNSSR SAC as well (noting the relevant principles of the EU guidance as summarised in Section 3.1.3).

5.17 From discussions with the EIFCA it is understood that a number of key criteria are applicable in selecting suitable sites for restoration work, including, level of shelter from waves (important in ensuring resilience), level of water cover and flow throughout the tidal cycle (important for feeding opportunity and supply of food source), existing sedimentary conditions (suitable substrate type for establishment) and existing pressures (avoidance of existing cockle and shrimp fishing grounds would be necessary).

5.18 Furthermore, slipper limpets are an invasive non-native species (INNS) that are known to be widespread throughout The Wash in low densities. The EIFCA have highlighted that a potential means to help manage this INNS threat could be to use the slipper limpet beds as a location for the mussel restoration work (the establishment of a mussel bed would have a smothering effect on the slipper limpets) and would serve as a form of biosecurity.

5.19 In practice, site identification would be undertaken through engagement with delivery partners (namely the EIFCA) and Natural England, desk-based studies and site visits to determine appropriate sites for deployment within The WNNC SAC.

Delivery and acceptability

Delivery

5.20 The process for mussel bed restoration would be developed with the proposed delivery partner (namely, the EIFCA). Experience from existing EIFCA restoration trials and other relevant studies that have been undertaken on seed mussels (from which beds can be developed) in the UK[29] and further afield[30] would be used to inform appropriate methods for delivery and ensure that possible threats to restoration are understood and appropriately managed. A technique deployed in the Menai Straights for mussel bed development (for harvesting purposes) comprises:

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28 https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK0017075&SiteName=&SiteNameDisplay=The+Wash+and+North+Norfolk+Coast+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=2

29 C. Saurel, J. Gascoigne, M.J. Kaiser. 2004. The Ecology of Seed Mussel Beds

30 N, Dankers, A.G. Brinkman., A. Meijboom., E. Dijkman. 2001. Hydrobiologica. 465. 21-30. Recovery of intertidal mussel beds in the Waddensea.
M. Wilcox A. Jeffs. 2018. Journal of the Society for Ecological Restoration. Impacts of sea star predation on mussel bed restoration https://doi.org/10.1111/rec.12831

- The collection of seed beds from elsewhere (e.g. Siloth, Beckford Flats, Morecambe Bay, Caernarfon Bay).
- The re-laying of these seeds on the muddy substrata in the Menai Strait for on-growing first in the intertidal zone for c. 18 months, until they grow large enough to reach a partial predation refuge.
- The relocation of the mussels into suitable lays for a final period of rapid growth.

5.21 Saurel *et al*. (2004) note that evidence exists for other methods of generating seed mussel (such as developing them on rope collectors) if harvesting from existing beds is not deemed to be acceptable.

5.22 The delivery of this measure would require support from a local vessel (for the relaying of mussel seed). It is also understood that licences for the works are likely to be required and these would be obtained by or in conjunction with the delivery body (the EIFCA) who have direct experience of this process.

5.23 Once suitable locations are identified and seed mussels translocated to these sites, ongoing management (by the EIFCA) would be undertaken to help reduce the risk of the mussel bed failing to develop. This would include monitoring for invasive species. Should threats to biosecurity be identified (for example an infestation of starfish) action would be taken to clear this.

5.24 A monitoring package would be designed with the delivery partner in consultation with the Environment Engagement Group. Monitoring would focus on the establishment of the mussel bed and the expected changes to the associated benthic communities in the vicinity over time. Discussions with EIFCA have indicated that they would seek to develop suitably frequent monitoring, supported by Hornsea Three, during the establishment phase (within the first 2 – 3 years) following which monitoring would occur on an annual basis. If necessary (and informed by the monitoring), a commitment to adaptive management could be made to ensure that re-seeding of the bed was undertaken or that measures to help reduce other pressures were implemented.

5.25 Based on the assumptions set out above in relation to the stages necessary to implement the measure, it is considered that it would be feasible to lay the mussel bed(s) prior to the commencement of the export cable construction works (i.e., in advance of any impact occurred on a designated sandbank habitat). The timescale associated with individual components of the measure are discussed further in Appendix 2A, and a formal delivery timescale would be agreed within the Sandbank Compensation Plan.

5.26 The costs associated with the delivery of this measure are considered to be viable in the context of the Hornsea Three Project.

Acceptability

5.27 In addition to being a feature of The WNNC SAC sandbank habitat, blue mussel beds are a UK Biodiversity Action Plan (BAP) Priority Habitat[31] and on the OSPAR List of Threatened and/or Declining Species and Habitats (Region II – Greater North Sea, and Region III – Celtic Sea). Given their link to the habitat for which compensation is being considered (subtidal sandbanks), their

[31] BAP habitats are now Habitats of Principal Importance/Priority Habitats

important ecological function, and the recognised importance of blue mussel beds at both a UK and European level, efforts to restore this feature as part of a compensation package would clearly provide 'habitat improvement'. This measure was positively received by Natural England at the workshop of 12 December 2019, who expressed an interest in exploring this measure further, and is supported in-principle by the EIFCA.

5.28 Moreover, ecologically blue mussel beds have a greater ability to support diversity and richness (distinctiveness) at local and regional scales than subtidal sandbanks *per se*[32]. As set out above, the JNCC acknowledge the high conservation value of mussel beds because of the diversity of species they support. Hence, based on a combined long-term temporary loss of 44.57 ha of subtidal sandbank from the SACs, if a 44.57 ha mussel bed was to be established within The Wash, 'ecologically' it would provide compensation at a ratio of greater than 1:1.

Habitat Measure 2: Litter removal and measures to increase the recovery of lost gear

Description and feasibility

5.29 The presence of marine litter, especially ghost fishing gear (lost or abandoned commercial fishing gear) is a recognised and well documented issue within our seas. Throughout the North Sea fishermen deploy thousands of crab pots and various specialised fishing nets every year. Inevitably this leads to the loss of valuable fishing gear due to storms, snagging and breakage which, once lost, is expensive and difficult to recover. Lost or abandoned shellfish pots and non-degradable nets account for about a third of marine litter found in European Seas and are estimated to total 11,000 tons/year. The European Commission has reported that it believes that up to 20% of fishing gear is lost at sea annually.

5.30 Marine litter such as lost and abandoned fishing gear has the potential to:

- "ghost fish" - resulting in the unintentional catch of marine life;
- damage habitats through abrasion;
- cause injury or death to marine life from entanglement; and
- cause navigation and safety hazards to fishing due to snagging of gear, potentially resulting in further losses.

5.31 Removal of such material would benefit the 'structure and function' attribute of the sandbanks feature, through reducing any direct abrasion impacts and also improving the ecological conditions for those species that rely on its associated communities. In this context the removal of marine litter would be both a direct and indirect means to restore damage from anthropogenic activities. Such action is in line with Marine Strategy Framework Directive 2008/56/EC (D10) and marine litter is also specified as an issue within the East Inshore and Offshore Marine Plans.

[32] ABPmer (2019). *Marine Net Gain White Paper: Moving towards a practical framework and metric for the marine environment.* July, 2019.

5.32 If this remediation activity was supported by an awareness campaign that targeted the introduction of measures to facilitate the rapid recovery of any lost gear in the future, the contribution it would make to restoration of the SACs would be even greater and further harm could be avoided or limited. This would contribute to the restore objective. It is understood that removal of lost gear and litter is not part of the EIFCA's management plans and therefore, such measures would provide additionality.

5.33 It is proposed that the delivery of this measure would be a single removal campaign undertaken in partnership with the EIFCA, the local fishing industry and potentially other conservation organisations involved in ocean clear-up campaigns.

5.34 The removal of marine litter could be readily achieved and evidenced once such litter was identified through industry consultation and site based geophysical surveys. Removal would be undertaken using appropriately equipped vessels and standard extraction techniques.

5.35 Identification of suitable measures to ensure rapid recovery of lost gear would be developed with the EIFCA, these may comprise options such as voluntary reporting and provision of technical solutions (such as transponders[33]) that can be fixed to static gear.

Location

5.36 Marine litter could be identified using high resolution geophysical surveys preceded by a desk top study that screens plausible removal/remediation candidate areas within the SACs, based on historic and current activity. Engagement with the EIFCA and local fishing industry would be undertaken to help with the identification of hotspots for lost gear. It is not possible (at this stage) to precisely establish the volume of marine litter that could be removed, therefore, whilst the primary target for such removals would be the SACs themselves, removal could be extended to subtidal sandbanks (i.e. the qualifying feature) outside of the SACs.

5.37 Measures relating to the improvement in rapid identification and recovery of lost gear would be applied to local fishing fleets known to operate static gear within the designated sites within the EIFCA's District. However, such fleets would not restrict their practice to within the designated sites and, therefore, this component of the measure would have much a wider application.

Delivery and acceptability

5.38 As set out above, the removal of litter would be undertaken by a marine vessel, potentially a survey vessel or local fishing vessel.

5.39 The removal of litter from the seafloor is considered to represent a valuable measure by the EIFCA and aligns with the "restore" objective for the extent and distribution and structure and function attributes of the SACs.

[33] Such as https://www.ncl.ac.uk/press/articles/archive/2019/04/nettag/

5.40 The Applicant could readily evidence the removal of material from the SACs (and if necessary surrounding sandbank habitats) as the material would be brought to shore. The proposed Compensation Plan to be produced for this measure (see Section 6) would need to set out measures to re-purpose or responsibly dispose of any removed material.

5.41 It is also proposed that awareness raising events with the fisheries industry (undertaken in partnership with the EIFCA) would take place to support the implementation of a scheme to reduce the on-going nature of this threat, through the rapid identification and retrieval (by other parties i.e. the fisheries industry) of lost gear (which may be achieved through a voluntary reporting mechanism or technical solution that can be fixed to static gear). This process would involve working (through the EIFCA) with the local fishing industry to develop an education and an uptake programme around the identified solution for local fishermen (see Appendix 2A for further details). Ensuring that the benefits of rapid gear recovery were well communicated would be key to maximising uptake.

5.42 Monitoring of removal of marine litter would focus on the effectiveness of the removal work rather than any specific recovery of a feature (as any change would not be able to be easily attributed to the removal of an item of fishing gear). Therefore, the monitoring for this measure would focus on:

- evidence of removed litter;
- take up of any solution identified to improve recovery of lost fishing gear; and
- reporting of lost fishing gear.

5.43 As the habitats to be targeted have recently been determined to be in unfavourable condition by the SNCB, a programme that provides understanding of the level (and consequence) of anthropogenic activity and helps to improve the quality of these habitats (where feasible) would be beneficial. The potential exists for such works (including the pre and post-surveys) to be delivered in partnership with the SNCB.

5.44 The removal works could be initiated prior to the construction of Hornsea Three and prior to adverse effects arising. A programme would need to be agreed, following an engagement phase that would identify areas for the removal works. The implementation of measures to improve the recovery process of lost gear could also be delivered prior to the construction works commencing.

