

# Norfolk Boreas Offshore Wind Farm

## Appendix 6.1

### Habitats Regulations Assessment Integrity Matrices (Clean)

Applicant: Norfolk Boreas Limited  
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*Photo: Ormonde Offshore Wind Farm*

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## Glossary of Acronyms

BDMPS	Biologically Defined Minimum Population Scale
CRM	Collision Risk Modelling
EIA	Environmental Impact Assessment
EMF	Electromagnetic Fields
ES	Environmental Statement
HRA	Habitats Regulations Assessment
LSE	Likely Significant Effect
NE	Natural England
PVA	Population Viability Analysis
Ramsar	Wetland site designated to be of international importance under the Ramsar Convention
SAC	Special Area of Conservation
SCI	Site of Community Importance
SPA	Special Protection Area

## 1 INTRODUCTION

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1. This document provides the Habitats Regulations Assessment (HRA) integrity matrices for Norfolk Boreas Offshore Wind Farm. The matrices summarise information provided in the Information to Support HRA report (document 5.3 of the application).
2. This document was updated (AS-004) following Section 51 advice provided by The Planning Inspectorate (PINS) following acceptance of the Norfolk Boreas Development Consent Order (DCO) application as follows:
  - Added footnotes to all matrices to cross reference to where the supporting evidence for the conclusions can be found in the application documents;
  - Addition of integrity matrices for Breydon Water SPA and Ramsar, Broadland SPA and Ramsar and North Norfolk Coast SPA and Ramsar; and
  - Updating the matrices for Haisborough, Hammond and Winterton SAC.
3. Norfolk Boreas Limited has included two scenarios within the DCO application; Scenario 1 where Norfolk Vanguard and Norfolk Boreas proceed to construction and Scenario 2 where Norfolk Vanguard does not. These two scenarios are summarised in the Information to support HRA report (section 3) and presented in more detail in Chapter 5 Project Description of the ES (document reference 6.1.5). As described in section 3 of the Information to support HRA report (section 3) the two scenarios have not materially affected the way the Stage 1: Screening has been undertaken nor have they affected Stage 2 when assessing potential effects linked with the offshore parts of the Project as the Project would be very similar in the offshore environment regardless of the two different scenarios. However, the Stage 2 assessment of onshore Natura 2000 sites (section 9 of the Information to support HRA report) does undertake separate assessments for Scenario 1 and Scenario 2, and those assessments are reflected in the integrity matrices (sections 2.10, 2.13, 2.14 and 2.16) provided within this appendix.
4. The Applicant undertook additional offshore ornithology assessment to address the concerns raised by Natural England in their Relevant Representation (REP-099) and also discussed this during production of the Statement of Common Ground (REP2-055). The updated offshore ornithology assessment was submitted at Deadline 2 (REP2-035). The updates to the integrity matrices made at Deadline 1 reflected the updated assessment and include revisions to:
  - a. The Alde-Ore Estuary SPA assessment of potential effects on lesser black-backed gull for the project alone and in-combination with other wind farms;

- b. The Flamborough and Filey Coast SPA assessment of potential effects on gannet, kittiwake, guillemot and razorbill for the project alone and in-combination with other wind farms, and;
    - c. The Greater Wash SPA assessment of potential effects on common scoter for the project alone and in-combination with other wind farms.
5. At the request of Natural England, the Applicant screened in Broadland SPA from the perspective of impacts associated with the onshore project area (see updated screening matrices, REP1-015) at deadline 1. The updates to the integrity matrices submitted at Deadline 1 reflected this and included the addition of:
  - a. The Broadland SPA and Ramsar (onshore) assessment of potential effects on Bewick's Swan, Whooper Swan, Pink-footed Goose and Greylag goose.
6. For Deadline 6 this document has been revised to address the following:
  - A request from the Examining Authority to review the named features for designated sites which are both SPA and Ramsar sites; and,
  - To incorporate changes made to the project design at Deadline 5 (REP5-059, REP5-003) which have reduced the project's collision risks (as summarised below).
7. In response to requests from Natural England, the Royal Society for the Protection of Birds and the Examining Authority to reduce impacts as far as possible, the Applicant has undertaken a detailed review of design options and construction vessel capacity. Following this the Applicant has committed to a minimum 13m increase in draught height, from 22m to 35m above mean high water springs (MHWS) for turbines with a capacity up to and including 14.6MW and to a minimum 8 m increase in draught height, from 22 to 30m above MHWS, for turbines with a capacity of 14.7MW and above; and through the removal of turbines with a generating capacity of less than 11.55MW, a reduction in the maximum number of turbines from 180 in the original application (APP-226) to 158. These design revisions, which are detailed in REP5-059 and ExA.AS-1.D6.V1) and secured in the draft DCO submitted at Deadline 5 (REP5-003) have been used to update the collision risk modelling for the project (REP5-059) and have been incorporated into revised cumulative and in-combination assessment (ExA.AS-1.D6.V1). The project collision risks have been reduced by 74% for gannet, 73% for little gull, 72% for kittiwake, 64% for lesser black-backed gull, and 63% for herring gull and great black-backed gull, compared with the estimates in the original application (APP-226).
8. In-combination collision risks have also been updated, following advice from Natural England (REP4-014). This includes use of the consented collision risk figures for

Dogger Bank Creyke Beck and the addition of little gull collision risk estimates for East Anglia ONE North and East Anglia TWO.

9. The update also includes revised figures for the Norfolk Vanguard wind farm which has also made a commitment to the same turbine revisions as detailed above for Norfolk Boreas (and in REP5-059), and these were submitted to the Planning Inspectorate on 28<sup>th</sup> Feb 2020).



## 2 INTEGRITY MATRICIES

10. Following screening of potential impacts of Norfolk Boreas on European designated and Ramsar sites (as presented in Appendix 5.1 and Appendix 5.2 of the Information to Support the HRA Report (document 5.3 of the DCO application)), the following features of the European and Ramsar sites were assessed to determine if there was a risk of Adverse Effects on the Integrity (AEOI) of their qualifying features in the Information for Habitats Regulations Report.

**Table 2.1 European designated sites and qualifying features screened in**

Site	Qualifying feature
Alde-Ore Estuary Special Protected Area (SPA) and Ramsar	<ul style="list-style-type: none"> <li>Breeding lesser black-backed gull <i>Larus fuscus</i></li> </ul>
Breydon Water SPA and Ramsar	<ul style="list-style-type: none"> <li>Wintering and passage waterbird assemblage including as named features Bewick's swan, Ruff, Golden Plover, Avocet, Lapwing, Common tern, Black-tailed godwit, Shoveler, Wigeon, White-fronted goose, Cormorant.</li> </ul>
Broadland SPA and Ramsar	<ul style="list-style-type: none"> <li>Wintering and passage waterbird assemblage including as named features Shoveler, Wigeon, Gadwall, Bewick's Swan, Whooper Swan, Pink-footed Goose, Greylag Goose, Ruff, Bittern, Marsh