5.45 Remedial works would provide an immediate improvement in terms of physical attributes and biological recovery, and the measures to improve recovery process would help ensure that the threat from this pressure on the designated features of the SAC(s) was reduced over the long term.

5.46 The costs associated with this measure are considered to be viable in the context of the Hornsea Three Project.

Habitat Measures 1 and 2: Area of Habitat Improvement and Restoration and Species Recovery

5.47 It is believed that the total area to be improved and/or remediated 'spatially' would need to equate to the area of impact, but that this would be sufficient in this case (i.e. the compensation to impact ratio could be 1:1). That is because the adverse effect relates to placing material on the seabed and the compensation would involve enhancing the ecological function of, or removing foreign material from, the seabed. Furthermore:

- Location – the compensation would be provided in or adjacent to the designated sites.
- Habitat type (and conditions) – the qualifying habitats would be replicated.
- The habitat created would be sustainable.
- Timing – the works could be undertaken in parallel with (or indeed, before) the offshore construction phase.
- Uncertainty – there would be a high level of confidence around the likelihood of success.

5.48 However, because ecologically blue mussel beds have been found to support more diversity and richness at local and regional scales than some sub-features of the Annex I sandbank feature, 'ecologically' it would provide compensation at a ratio of over 1:1. The removal of marine litter in addition complements this by targeting a different pressure to sandbank habitat, thereby providing full confidence that the overall scale of compensation delivered will appropriately offset the worst case predicted impact.

5.49 To give additional confidence that maintenance of the overall coherence of the network can be ensured, should initial establishment and management of the above measures not succeed to the targeted extent, contingency measures have also been considered and could be implemented if necessary (see paragraph 5.50 *et seq*. and paragraph 5.60 *et seq*. below).

Contingency Habitat Measure 1: Eelgrass Restoration

Description and feasibility

5.50 Eelgrass *Zostera spp.* beds are of high conservation value due to the diversity of species it supports and its scarcity in UK waters. They are (when in bed form) a UK Biodiversity Action Plan (BAP) Priority Habitat and are listed as a vulnerable sub feature of Annex I sandbanks by the JNCC. Whilst eelgrass is not listed as a sub-feature of The WNNC SAC, it is understood to occur at a number of locations within the site[34]. Restoring eelgrass in The WNNC SAC and extending areas where there is existing eelgrass, would enhance the biodiversity of the site. As much as 92% of the UK's eelgrass has been lost, and its restoration has significant biodiversity benefits through, for example, the provision of fish nursery grounds and carbon traps. 50 species of fish live in or visit UK eelgrass, and it supports up to 30 times more animals than nearby habitats (Project Seagrass, 2018).

5.51 The conservation objectives of the SAC include ensuring that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its 'qualifying features', by maintaining or restoring the structure and function (including typical species) of its qualifying natural habitats. Eelgrass provides a similar ecosystem function to subtidal sandbanks (e.g. as a fisheries nursery) in terms of its contribution to the Nature 2000 network. Hence the restoration of eelgrass beds would support typical species of the Subtidal Sandbanks feature and help in the recovery of the species composition of component communities (Hab_Att_3.01).

[34] https://www.eastern-ifca.gov.uk/marine-protected-areas-byelaw-2016-2/

5.52 There are known records of eelgrass within The Wash and North Norfolk Coast[1] and, for example; https://www.eastern-ifca.gov.uk/marine-protected-areas-byelaw-2016-2/[2], provides details of where fishing is restricted due to the presence of eelgrass. Natural England has also provided notice that eelgrass and seagrass beds in the WNNC SAC at Wells-next-the-sea are at risk[3]. Potential areas for restoration sites are, therefore, able to be identified.

5.53 Recent UK projects, including a Natural England seagrass project on the South Coast and Project Seagrass in Wales (2.5ha off Porthdinllaen), would inform the methodology adopted.

5.54 Although it is understood that eelgrass restoration is not a management target for Natural England within The WNNC SAC, discussions with the Environment Agency have identified that they would strongly support such measures at suitable locations on the UK coast. Therefore, it is proposed that any such measure is developed in conjunction with the Environment Agency or Natural England.

5.55 As identified in paragraph 5.47 above, the implementation of this measure would be based on the success of the principal measures (blue mussel restoration and litter removal); that is, it represents an adaptive management proposal to be implemented if necessary. Given the circumstances under which such a measure may be developed, its required scale would be determined at the time. It is material to note that it would only ever be a supplementary measure to be delivered alongside either Habitat Measure 1 or 2 (or both). Its high biodiversity value should also be an important factor when considering scale.

Delivery and location

5.56 It would be necessary to engage with delivery partners (such as the Environment Agency) to determine an appropriate site and methodology for eelgrass establishment within The WNNC SAC. This would be followed by further desk-based work associated with the acquisition of any necessary licences and appointment of contractors.

5.57 Following preparatory works, field-based implementation of the measure would take place, with a period of monitoring and reporting (to be set out and agreed within the Compensation Plan) to be implemented thereafter.

5.58 Given the proposed nature of this measure (as an adaptive response to be implemented as necessary) its timing has not been defined, however, it would be deployed in response to monitoring of the primary measures, as detailed through the relevant Compensation Plan.

5.59 The costs associated with this measure are considered to be viable in the context of the Hornsea Three Project.

[1] Wash and North Norfolk Coast European Marine Site. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994

[2] http://www.eastern-ifca.gov.uk/wp-content/uploads/2016/05/Areas-SH-EH-SF-BP-and-BC-on-the-North-Norfolk-Coast.pdf

[3] http://www.eastern-ifca.gov.uk/wp-content/uploads/2018/07/2018_11_07-NE-advice-on-EIFCA-shrimp-trawl-HRA-WNNC-Full-version.pdf and http://www.norfolkcoastaonb.org.uk/mediaps/pdfuploads/pd004789.pdf

Contingency Habitat Measure 2: Removal of litter/debris

Description and feasibility

5.60 The removal of existing anthropogenic pressure in the form of litter/debris would be a direct means to improve habitat quality within the affected SACs. It is expected that any litter to be removed would predominantly constitute abandoned or lost fishing gear, and that any debris to be removed would predominantly constitute abandoned infrastructure or dropped objects. The exact nature of the litter/debris to be removed would be subject to technical feasibility, HSE, legal and industry acceptability (for example, oil and gas platforms, installed subsea infrastructure and pipelines are excluded) and developed further in the Sandbanks Compensation Plan.

5.61 As nearshore litter is addressed as part of the primary package, nearshore areas would be searched for debris only as part of this measure. Offshore this measure would cover marine litter and/or debris as reasonable and proportionate.

5.62 Removal would benefit the Annex I sandbanks feature, with natural sediment composition and associated benthic communities recovering quickly within the areas from which debris/litter was removed. Hence the removal of litter/debris would support the restoration of the SACs in general and directly counteract the impact from proposed placement of rock protection within the SACs. Such action is in line with Marine Strategy Framework Directive 2008/56/EC (D10).

5.63 As identified in Section 2, sandbank features (in The WNNC and NNSSR SACs) have a restore objective given the perceived level of degradation from existing anthropogenic activity within the SAC. In this case, therefore, the objective of this compensation measure would be to improve the quality/contribution of the features/sub-features that Hornsea Three could affect. In this context, any restoration or improvement work would need to target those areas where there has been historic activity that has degraded the sandbanks habitat.

5.64 In terms of the features' attributes, its 'extent and distribution' is affected by the presence of foreign material from anthropogenic activity; 'structure and function' is affected by changes in fine scale topography, sedimentary composition and, consequently, characteristic communities which occurs as a result of disturbance from (for example) demersal fishing, and other anthropogenic activity; and its 'supporting processes' are affected by effects on hydrodynamic processes and water quality from the presence of artificial material and or ongoing anthropogenic activity. These effects would be removed where they are associated with material that can be removed. It is noted that once material was identified, a detailed evaluation of the liabilities and health and safety constraints would be need to take place to confirm the feasibility of any removal work.

Location

5.65 The location of any marine litter/debris removal work would be informed through discussions with relevant offshore industry groups, the MMO, SNCBs and The Crown Estate to identify any material within the designated (or adjacent) sandbank habitats that can be readily removed without constraint (e.g. technical feasibility, HSE considerations, ongoing ownership liability issues).

5.66 High-resolution geophysical surveys would be preceded by a desk top study that screens plausible removal/remediation candidate areas within the SACs based on historic and current activity.

5.67 Locations of interest would then need to undergo a process of characterisation to establish the reason and context for the change (e.g. the presence of litter/debris) and to inform a process of risk assessment that would consider the implications of removal or remediation.

Delivery and acceptability

5.68 Natural England expressed an interest in further exploring the removal of abandoned infrastructure and/or dropped objects from the seafloor as a compensation measure. This measure aligns with the "restore" objective for the extent and distribution and structure and function attributes of the SACs.

5.69 As the habitats to be targeted have recently been determined to be in unfavourable condition by the SNCB, it is envisaged that a programme that provides understanding of the level (and consequence) of anthropogenic activity and helps to improve the quality of these habitats (where feasible) would be beneficial. The potential, therefore, exists for such works (including the pre and post-surveys) to be delivered in partnership with the SNCB.

5.70 Should this measure need to be progressed, this is likely to comprise a desk-based screening exercise of abandoned infrastructure and/or dropped objects, and consultation with relevant sectors and regulators. If any material within the designated (or adjacent) sandbank habitats that can be readily removed without constraint (e.g. technical feasibility, ongoing ownership liability and health and safety issues) then a targeted ground-truthing campaign of area up to 20ha identified as having high potential for litter/debris would be undertaken. The ground-truthing work would seek to identify (using high resolution and ROV techniques) the nature and precise location of the litter/debris and licences would be sought from the MMO if necessary, for the removal and disposal activity. The litter/debris found within this area would be removed by a suitable contractor. This measure would not consider removal of any oil and gas platforms, installed subsea infrastructure and pipelines.

5.71 Decommissioning is an established process within the North Sea, and from consultation with the JNCC it is understood that such activity is likely to increase within the southern North Sea in the coming years. Furthermore, Hornsea Three has recently provided evidence (REP6-018: Rock Protection Decommissioning Methods) in support of the decommissioning of rock protection. Practical options exist to facilitate such measures.

5.72 Given the stage of development of this measure (as a contingency response to be implemented as necessary) its timing has not been defined, however, it would be deployed in response to monitoring of the primary measures, as detailed through the relevant Compensation Plans.

5.73 Hornsea Three could readily evidence the removal of material from the SACs as the material would be brought to shore. The proposed Compensation Plan for this measure (see paragraph 6.6) would need to set out measures to re-purpose or responsibly dispose of any removed material.

5.74 Remedial works associated with the removal of marine debris would provide an immediate improvement in terms of physical attributes and relatively rapidly biological recovery. The return of the communities to the area within which removal works have taken place would be expected to be in line with the predictions made within the ES and RIAA (as summarised in Tables 9.1 – 9.4 of the RIAA; APP-051) for habitat disturbance following construction activity (i.e. full recovery within a number of years); this would be monitored.

5.75 The costs associated with this measure are considered to be viable in the context of the Hornsea Three Project.

Seabird Measure 1: Predator control at kittiwake breeding colonies on UK islands

Background

5.76 The eradication of invasive mammalian predators has been identified as a potential compensation measure for kittiwake and most other seabirds by Furness *et al*. (2013), with islands being identified as the most beneficial locations due to their physical isolation which may limit re-infestation (Stanbury *et al.* 2019). Whilst it cannot be delivered at the FFC SPA, it represents what Hornsea Three consider to be the most viable (deliverable, proportionate and effective) form of compensation for the predicted impacts on kittiwake.

5.77 Whilst records of documented kittiwake predation are uncommon, this is likely due to the remote locations of colonies being infrequently monitored, and due to the nesting habitat of the species limiting access from ground predators to some nests. Despite this, records (including photographic evidence) of invasive mammalian predators preying on kittiwakes exist (Walsh *et al.* 1995, Thompson *et al.* 1999, Mavor *et al.* 2002, Furness *et al*. 2013) although it is apparent that other species of seabird (such as burrow nesting species) are more vulnerable to ground predators.

5.78 Walsh *et al.* (1995) reported that brown rat predation at the Isles of Scilly archipelago was the cause of reduced kittiwake productivity whist also suggesting that the 1994 breeding season was not the only year to suffer from depredation. Furthermore, Thompson *et al*. (1999) reported that kittiwake depredation by cats was the cause of very low productivity at the Isles of Scilly. The report also documents that the productivity at most monitored colonies around the coasts of UK and Ireland during that breeding season were close to or above average, suggesting that predation by invasive mammalian predators was a determining factor for that colony.

5.79 Following the eradication of rats from Gugh and St. Agnes islands after the 2013 breeding season, kittiwake numbers were reported by the Seabird Monitoring & Research Project Isles of Scilly (2017) to have increased, with numbers almost doubling at the St. Agnes colony and the reinstatement of breeding kittiwake at Gugh following a 5-year absence.

5.80 The Joint Nature Conservation Committee (JNCC) report on breeding seabird numbers (Mavor *et al.* 2002) provides account of productivity at key colonies around the UK and Ireland. For St Abb's Head (Scotland) the report documents that kittiwake productivity at the colony was halved during the 2001 breeding season when compared to the previous breeding season, likely as a result of American mink predation on kittiwake chicks.

5.81 Evidence of predation events for many UK breeding seabirds is sparse as it often requires direct observation of the predation event, or evidence of predation to be detectable (i.e. shell fragments). This is even true of species known to be particularly vulnerable to invasive mammalian predators such as puffin and razorbill, with a relatively low number of records documenting predation cases (Furness *et al*. 2013). Whilst this does not suggest that predation of seabirds is a rare event, it supports the argument that predation detection and documentation is limited. Despite this, the evidence presented above for kittiwake does establish a link between invasive mammalian predation and reduced productivity where those invasive species exist.

5.82 By eradicating invasive mammalian predators from a kittiwake breeding colony or colonies, the pathway of predation pressure on productivity is thus removed. Species more vulnerable to predation by ground predators than kittiwake are likely to benefit to a higher degree from invasive mammalian predator eradication. For example, post-eradication monitoring at the Isles of Scilly reported a significant increase in the number of breeding Manx shearwater (Seabird Monitoring & Research Project Isles of Scilly 2017). Similarly, Nordstorm *et al*. (2008) reported dramatic increases in breeding seabird densities on islands where American mink had been eradicated. There is no evidence however that increases in other breeding seabird populations would out-compete kittiwake populations as a result of predator eradication. Further information on the success of invasive species eradication on islands can be found on the Database of Island Invasive Species Eradications (http://diise.islandconservation.org/) which hosts data from a large number of previous eradication projects around the globe. Supplementary benefits to other qualifying bird species would further increase the coherence of the UK SPA network.

Description, feasibility and acceptability

5.83 The removal of mammalian predators such as rodents is increasingly being seen as a key conservation tool, with popularity rising as efficiency of eradication increases (Jones *et al.* 2016). Multiple islands around the UK have successfully eradicated mammalian predators and demonstrated a subsequent benefit to breeding seabirds (Furness *et al.*, 2013). Furthermore, due to the increase in popularity of invasive species eradication on islands around the world (Jones *et al*. 2016), well documented methodologies are readily available; a list of global eradication programs can be found on the Database of Island Invasive Species Eradications. Examples of mammalian predator eradication in the UK include the Shiant Isles Seabird Recovery Project 2018, St Agnes & Gugh in 2016, Canna in 2006 and Lundy in 2002. The key species targeted by these eradication projects were black and brown rat, with both species being a known factor in contributing towards a reduction in productivity when present at seabird colonies where kittiwake are present.

5.84 In high level terms, delivering this measure would comprise the identification of a suitable location(s) for the programme, implementation of the eradication programme, monitoring to confirm success of measure, and implementation of adaptive management if and when required.

5.85 A suitable location for invasive predator eradication would comprise an uninhabited island where breeding kittiwake and an eradicable kittiwake predator are present. There are several candidate islands which fit these criteria in the UK (Thomas *et al.* 2017) and the methodology for locating a preferred site(s) would be informed by a number of criteria, including:

- Presence of breeding kittiwake;
- Presence of invasive mammalian predator;
- Absence of current or planned offshore wind development;
- Island designation status;
- Great skua SPA proximity;
- Kittiwake prey resource constraints; and
- Wider seabird assemblage.

5.86 These criteria, and how they would be applied is further explored in the accompanying Kittiwake Compensation Strategy (see Appendix 2B).

5.87 Initial guidance provided by the Royal Society for the Protection of Birds (RSPB), given the challenges associated with influencing adverse effects on productivity due to climate change (as shown in the description of work completed by Sadykova *et al.* (2019)), has recommended that compensation focuses on addressing the declining kittiwake populations in other UK regions away from the FFC SPA. Scotland has the majority of kittiwake colonies but has also endured some of the most significant population declines, particularly around Shetland (Mitchell *et al.* 2004). Welsh colonies and those within the wider Irish Sea region have endured less severe population declines (Mitchell *et al.* 2004).

5.88 In order to deliver compensation measures which would be additional to current management of the National Site Network, the focus would be to identify islands for eradication adjacent to SPAs, in order to enhance the integrity of the SPA network for kittiwake[35]. This measure is expected to lead to an increase in kittiwake productivity, and other breeding seabird species at the island.

5.89 This increase in productivity following predator eradication would compensate for the predicted population effects associated with in-combination offshore wind farm collision risks due to the predation pressure posed by invasive mammalian predators at island locations. This measure would relieve pressure on the kittiwake population in the biogeographic region and assist distressed colonies. Furthermore, other seabird species (such as Manx shearwater and puffin) are extremely vulnerable to mammalian predation due to their easily accessible nesting locations. It is, therefore, highly likely that the eradication of mammalian predators at an island colony for multiple seabird species would have significant benefits in productivity.

Delivery, location, timescale and scalability

5.90 Based on the evidence presented above, it is proposed that the Applicant would carry out (through delivery partners) an eradication campaign for an island or islands in proximity to an existing SPA which hosts a breeding kittiwake colony as a compensatory measure for in-combination impacts associated with Hornsea Three. While the final location(s) and, therefore, scale of this measure would be agreed post-ground truthing, a cap of up to three islands with a total, in combination, area of approximately 500ha is considered the extent of what would be implemented. This would enable the compensation to be scaled both in lieu of the kittiwake colony sizes on any given island, but also, and importantly, to reflect the scale of impact as determined by the Secretary of State (noting the range presented in Table 4.3).

5.91 The measure would be implemented in a multistage process which can be summarised as follows (full details are presented within the Kittiwake Compensation Strategy at Appendix 2B to the Applicant's Response):

- Island Screening;
- Island ground-truthing;
- Implementation of eradication programme;
- Monitoring.

[35] Whilst it is not an objective to secure future designation of the site following implementation of the measures (as this would not be in the gift of Hornsea Three), data would be provided to help support this process if requested by the SNCB.

5.92 The identification of suitable location(s) for this measure would be informed by an extensive screening exercise (details of which are summarised above and presented in detail in Appendix 2B to the Applicant's Response). the Applicant has undertaken an initial site selection process and feasibility assessment of suitable UK islands (to help demonstrate the viability of this measure) based on the proposed methodology. The outputs are presented below in Table 5.1.

Table 5.1: Shortlist of Potential Islands

Site code36	***Region***	***Country***	***Size (ha)***	***Kittiwake population (AON)37***	***Key additional species present***
A	Small Isles	Scotland	523	14 (2001)	Puffin, guillemot, razorbill
B	Northern Ireland	Northern Ireland	5	314 (2018)	Guillemot, razorbill
C	Outer Hebrides	Scotland	15	305 (2005)	Puffin, guillemot, razorbill
D	Outer Hebrides	Scotland	Unknown	170 (2002)	Puffin, guillemot, razorbill
E	Wales	Wales	7	243 (2018)	Puffin, guillemot, razorbill
F	Inner Hebrides	Scotland	Unknown	21 (1987)	Razorbill
G	Northern Ireland	Northern Ireland	Unknown	568 (2000)	Guillemot, razorbill
H	Northern Ireland	Northern Ireland	Unknown	0-170 (2002 – 2000)	Shag, herring gull

5.93 If taken forward, the screening stage of this compensation measure would produce similar (but more comprehensive) outputs to that shown above. The shortlist of islands from the screening would form the foundation of discussions with stakeholders through to the next stage of the measure (namely, island ground truthing).

5.94 Ground-truthing of relevant island(s) would be undertaken to confirm suitability (likelihood of success) of delivering the eradication programme. This would be followed by the implementation of the eradication programme.

5.95 The approach taken to the delivery of this measure (predator eradication) would be in line with the UK Rodent Eradication Best Practice Toolkit (2018), with the additional consideration of location specific issues.

[36] Due to the sensitivity surrounding island names, site codes have been used.
[37] Apparently Occupied Nests. Based on JNCC SMP data with most recent count year in parenthesis.

5.96 The RSPB have expressed an interest in being a delivery partner for this measure and has gained experience from the contractor who led the Shiants eradications.

5.97 The RSPB would prefer that a measure such as this was tied to a biosecurity commitment (see Seabird Measure 2 below). This would limit the possibility of re-infestation.

Such a measure could be delivered relatively quickly (over the course of 6 – 12 months, depending on the population of target species and size of island) and, from the point which it is undertaken, be effective in the following breeding season. Hence this measure could be implemented prior to the predicted project impact (collision with operational turbines) arising.

Monitoring

5.98 Monitoring would be necessary to establish eradication of the targeted predator species and evidence any changes to kittiwake productivity. Monitoring would also be used to inform adaptive management measures if deemed necessary, and build the evidence base on predator eradication and seabird assemblage response more broadly. Further information on the monitoring which would be undertaken in association with the eradication proposal is provided in the Kittiwake Compensation Strategy document (see Appendix 2B to the Applicant's Response).

Seabird Measure 2: Enhanced biosecurity at kittiwake breeding colonies on UK islands

Description, feasibility and acceptability

5.99 Invasive mammalian predators, such as rats and American mink, are known to predate kittiwake eggs and chicks with potential impacts on colony productivity (Furness *et al*. 2013). The introduction or reintroduction of any invasive mammalian predator at a breeding colony could therefore lead to an adverse effect on kittiwake productivity.

5.100 The RSPB are currently managing a EU Biosecurity for LIFE fund intended to prevent the arrival of alien invasive vertebrate predator species on islands that support breeding colonies of seabirds.

5.101 The Applicant could contribute to a similar fund for biosecurity management at UK island kittiwake breeding colonies which are not designated as SPAs (and which do not overlap with existing RSPB management). The RSPB have identified biosecurity as a priority for seabird conservation and the existing measures taken under the Biosecurity for LIFE fund do not reduce predation risks to seabirds which are not located within SPAs.

5.102 This measure would remove a known pressure on kittiwake populations. It would provide compensation for the potential effects of collision on the population, in association with predator control, and should be linked (in part) to the location(s) identified for predator eradication.

Delivery, timescale, scalability and monitoring

5.103 The Applicant could contribute to a fund, proposed to be managed by the RSPB, to prevent the arrival of invasive mammalian predator species at breeding kittiwake colonies on UK islands which are not designated as SPAs. In this case it is proposed that enhanced biosecurity is provided on the island location to be targeted for predator eradication through Seabird Measure 1.

5.104 The fund could be used to purchase equipment such as rodent proof containers, traps and bait, and for biosecurity training, staff positions and public education (details not yet discussed or agreed).

5.105 It is proposed that the RSPB deliver the fund as they have the relevant experience, potentially in partnership with local NGOs.

5.106 Such a measure could be delivered relatively quickly and, from the point which it is undertaken, be effective in the next breeding season.

5.107 This measure could be scaled as required through the contribution of further funds.

5.108 The need for and nature of any monitoring for this component of the measure would be discussed with the SNCB and RSPB and detailed within the Kittiwake Compensation Plan.

6. Conclusion

Habitats

Introduction

6.1 Following the assessment of and consultation on the options with key stakeholders, the package of measures taken forward as developed compensation options of the long-term temporary loss of Annex I Sandbank feature is:

- 'habitat improvement and species recovery' through the establishment and protection of blue mussel beds in The WNNC SAC; and
- 'habitat restoration' within The WNNC SAAC focused on the removal of marine litter.

6.2 Based on a combined long-term temporary loss of 44.57 ha of Annex I sandbank feature from the SACs, it is proposed that a 44.57 ha mussel bed would be established within The Wash. The quantity of marine litter that could be removed from The WNNC SAC and the NNSSR SAC cannot be determined until the consultation and survey work in this regard has been undertaken, but this would be in addition to the blue mussel restoration works.

6.3 Furthermore, should initial establishment and management of the above measures not succeed to the targeted extent, eelgrass (*Zostera*) restoration in The WNNC SAC or debris removal in The WNNC SAC and/or litter/debris removal in the NNSSR SAC could be undertaken.

Kittiwake

6.4 The compensatory measure for kittiwake would comprise the eradication of invasive mammalian predators, in conjunction with the initiation of an island biosecurity measure, at kittiwake breeding colonies on UK islands. This measure would enhance the integrity of the SPA network for kittiwake due to the anticipated improvement in productivity. This would compensate for the maximum predicted impact of the Hornsea Three offshore wind farm in conjunction with other wind farms, related to increased collision risk, on the FFC SPA. It is expected that both measures would also lead to an increase in productivity other seabird species, including puffin, guillemot, razorbill, Manx shearwater, and terns (a number of which form part of the wider seabird assemblage of the FFC SPA).

6.5 The costs associated with the compensatory measure for kittiwake are considered to be viable in the context of the Hornsea Three Project.

Securing and Ensuring Compensation

6.6 Should they be deemed necessary, the Compensation Measures developed by the Applicant can be readily secured through additional Requirements that the Secretary of State could add to the DCO. Draft wording for these Requirements has been provided within the updated draft DCO (Appendices 9 and 10 to the Applicant's Response).

6.7 The draft Requirements refer to Compensation Strategies for The WNNC SAC and NNSSR SAC and, the FFC SPA. A proposed Compensation Strategy for the sandbank feature of The WNNC and NNSSR SACs is included as Appendix 2A to the Applicant's Response and for the kittiwake feature of the FFC SPA at Appendix 2B to the Applicant's Response.

6.8 Where further details on the developed measures are needed, the Strategies include a commitment for the production of a (Sandbank or Kittiwake) Compensation Plan at the appropriate point in the project timeline, to be agreed with the relevant SNCB, and these submissions would form the mechanism by which the measures and defined and approved by the regulator.

6.9 The risks associated with the failure of the measures developed by the Applicant (Habitat and Seabird Measures 1 and 2) have been considered and would be mitigated through monitoring and adaptive management, as appropriate, or through the delivery of additional measures developed (Contingency Habitat Measures 1 and 2); where any one measure could be scaled to resolve any deficit in another. Central to the promotion of these measures is a commitment to monitor their implementation and outcomes, and to have in place an adaptive management plan, to ensure success.

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Annex A supplementary advice on the Conservation Objectives for Kittiwake

Feature/Sub-feature name	*Attribute*	*Target*	*Season*	*Supporting notes*
Kittiwake (Rissa tridactyla), Breeding	Breeding population: abundance	Restore the size of the breeding population at a level which is above 83,700 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Breeding (summer) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (e.g. by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural

Feature/Sub-feature name	Attribute	Target	Season	Supporting notes
				fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. ***Site-specifics:*** At the time of reclassification as the Flamborough & Filey Coast SPA there were approximately 44,520 breeding pairs of kittiwake. This was calculated using the 2008 Seabird Monitoring Programme (SMP) for Flamborough Head and Bempton Cliffs SPA which showed 37,617 pairs along the Flamborough Head section of the designation and a further 6,903 pairs from Filey Brigg to Cunstone Nab from surveys in 2009-2011 (Natural England, 2014). A single year full colony count taken in 2017 indicated 51,535 pairs across the whole of the SPA (Aitken et al., 2017) The original citation for Flamborough Head and Bempton Cliffs SPA specifies that the site supported 83,700 pairs of breeding kittiwake in 1987. At the time this was 4% of the western European population and 7% of the UK population (Natural England (NE), 2013). The current figures clearly indicate a major decline in numbers since this time. At present, it is unclear why this decline has occurred, although evidence suggests that reductions in the availability of the kittiwakes preferred prey species (sandeels) has also reduced kittiwake productivity (Frederiksen et al., 2004). This reduction in prey availability is thought potentially to be a response to climate change, as this decline in kittiwake population has been seen in other parts of the North Sea region, coinciding with a rise in sea surface temperatures (Wanless et al., 2007). It should be noted that the abundance of the breeding population is reliant on recruitment from the non-breeding population and is therefore dependent on a stable age class structure. Therefore, population abundance could also be affected by disproportionate impacts to a particular age class. ***Productivity:*** Breeding productivity is an important factor influencing adult abundance. The number of chicks fledged per pair indicates the likely availability of new recruits to the breeding population in future years. The 2015 Flamborough and Filey Coast pSPA Seabird Monitoring Programme monitored the productivity of kittiwake across the site at both Bempton/Flamborough and at Filey Cliffs. Overall

Feature/Sub-feature name	*Attribute*	*Target*	*Season*	*Supporting notes*
				productivity for Kittiwake at Bempton/Flamborough averaged 0.73 chicks per pair and at Filey Cliffs productivity averaged 0.47 chicks per pair. (Babcock et al., 2015) Between 2009 and 2015 there are indications of a gradual downward trend in kittiwake productivity at Flamborough/Bempton. However, productivity at Filey Cliffs, whilst generally low, appears to have been relatively stable between 2012-2015 (Babcock et al., 2015). The 2017 report also showed differences between the two parts of the site in terms of productivity; although productivity at both locations was still lower than that indicated in the 2015 report. At Bempton/Flambough mean productivity was 0.58 chicks per AON. At Filey this figure was 0.39. (Aitken et al., 2017) Mean productivity for kittiwake recorded between 1986-2005 across UK colonies was 0.68 chicks per pair (Mavor et al., 2008). The target has been set to restore, on the basis of best available evidence. This evidence indicates that the population at the site has declined significantly since the initial census of 1987.

Kittiwake (Rissa tridactyla), Breeding	Connectivity with supporting habitats	Restore safe passage of birds moving between nesting and feeding areas.	Year-round	This target has been included because the ability of the feature to safely and successfully move to and from nesting, feeding and roosting areas is critical to their productivity and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Thaxter et al. (2012) summarised foraging range information for breeding seabirds. The mean of recorded maximum foraging ranges for kittiwake is 60 km, whilst the maximum reported foraging range is 120 km. Although birds might generally be expected to forage within these distances from the colony, all estimates come with associated uncertainty. Site-specific research will also be relevant where available. Additionally, any new studies of seabird foraging ranges should be taken into consideration (Thaxter et al., 2012). ***Site-specifics:*** The presence of the tidal stream just off Flamborough Head, known as the Flamborough Front, (where cooler waters from the north meet with warmer waters coming up from the south) creates a nutrient-rich environment in the waters adjacent to the kittiwake colony (English Nature (EN), 2000). This upwelling of nutrients, coupled with the availability of nesting ledges provided by the local geology, creates the necessary conditions for the kittiwake's preferred breeding habitat. As such, the kittiwake population should be able to freely access both the cliff-face nesting sites and adjacent foraging areas, outside of the SPA boundaries. Tracking data from the Flamborough and Filey Coast pSPA colony between 2010 and 2013 indicates that kittiwake tagged at Flamborough were foraging up to 219km offshore from the colony (Aitken et al., 2014). In all years when tracking data was collected, an area close to the colony was used by a high density of birds, as well as areas located further to the east (Aitken et al., 2014), perhaps indicating important foraging grounds. A potential collision risk has been acknowledged when kittiwake interact with offshore wind turbines (Cook et al., 2012). Therefore, interaction with offshore structures in important locations for foraging kittiwake may have an impact on the colony through collision mortality. Natural England has advised regulators that the predicted in-combination collision mortality from consented or proposed offshore wind farms could adversely affect the integrity of the SPA. Natural England's understanding of seabird foraging ranges is continually evolving and this information may be updated as new site specific evidence becomes available.

Feature/Sub-feature name	*Attribute*	*Target*	*Season*	*Supporting notes*
				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Kittiwake (Rissa tridactyla), Breeding	Disturbance caused by human activity	Restrict the frequency, duration and / or intensity of disturbance affecting roosting, nesting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed.	Breeding (summer) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either: • changed local distribution on a continuing basis; and/or • changed local abundance on a sustained basis; and/or • the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997)

Feature/Sub-feature name	*Attribute*	*Target*	*Season*	*Supporting notes*
Kittiwake (Rissa tridactyla), Breeding	Predation - all habitats	Restrict predation and disturbance caused by native and non-native predators.	Breeding (summer) season	This will ensure that breeding productivity (number of chicks per pair) and survival are sustained at rates that maintain or restore the abundance of the feature. Impacts to breeding productivity can result directly from predation of eggs, chicks, juveniles and adults, but also from significant disturbance. The presence of predators can influence bird behaviours, such as abandonment of nest sites or reduction of effective feeding. Where evidence suggests predator management is required, measures can include their exclusion through fencing, scaring and direct control. Any such measures must consider the legal protection of some predators, as well as the likely effects of such control on other qualifying features. Predation can influence distribution on a local scale (e.g. through abandonment) or at a wider population scale (Smith et al., 2010), (Smith et al., 2011). ***Site-specifics:*** Predation of juvenile and adult birds by carrion crow (Corvus corone) and peregrine falcons (Falco peregrinus) is known to occur, particularly around Filey Brigg and the Briel Newk section of Flamborough Head. However it is not thought to be significantly affecting the population size or productivity of the kittiwake feature. Due to the nature of the sheer cliffs, mammalian predation is not deemed to be a significant problem at this site. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

Kittiwake (Rissa tridactyla), Breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (APIS) (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. ***Site-specifics:*** • The APIS records this feature's supporting habitat as not sensitive to the following pollutants: • Nitrogen deposition • Acidity • Ammonia • Mono-nitrogen oxides • Sulphur Oxides The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

Feature/Sub-feature name	*Attribute*	*Target*	*Season*	*Supporting notes*
Kittiwake (Rissa tridactyla), Breeding	Supporting habitat: conservation measures	Restore the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. ***Site-specifics:*** Understanding of factors driving kittiwake decline since the population peaked in 1987 is limited and still evolving so it is unclear what measures are needed in the marine environment. It is possible wider ecological issues are a major factor, such as those linked to the abundance of prey species. Individual civil sanctions, in the form of stop-notices, have been issued within the SPA in order to reduce disturbance caused by personal watercraft use. Other voluntary measures are also in place around the site, and are facilitated by the Flamborough Head European Marine Site Management Scheme. In an effort to reduce the impact of recreational activities on the breeding seabird colony, a number of activity-specific voluntary codes of conduct have been initiated or are in development. Additional information regarding the above conservation measures can be found in the Natura 2000 Site Improvement Plan (SIP) for the SPA: Natura 2000 Site Improvement Plan. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Kittiwake (Rissa	Supporting habitat: extent and distribution of	Maintain the extent, distribution and availability of	Year round – to ensure the habitat remains	To maintain or restore the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection.

Feature/Sub-feature name	*Attribute*	*Target*	*Season*	*Supporting notes*
tridactyla), Breeding	supporting habitat for the breeding season	suitable breeding habitat which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) at existing level.	suitable for when the feature is present	Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. **Site-specifics:** The kittiwake colony is reliant on the numerous chalk and limestone ledges which exist around Flamborough Head and Filey Brigg, respectively. The sheer nature of the cliff face ensures that the risk of mammalian predation is minimised, allowing the kittiwake to build their nest in relative security. Further information about the hard chalk cliffs around Flamborough Head can be found in the Vegetated Sea Cliffs feature description for Flamborough Head SAC. Additionally, the kittiwake colony is also reliant on the water column to provide feeding and loafing areas. The SPA extends 2 km into the marine environment to include waters vital to the essential ecological requirements of the breeding seabird populations, for example preening, bathing and social displaying behaviour (Natural England, 2014). However, kittiwakes are also reliant on the offshore environment for feeding, with a study recording breeding adults from Flamborough travelling 219 km offshore in one foraging trip (Aitken et al., 2014) (see Supporting Habitat: Food Availability for more information). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Kittiwake (Rissa tridactyla), Breeding	Supporting habitat: food availability	Restore the distribution, abundance and availability of key food and prey items (e.g. sandeel, sprat, cod, squid, shrimps) at preferred sizes.	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population alter the distribution of birds. Main food sources can be found within: coastal and offshore waters (Cramp and Simmons, 1983), (Furness, 1990), (del Hoyo et al., 1996), (Chivers et al., 2012). ***Site-specifics:*** Kittiwake feed mainly on small shoaling fish near the sea surface, such as sandeels, sprats and young herring, as well as invertebrates on the sea surface (Mitchell et al., 2004). At the start of the

Feature/Sub-feature name	*Attribute*	*Target*	*Season*	*Supporting notes*
				breeding season, kittiwake prefer to feed on year-one sandeels, before switching to the smaller year-zero sandeels in order to feed their young (Frederiksen et al., 2007). Scavenging for offal and discards around fishing boats can also be an important food source in years when their preferred prey species are less abundant (Mitchell et al., 2004). Unlike guillemot and razorbill, kittiwake consume prey at sea and regurgitate it for their young once returned to the nest (Frederiksen et al., 2007). If sufficient amounts of prey are available, multiple provisioning trips may be completed in a single day (Frederiksen et al., 2007). Evidence for the wider North Sea indicates that availability of sandeels is likely to be a factor in kittiwake decline. (Frederiksen et al., 2004) (Wanless et al., 2007). Recent evidence suggests that the decline in sandeel in the area around Flamborough may be attributable to fishing activity. It is also acknowledged that sea surface temperature rise (related to climate change) may be an additional factor in the reduction of sandeel availability. (Carroll et al., 2017) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Kittiwake (Rissa tridactyla), Breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. ***Site-specifics:*** Flamborough and Filey Coast SPA sits within two WFD water bodies; Yorkshire North and Yorkshire South. These WFD waterbodies are routinely monitored by the Environment Agency. No contaminant issues have been identified. There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.

Feature/Sub-feature name	*Attribute*	*Target*	*Season*	*Supporting notes*
		deterioration from existing levels.		
Kittiwake (Rissa tridactyla), Breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to High Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. ***Site-specifics:*** Flamborough and Filey Coast SPA sits within two WFD water bodies; Yorkshire North and Yorkshire South. Since 2009 the dissolved oxygen levels within the SPA have been classified as achieving High Ecological Status. There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Kittiwake (Rissa tridactyla), Breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration	Year-round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: The mean winter dissolved inorganic nutrient levels for site are considered (using expert judgement) to be at background levels, with biological indicators of eutrophication (opportunistic macroalgal cover

Feature/Sub-feature name	*Attribute*	*Target*	*Season*	*Supporting notes*
		equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.		and phytoplankton communities) presumed to be at undisturbed conditions (e.g. opportunistic macroalgal cover is < 5 % with no entrainment). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Kittiwake (Rissa tridactyla), Breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year-round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, e.g. affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. ***Site-specifics:*** Due to the tidal streams and complex sediment movement around Flamborough Head, there can be varying degrees of turbidity throughout the year (CEFAS, 2000). The combination of strong tides, wave action and chalk make the shallow waters around the headland especially turbid (Howson et al., 2002).

Feature/Sub-feature name	*Attribute*	*Target*	*Season*	*Supporting notes*
				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

Annex B Sandbanks Compensation Measures Options Screening

Background

A.1 The following text provides context on the consideration of compensatory measures for Annex I sandbank feature, through case studies and application of the principles set out within the EU guidance (2018).

A.2 The ability to 'create' offshore subtidal habitat as a means of compensation is limited and without precedent. Moreover, the morphology of the subtidal sandbank habitats present in The WNNC and NNSSR SACs is driven by regional scale sedimentary and hydrodynamic processes over geological timescales. It is, therefore, unrealistic to assume that the creation of subtidal sandbanks, or indeed their supporting habitats, is possible; they comprise substantive soft sediments which, if placed artificially, would be remobilised and redistributed within the wider system rather than remaining in-situ. Therefore, this option is not considered to be feasible.

A.3 Given that new subtidal habitat per se cannot be created, with respect to the delivery of compensation for subtidal habitats, there is clearly a requirement for flexibility and this is acknowledged in the EC guidance (2018). Subtidal habitat can, however, be enhanced to support more biodiverse ecosystems. This may involve translocating or recreating certain subtidal habitats or features (e.g. seagrass was successfully transplanted in the Anacapa Island marine protected area in southern California), but this can be difficult to deliver at scale. Assessment of the loss of subtidal habitat, therefore, has to focus on the value of the habitat to be lost in the wider biogeographic context and the contribution this makes to the integrity of the SAC in question.

A.4 The Port of Rotterdam Maasflakte 2 example (below) provides details of a circumstance where a subtidal reserve was created within the designated site.

Case Study: Maasflake 2 (Voordelta SAC)

An example of compensation being provided within a European site is provided by port development in Rotterdam (Schouten *et al.*, 2008[38]); Maasflakte 2. The development took place within the Voordelta European site which is designated for a range of habitats and species, including submerged sandbanks and birds. It is also a commercial fishery and heavily used for recreation. An appropriate assessment identified that the proposed development would have an adverse effect on the subtidal sandbanks and on velvet scoter, common and sandwich tern. It was determined that there were no alternative solutions and that the project was necessary for reasons of overriding public interest. Compensation was therefore required.

Creation of new subtidal sandbanks outside of the Voordelta site was not considered viable, so research was undertaken into other ways to compensate for the loss of this habitat. It was found that, while the subtidal sandbanks within the site were classified as being in 'favourable condition', removing the use of beam trawlers could result in an increase in habitat quality of 10%. Therefore, beam trawling was removed from an area 10 times that of the area to be lost, equating to an initial theoretical 1:1 ratio of compensation for loss. Extensive monitoring is in place to assess the effectiveness of the quality

[38] Schouten P., Jennings K., McMullon C., Paterak B., Smit C. and Verbeek, H. (2008). Natura 2000 and development in estuarine areas. Mitigation and Compensation issues: Results of the first EU peer-exchange Natura 2000 estuaries group.

Case Study: Maasflake 2 (Voordelta SAC)
improving measure, and there is agreement about further measures to be taken if the required degree of habitat improvement is not achieved. The Netherlands presented the project and the proposed compensation to the EC to secure approval for the approach.

A.5 For development of the Port of Grenadilla, Tenerife in 2005, new site designation and restoration was proposed due to predicted disruption in natural sand accretion and deposition affecting coastal dunes and subtidal sandbanks. Compensation in this case involved the designation of two new European sites totaling 7,491ha for sandbanks and a new site for fixed coastal dunes (0.93ha) that included habitat restoration. This provided new sites that benefited from the protection of the Habitats Directive and a requirement for its obligations to be met.

A.6 Advice provided by Natural England and the JNCC at the Derogation Workshop (Habitats Directive, Article 6(4) Derogation) held by the BEIS Offshore Wind Programme Board in October 2017 acknowledged that for the 'wider marine environment' (outside of the coastal environment) uncertainty exists on the options that can be considered and the effectiveness of those options. As such, the SNCBs promoted the need to:

- consider flexible approaches;
- be open to all possibilities, novel/innovative approaches and blue skies thinking; and
- advocate goodwill amongst all parties and flexibility.

A.7 The Applicant has sought advice during the consultation period from Natural England, Defra, the MMO, JNCC, Eastern IFCA, the RSPB and The Wildlife Trusts with respect to compensation. A summary of stakeholder engagement specific to compensation is included in the Appendix 8 to the Applicant's Response, Record of Consultation. In particular, a constructive workshop on compensation measures was held on 12 December 2019 with Natural England and the MMO in attendance, where all potential routes for compensation were discussed and explored.

A.8 Given the framework provided by the Directive, Regulations and relevant guidance, and the nature of the effects predicted to be associated with Hornsea Three, Table B1 lists the (seven) compensation measures proposed in the guidance (see Section 3) and considers options for these which could be viable as compensation measures for the Annex I sandbank features (and sub-features) of the above SACs.

Table B1: 'sandbank habitat' compensation options for Hornsea Three

Measures from Guidance	***Potential options for Hornsea Three***	***Location***	***Additionality (beyond normal management measures)***
1. Habitat creation	i. Like for like subtidal sandbank habitat creation	Outwith the SACs	No other proposals or existing duties for such
	ii. Non-like for like coastal habitat creation	Outwith the SACs	No other proposals or existing duties for such
2. Habitat restoration or improvement	i. Habitat restoration / improvement - removal of marine debris and / or litter	a. Within the SACs	NE have no action proposed in a similar timeframe
		b. Outwith the SACs	No action proposed in a similar timeframe
	ii. Habitat restoration / improvement – remediating/levelling topographic changes	a. Within the SACs	NE have no action proposed in a similar timeframe
		b. Outwith the SACs	No action proposed in a similar timeframe
	iii. Coastal pollution reduction and prevention, including invasive species management	Within The WNNC SAC	Site specific (such as invasive species management) – some action currently proposed in a similar timeframe
	iv. Blue mussel bed restoration	Within The WNNC SAC	NE have no action proposed in a similar timeframe. The EIFCA have attempted a small restoration trial with no plans for a more ambitious measure proposed in a similar timeframe.
	v. Eelgrass bed restoration	Within or nearby The WNNC SAC	No action proposed in this location in a similar timeframe.
3. Species recovery and reinforcement or 4. Species reintroduction	To be delivered indirectly through the other measures in this table (and, therefore, not considered separately below)	a. Within the SACs	No action proposed in this location in a similar timeframe
		b. Outwith the SACs	No action proposed in this location in a similar timeframe
5. Reduction of other threats/ pressures	Reduction of other threats/pressures	Within the SACs	NE have no other overlapping proposals for such

Measures from Guidance	*Potential options for Hornsea Three*	*Location*	*Additionality (beyond normal management measures)*
6. Incentives/ disincentives for certain activities	i: Establishing a fisheries exclusion area	Within the SACs	Fisheries management is cited as a management measure for The WNNC SAC; hence any measures would have to be additional to this. Efforts have been made by JNCC to implement fisheries management in the NNSSR SAC, but no such measures are currently in place.
	ii: Working with fishing industry to change practices to less harmful methods		
7. Reserve creation / provision of a new site and conservation measures	i: Establishing a new protected area	Outwith the SACs	The Applicant has been advised that the network of sites for sandbanks in the UK is broadly complete. Without further management, there is questionable additionality to this measure.
	ii: Extension of existing protected site	Outwith (but connected to) the SACs	The Applicant has been advised that the network of sites for sandbanks in the UK is broadly complete. Without further management, there is questionable additionality to this measure.
	iii: Enhancing the level of protection within an existing protected area	Within the SACs	Overlapping proposals at an early stage of development

Measures Screened Out

A.9 Table B2 considers the potential *Natura 2000* habitat compensation options for Hornsea Three outlined above in terms of the following criteria:

- Feasibility (consideration of the logistical and technical requirements of the compensation, including size).
- Likely acceptability (consideration of the likely acceptance of the compensation measure, including public acceptance, and legal and financial feasibility in the required timeframe).
- Securing mechanisms (suitable locations and acquisition of such).
- Success criteria (consideration of how and how long it will take to determine whether the compensatory measures have been effective).
- Timescales (when could the measure be in place / when could it be expected to meet its objectives and how does this align with the schedule for project implementation).
- Cost effectiveness (orders of magnitude; ecological cost and value; and how to measure the delivery of equivalent or increased value) and financing programme.
- Potential threats and unintended consequences (enduring liabilities over a 10 to 30-year timescale).
- Monitoring requirements (monitoring timeframes and actions; including responsibility and how outcomes will be measured (e.g. can the compensation be delivered in partnership with an NGO/other)).

A.10 The options for Hornsea Three are considered both in the context of their ability to replicate (a) the physical attributes of sandbanks and (b) the biological attributes of sandbanks which are slightly covered by seawater all the time.

Table B2: Screening of Natura 2000 'sandbank compensation' options for Hornsea Three

Measure from EC guidance	***Hornsea Three Compensation Options***	***Feasibility***	***Acceptability/ securing mechanisms***	***Available evidence***	***Estimated timeframe for delivery***	***Limitations***	***Monitoring***
1. Habitat creation	i: Subtidal sandbank habitat creation (like for like)	×	×39	Limited evidence	N/A	Site suitability – new material/profiling would not be stable due to hydrodynamics.	✓ potential to partner with SNCB
	ii: Coastal habitat creation (non like for like eg saltmarsh, mudflats)	✓	×40	Readily evidenced	2-5 years	Social considerations41, unintended ecological effects.	✓ potential to partner with SNCB

[39] This option was ruled out following stakeholder consultation with (NE & MMO, 12 December 2019, see Record of Consultation (Appendix 8 to the Applicant's Response)
[40] This option was highlighted as a less preferred compensation measure due to the existence of marine compensation measures following stakeholder consultation (NE & MMO, 12 December 2019, see Record of Consultation (Appendix 8 to the Applicant's Response))
[41] Social considerations include: Lack of stakeholder/community support, displacement of other activities and impact elsewhere, local and or national political change, additional development in the area impacting the site.

Measure from EC guidance	*Hornsea Three Compensation Options*	*Feasibility*	*Acceptability/ securing mechanisms*	*Available evidence*	*Estimated timeframe for delivery*	*Limitations*	*Monitoring*
2. Habitat restoration or improvement	i: Removals (debris and/or litter) within site	✓42	✓	Readily evidenced	<2 years	Short-term localised ecological impact of removals	✓ potential to partner with SNCB
	ii: Removals (debris and/or litter) out with site	✓43	✓	Readily evidenced	<2 years	Short-term localised ecological impact of removals	✓ potential to partner with SNCB
	iii: Topographic profiling (within site) for example levelling trawl scars, spoil mounds ect.	✓	×44	Readily evidenced	N/A	Wider spatial impact, and; no protection against repeated impact without exclusion of the activity which caused the harm	✓ potential to partner with SNCB

[42] It is expected that litter would predominantly constitute abandoned or lost fishing gear, and that debris would predominantly constitute abandoned infrastructure or dropped objects (excluding oil and gas platforms, pipelines and installed subsea infrastructure). Ability to identify significant volumes of debris that can be removed without significant technical, legal, HSE and/or commercial risk may be challenging.

[43] It is expected that litter would predominantly constitute abandoned or lost fishing gear, and that debris would predominantly constitute abandoned infrastructure or dropped objects (excluding oil and gas platforms, pipelines and installed subsea infrastructure). Ability to identify significant volumes of debris that can be removed without significant technical, legal, HSE and/or commercial risk may be challenging.

[44] This option was screened out following stakeholder consultation (NE & MMO, 12 December 2019, see Record of Consultation (Appendix 8 to the Applicant's Response) on the grounds that it could impact the habitat in question and would not remove the pressure on the feature in the long term.

Measure from EC guidance	*Hornsea Three Compensation Options*	*Feasibility*	*Acceptability/ securing mechanisms*	*Available evidence*	*Estimated timeframe for delivery*	*Limitations*	*Monitoring*
	iv: Topographic profiling (out with site) for example levelling trawl scars, spoil mounds ect.	✓	×45	Readily evidenced	N/A	Wider spatial impact, and no protection against repeated impact without exclusion of the activity which caused the harm	✓ potential to partner with SNCB
	v: Coastal pollution reduction and invasive non-native species management (within The WNNC SAC)	✓	✓46	Readily evidenced	<2 years	Social considerations47 and potential unintended ecological effects	✓ potential to partner with the Environment Agency / SNCB
	vi: Blue mussel bed restoration (within The WNNC SAC)	✓	✓48	Readily evidenced	2-	Hydrodynamics and site suitability	✓ potential to partner with Eastern IFCA/ SNCB

[45] This option was screened out following stakeholder consultation (NE & MMO, 12 December 2019, see Record of Consultation (Appendix 8 to the Applicant's Response), for the reasons set out above
[46] Level of "Additionality" is questionable given the existing management measures and tenuous linkages to impacted habitats, and further discussion with the EA was recommended at the 12th December workshop. A telecon with EA national conservation representatives was held on 22 January 2020 where this measure was discussed – the EA advised that they would be speaking with their local colleagues to identify priorities. This measure has not been progressed further as other, more closely linked, compensation measures have been identified.
47 Social threats include: Lack of stakeholder/community support, displacement of other activities and impact elsewhere, local and or national political change, additional development in the area impacting the site.
[48] Blue mussel restoration was raised during stakeholder consultation on 12 December 2019.

Measure from EC guidance	*Hornsea Three Compensation Options*	*Feasibility*	*Acceptability/ securing mechanisms*	*Available evidence*	*Estimated timeframe for delivery*	*Limitations*	*Monitoring*
	vii: Eelgrass bed restoration (within The WNNC SAC or nearby pending advice from statutory stakeholders)	✓	✓	Readily evidenced	2-5 years including monitoring	Hydrodynamics and site suitability, presence of recreational users	✓ potential to partner with the Environment Agency / SNCB
3. Species recovery and reinforcement or 4. Species reintroduction	i: Species recovery and reinforcement or Species reintroduction; like for like	Species recovery and reinforcement would be delivered as a consequence of most other options					
	ii: Species recovery and reinforcement or Species reintroduction; non-like for like	See habitat restoration / improvement Compensation Option 2vi: blue mussel restoration and vii eelgrass bed restoration.					
5. Reduction of other threats and pressures	Taking up licences from other activities (aggregate extraction or oil and gas)	×	×	Lack of evidence	N/A	Displaces the impact to other areas potentially more sensitive. Other sectors unlikely to support due to pre-existing commercial commitments.	✓ potential to partner with SNCB

Measure from EC guidance	*Hornsea Three Compensation Options*	*Feasibility*	*Acceptability/ securing mechanisms*	*Available evidence*	*Estimated timeframe for delivery*	*Limitations*	*Monitoring*
6. Incentives/ disincentives for certain activities	i: Fisheries exclusion zone within site	×49	Offshore >12nm ×50 6nm-12nm ×50 Nearshore <6nm ×51	Readily evidenced	N/A	Reliant on government power to exclude fisheries.	✓ potential to partner with IFCA/MMO
	ii: Working with fishing industry to change practices to less harmful methods	✓	×52	Limited evidence for offshore areas, readily	2-5 years	Stakeholder support required	✓ potential to partner with SNCB/IFCA

[49] Exclusion of a fisheries area within an SAC is considered a management measure, and therefore is not in addition to normal management measures (does not meet the additionality test). This is particularly the case where fisheries pressures are listed as a contributor to unfavourable status in the specific site.
[50] Common Fishery Policy will be replaced with new powers under the proposed Fisheries Bill executed by the MMO. Any exclusions will be subject to consultation and approval by MMO and therefore does not meet the criteria "ability to secure".
[51] The EIFCA confirmed that they have powers to secure nearshore exclusion zones through bye-laws, but as they had implemented all that was necessary under the existing management of the nearshore site there was no scope for additional actions resulting from any compensation.
[52] Initial discussions (12 December 2020) with Natural England and the MMO recommended that the Eastern IFCA were consulted on the viability of nearshore fisheries measures. The EIFCA excluded this as a viable measure and advised that the MMO were consulted on potential bye-laws for the 6-12nm region. The MMO advised that they see this measure as a potential plan level strategy as it would need UK government support to implement.

Measure from EC guidance	*Hornsea Three Compensation Options*	*Feasibility*	*Acceptability/ securing mechanisms*	*Available evidence*	*Estimated timeframe for delivery*	*Limitations*	*Monitoring*
	within and or out with site			evidenced for nearshore areas			
7. Reserve creation / provision of a new site	i: Identification of new area for designation	✓	×53	Readily evidenced	5-10 years	Social – stakeholder support	✓ potential to partner with SNCB
	ii: Extension of existing designated site	×54	×	Readily evidenced	5-10 years	Social – stakeholder and political/legislative support	✓ potential to partner with SNCB
	iii: Enhancing the level of protection within an existing protected area	✓	×55	Readily evidenced	3-5 years	Social – stakeholder and political/legislative support	✓ potential to partner with SNCB

[53] Initial feedback from Defra has indicated that they consider the existing UK network for Annex I sandbanks feature to be currently sufficient, and they are unlikely to support creating a new site at the scale recommended for the Annex I sandbanks feature. As a new site would need Defra support, this is not considered further.

[54] NE and DEFRA do not support this measure in isolation, but advise that it may be a component part of a proposal. For example, if a compensation measure improved the condition of a site such that it became a suitable candidate for designation, the Applicant could support the designation process through monitoring/evidence provision. However, extension of an existing site does not meet the criteria "ability to secure" and so is not considered further. In addition none of the compensation measures screened in this document for Annex I sandbanks feature would lead to a new/extended area qualifying for designation.

[55] Defra have launched an independent review of the need for Highly Protected Marine Areas (HPMA) and are expected to deliver recommendations to UK Government in Spring. The 6 month review, led by ex-fisheries Minister Richard Benyon MP, has been asked to recommend whether and how HPMAs could be introduced within English inshore and off shore waters and Northern Irish offshore waters and, if supported by the evidence, recommend potential locations for pilot sites. At present there is no way of knowing the outcome of this review as the recommendations have not been published and therefore of knowing if this will provide a mechanism for a designation with additional protection.

A.11 The ability to create 'new' like for like Annex I sandbank habitat (Compensation Option 1i) is not considered feasible, for the reasons set out above. For Compensation Option 1ii (non-like for like habitat creation), the ability to create coastal habitat such as saltmarsh or mudflats is well accepted and demonstrable. However, less linked habitat creation should not be considered as an option for compensation for adverse effects on Annex I sandbank feature until all directly linked options have been explored. It is generally accepted that, where directly linked compensation can be provided, less linked compensation which targets interest features within a site that would not be affected by the works should not be pursued as a primary option[56]. For Hornsea Three, compensation that has a strong link to the extent and or function of Annex I sandbank feature (including Subtidal Sand, Subtidal Coarse Sediment and Subtidal Mixed Sediment) can be provided. Hence this option was not explored further for the reasons given above and following stakeholder consultation.

A.12 Compensation Options 2iii and iv (topographic levelling within or out with a designated site) would comprise remediating topographic changes caused by, for example, previous construction activities (e.g. spoil mounds or depressions from oil and gas infrastructure installation activity) and demersal fishing (e.g. trawl scars[57]). Whilst such measures are potentially feasible, they would entail further manipulation (disruption) of sediments (and its associated biology) via mechanical means. Furthermore, unless this activity was paired with an exclusion zone, the damage could readily reoccur. Hence this option was not explored further for the reasons given above and following stakeholder consultation.

A.13 For Compensation Option 2v (Coastal pollution reduction and prevention, including invasive species management), measures could be implemented that target reduction in pollution and/or invasive species removal / prevention. For pollution, whilst The WNNC SAC Site Improvement Plan58 (SIP) identifies deposition of atmospheric nitrogen as a threat it does not identify sandbank habitat (the impacted habitat) as a receptor of concern. For invasive species, the SIP does identify sandbank habitats as one of the features where this threat exists. In this context, a European funded project (SEFINS59) was established to bring together experts from across Europe to focus on invasive species in estuaries. Led by the Norfolk Non-Native Species Initiative (NNNSI) and Norfolk County Council, the project worked with The Wash and North Norfolk Marine Partnership, EIFCA and Cefas to bring cutting-edge invasive species science to The Wash. The aim of the project was to improve the way invasive species are managed in estuaries across Europe, helping to identify the risks and

[56] A valid argument can be made for pursing non-like for like options where there is a functional link between the affected habitat and the proposed compensatory habitat (e.g. mudflat backed by saltmarsh in an eroding system; where increased erosion of the mudflat could be compensated through enhancement of the saltmarsh resource behind it (this was the approach taken to compensation for the Wightlink 'W' Class Ferry Operation in Southampton Water (consented in 2012)). In the case of the Wightlink project, the connection between the affected feature and the enhanced feature was clear (i.e. in due course the saltmarsh will become mudflat).
[57] Evidence for which is cited in Jenkins *et al*. (2015) North Norfolk Sandbank and Saturn Reef cSAC/SCI Management Investigation Report. Report No, 7.
[58] http://publications.naturalengland.org.uk/publication/5327498292232192
[59] https://wnnmp.co.uk/home/partnerships/non-native-species-norfolk/

allow the development of new and improved management options to safeguard the environment and economy. The level of "additionality" is questionable given the existing management measures and tenuous linkages to impacted habitats, and further discussion with the EA was recommended at the 12 December workshop. A telecon with EA national conservation representatives was held on 22 January 2020 where this measure was discussed. This measure, in isolation, has not been pursued further as there are other measures available with more direct relevance to the affected interest features. However, elements of biosecurity and INNS work is included in the blue mussel restoration initiative.

A.14 Compensation Options 3 (Species Recovery and Reinforcement) and 4 (Species Introduction) would be delivered indirectly through the other measures identified and, therefore, are not discussed further here.

A.15 Compensation Option 5 relates to the reduction of other pressures or threats (excluding fishing which is captured under Compensation Option 6). Any such measures would require the return of a license from the operator of an existing oil and gas field or aggregate extraction site. Whist this is theoretically feasible, the cost of acquiring licences would likely be prohibitive and it is envisaged that such proposals would not be acceptable to the oil and gas and aggregate sectors. Furthermore, such licences (acquired from the Oil and Gas Authority (OGA) and The Crown Estate, respectively) typically come with conditions requiring certain activity levels within specified timeframes or the relinquishment of the lease to another party who would fulfil the required level if no such activity takes place. Therefore, this is unlikely to be a viable solution. Hence this option was not explored further for the reasons given above and following stakeholder consultation.

A.16 Compensation Option 6i relates to the establishment of a fisheries exclusion zone (for demersal fishing, for example, which is cited as representing a threat to the designated sandbank habitat of both The WNNC and NNSSR SACs). Offshore fishing activity within the UK (of relevance to the NNSSR SAC) is currently controlled at the European Union (EU) level under the Common Fisheries Policy (CFP), with Member States having equal access to fishing grounds beyond 12nm, and some access within the 6-12 nm zone. Common Fisheries Policy will be replaced with new powers under the proposed Fisheries Bill executed by the MMO. Any exclusions will be subject to consultation and approval by MMO and therefore this does not meet the criteria "ability to secure" necessary for compensation. Therefore, opportunities to take such action within the NNSSR SAC are limited as this site is entirely beyond 12 nm. Further to this, exclusion of a fisheries area within an SAC is considered a site management measure, and therefore is not in addition to normal management measures (does not meet the additionality test). This is particularly the case where fisheries pressures are listed as a contributor to unfavourable status in the specific site.

A.17 By contrast, the inshore areas within The WNNC SAC fall under the Eastern IFCA's remit. The establishment of a fisheries exclusion zone in this zone would involve identifying an area within the designated site (in collaboration with the EIFCA) that was particularly affected by mobile demersal fishing gear and working with the EIFCA to assist in the implementation of a new bye-law (or extension to an existing bye-law area) that sought to ban this form of fishing from the specified area. However, the EIFCA have already established exclusion zones within these inshore sites and are in

the process of implementing further exclusion areas, including a substantive one in The WNNC SAC. Therefore, it is considered that such measures form part of existing site management and, consequently, would not be additional. Moreover, EIFCA confirmed that they have powers to secure nearshore exclusion zones through bye-laws, but as they had implemented all that was necessary under the existing management of the nearshore site there was no scope for additional actions resulting from any compensation. Therefore, this option was not explored further.

A.18 The EIFCA also indicated that they would not support further proposals to work with the fishing sector to identify less damaging fishing techniques, as this work was already progressing under their normal operations. Hence Compensation Option 6ii Incentives / disincentives for certain activities, in this context, was screened out.

A.19 Compensation Options 7i, ii and iii, Reserve creation / provision of a new site and conservation measures (designation of new site or site extension, or improvement of the level of protection over part of an existing site), were not supported by Defra because the UK's SAC designation targets have been met. There is also a question regarding the additionality that these measures would provide (without being combined with fisheries exclusion or other measures, which have been screened out). Hence, they were also screened out.

Measures Screened In

A.20 Those measures that were agreed with stakeholders as meriting further consideration as sandbank habitat compensation options for Hornsea Three comprised:

- Compensation Option 2i and 2ii Habitat restoration / improvement (litter/debris removal); and
- Compensation Option 2vi Habitat restoration / improvement through blue mussel bed restoration and biosecurity measures.

A.21 Further to this and following engagement with the Environment Agency (see Appendix 8 to the Applicant's Response, Record of Consultation), Compensation Option 2vii Habitat restoration / improvement through eelgrass bed restoration has been included as an adaptive management measure.

A.22 The means by which these measures could be established to deliver compensation for Hornsea Three are discussed in detail in Section 5 above.

Annex C Flamborough & Filey Coast SPA Compensatory Measures Options Screening

Background

A.1 The main factors affecting seabird population trends in the British Isles are food abundance (linked to climate change and fisheries), severe weather events and predatory mammals at seabird colonies. Furness et al. (2013)[60] identified potential conservation measures for selected species of seabirds breeding in the British Isles, including kittiwake. The measures identified in that review aim to increase seabird productivity, or survival, or both and have formed the basis of identifying suitable conservation compensatory measure for breeding kittiwake – it should be noted that this review was not intended to offer advice on compensation for seabird species. The potential management options include:

- closure of sandeel and sprat fishing within 200km of SPAs used for breeding;
- eradication of American mink, feral cats and rats;
- exclusion of foxes from colonies;
- exclude great skuas from buffer zone around kittiwake colonies; and
- construction of artificial structures to support kittiwake colonies.

Application to the FFC SPA

A.2 A review of potential compensatory measures relevant to kittiwake and in relation to potential impacts to the FFC SPA has been undertaken and considers the potential FFC SPA compensation options for Hornsea Three outlined above in terms of the following criteria:

[60] Evidence review to support the identification of potential conservation measures for selected species of seabirds.

- Feasibility (consideration of the logistical and technical requirements of the compensation, including size)
- Likely acceptability (consideration of the likely acceptance of the compensation measure, including public acceptance, and legal and financial feasibly in the required timeframe).
- Securing mechanisms (suitable locations and acquisition of such).
- Success criteria (consideration of how and how long it will take to determine whether the compensatory measures have been effective).
- Timescales (when could the measure be in place / when could it be expected to meet its objectives and how does this align with the schedule for project implementation).
- Cost effectiveness (orders of magnitude; ecological cost and value; and how to measure the delivery of equivalent or increased value) and financing programme.
- Potential threats and unintended consequences (over a 10 to 30 year timescale).
- Monitoring requirements (monitoring timeframes and actions; including responsibility and how outcomes will be measured (e.g. can the compensation be delivered in partnership with an NGO/other)).

Table C1: Review of Potential Kittiwake Compensation Measures

Measure from guidance	*Hornsea Three Compensation Options*	*Feasibility*	*Acceptability/ securing mechanisms*	*Available evidence*	*Estimated timeframe for delivery*	*Limitations*	*Monitoring*
1.Habitat creation	Construction of artificial structures to support kittiwake colonies.	✓	×61	Lack of evidence	N/A	Site suitability, unintended negative consequences	✓ potential to partner with SNCB & RSPB
2.Habitat restoration or improvement	i: Eradication of American mink from a UK island	✓	✓	Evidence in development for Kittiwake	<3 years	Biosecurity, social threats	✓ potential to partner with SNCB & RSPB
	ii: Eradication of feral cat from a UK island	✓	×62	Limited evidence for Kittiwake	N/A	Biosecurity, social considerations and community support	✓ potential to partner with SNCB & RSPB
	iii: Eradication of rat (and house mouse63) from a UK island	✓	✓	Evidence in development for Kittiwake	<2 years	Biosecurity, social threats	✓ potential to partner with SNCB & RSPB
3.Species recovery and reinforcement or	i: Species recovery and reinforcement or Species	Kittiwake recovery and reinforcement is the objective of other options within this table and therefore it is not discussed separately here.					

[61] There is a lack of evidence for species benefit and obtaining this evidence is not achievable on the timescales of Hornsea Three.
[62] Local acceptability is challenging as pet cats are likely affected, leading to negative local stakeholder engagement.
[63] House mouse is not specifically mentioned in Furness (2013) but RSPB advise (December 2019) that house mouse, where present, is eradicated alongside rat to prevent them becoming a seabird predator.

Measure from guidance	*Hornsea Three Compensation Options*	*Feasibility*	*Acceptability/ securing mechanisms*	*Available evidence*	*Estimated timeframe for delivery*	*Limitations*	*Monitoring*
4.Species reintroduction	reintroduction; like for like						
	ii: Species recovery and reinforcement or Species reintroduction; non-like for like	Other seabird assemblage species are very likely to benefit as a direct consequence of other options within this table and therefore it is not discussed separately here.					
5.Reduction of other threats and pressures	i: Exclusion of foxes from a colony	✓	×64	Evidence in development for Kittiwake	<2 years	Unintended consequences to wildlife, suitable location, additionality	✓ potential to partner with SNCB & RSPB
	ii: Exclusion of great skua from a buffer zone around a kittiwake colony	✓	×65	Evidence in development for Kittiwake	<2 years	Unintended consequences to wildlife, suitable location, additionality	✓ potential to partner with SNCB & RSPB

[64] No feedback from stakeholders on this measure. Likely not additional to current SPA management.
[65] Direct impact to another seabird species (Great Skua), and not supported by the RSPB (28 January 2020).

Measure from guidance	*Hornsea Three Compensation Options*	*Feasibility*	*Acceptability/ securing mechanisms*	*Available evidence*	*Estimated timeframe for delivery*	*Limitations*	*Monitoring*
	iii: Management of recreational pressures at the FFC SPA	✓	×66	Limited evidence	<2 years	Social considerations and stakeholder support, additionality	✓ potential to partner with SNCB & RSPB
6.Incentives/ disincentives for certain activities	i: Sandeel fishery exclusion zone within 200km of breeding colony (offshore)	✓ (previously through CFP)	×67	Offshore >12nm ×68 6nm-12nm ×50	Readily evidenced	N/A	Reliant on government power to exclude fisheries.
	ii: Sandeel fisheries exclusion zone within the Hornsea Three array area	✓	×69	Lack of evidence	During operation	This would displace fishing effort to likely another FFC kittiwake foraging area – no benefit	✓ potential to partner with SNCB & RSPB

[66] This is not additional to current FFC SPA site management by the RSPB.
[67] Exclusion of a fisheries area for SPA impacts is considered a management measure, and therefore is not in addition to normal management measures (does not meet the additionality test). This is particularly the case where fisheries pressures are listed as a contributor to species decline across the UK SPA network.
[68] Common Fishery Policy will be replaced with new powers under the proposed Fisheries Bill executed by the MMO. Any exclusions will be subject to consultation and approval by MMO and therefore does not meet the criteria "ability to secure".
[69] Same mechanism and challenges as for 6i.

Measure from guidance	*Hornsea Three Compensation Options*	*Feasibility*	*Acceptability/ securing mechanisms*	*Available evidence*	*Estimated timeframe for delivery*	*Limitations*	*Monitoring*
7.Reserve creation / provision of a new site and conservation measures	i: Identification of new area for designation	✓	×70	Readily evidenced	5-10 years	Social – stakeholder support	✓ potential to partner with SNCB
	ii: Extension of existing designated site	×71	×	Readily evidenced	5-10 years	Social – stakeholder and political/legislative support	✓ potential to partner with SNCB
	iii: Enhancing the level of protection (biosecurity) within an existing protected area	✓	×72	Readily evidenced	3-5 years	Social – stakeholder and political/legislative support	✓ potential to partner with SNCB

[70] Sites which have the qualifying features to be designated as an SPA are recommended for designation as part of normal management processes. Therefore this is not acceptable compensation (see also 71.
[71] Stakeholder consultation indicated that this measure may be a component part of a compensation proposal. For example, if a compensation measure improved the condition of a site such that it became a suitable candidate for designation, the Applicant could support the designation process through monitoring/evidence provision. This may be the case if predator eradication improves the condition and features of the selected site such that it would qualify.
[72] Defra have launched an independent review of the need for Highly Protected Marine Areas (HPMA) and are expected to deliver recommendations to UK Government in Spring. The 6 month review, led by ex-fisheries Minister Richard Benyon MP, has been asked to recommend whether and how HPMAs could be introduced within English inshore and off shore waters and Northern Irish offshore waters and, if supported by the evidence, recommend potential locations for pilot sites. At present there is no way of knowing the outcome of this review as the recommendations have not been published and therefore of knowing if this will provide a mechanism for a designation with additional protection.

Measures Screened Out

A.3 Option 1 has been screened out because a) the availability of nesting space on the FFC SPA cliffs is not thought to be a limiting factor in their presence (therefore, additional nesting space may well not result in an increase in the kittiwake population at the site), and b) the construction of artificial structures is not considered to be appropriate in the FFC SPA given the nature of the cliffs and practicalities and acceptability of constructing artificial structures adjacent to these. There is a lack of evidence to suggest that availability of nesting space is a factor affecting breeding success for kittiwake across the UK network of SPAs.

A.4 Options 2i, ii, iii have been screened out for consideration at the FFC SPA due to limited effectiveness at this particular colony and lack of evidence suggesting invasive mammalian predation. However, should other colonies exist outside of the FFC SPA where the breeding sites are more exposed to such threats then predator eradication measures are considered to be readily implementable and have a strong likelihood of resulting in positive effects to the seabird assemblage.

A.5 Options 3 and 4 are addressed in other measures, as this compensation is designed to be species, not habitat, specific.

A.6 Option 5i ii and iii have been screened out due to limited effectiveness at the FFC SPA. There are no records of great skua or fox predation, and recreational pressures are already managed by the RSPB and therefore would not be additional to normal pressures.

A.7 Compensation Option 6i and ii relate to the establishment of a fisheries exclusion zone for sandeel fishing, as prey availability is cited as a key driver of breeding success for the Natura 2000 kittiwake population. It is established that the main pressure that kittiwake face in the FFC SPA is insufficient prey availability due to a) climate change and b) industrial sandeel fishing. However, due to the political complexity (and uncertainty) associated with controlling European fisheries; the lack of influence that Hornsea Three would have in this regard; the timescales associated with the implementation of any such measure; and the discord in proportionality between impact scale and fisheries areas, it is not proposed that this route (Option 6) is pursued by Hornsea Three. Offshore fishing activity within the UK (of relevance to the NNSSR SAC) is currently controlled at the European Union (EU) level under the Common Fisheries Policy (CFP), with Member States having equal access to fishing grounds beyond 12nm, and some access within the 6-12 nm zone. Common Fisheries Policy will be replaced with new powers under the proposed Fisheries Bill executed by the MMO. Any exclusions will be subject to consultation and approval by MMO and therefore this does not meet the criteria “ability to secure” necessary for compensation. Therefore, opportunities to take such action within the NNSSR SAC are limited as this site is entirely beyond 12 nm. Further to this, exclusion of a fisheries area for the benefit of an SPA is considered a site management measure, and therefore is not in addition to normal management measures (does not meet the additionality test). This is particularly the case where fisheries pressures are listed as a contributor to declining status of kittiwake in the UK SPA network.

A.8 Option 7 has been discounted for the reasons stated above.

Measures Screened In

A.9 Hornsea Three has engaged with the RSPB and Natural England on the options for compensation for potential effects on kittiwake. The Applicant has determined that, whilst not applicable to the FFC SPA itself, the eradication of mammalian invasive predators represents the best option (Option 2) for the delivery of compensation associated with the effects of the Hornsea Three Project on the assemblage (kittiwake) feature. This was discussed with Natural England and the MMO at the workshop held on 12 December 2019, and further discussed at an ornithology specific compensation workshop held on 28 January 2020.

A.10 The means by which these measures could be established to deliver compensation for Hornsea Three are discussed in detail in Section 5 above.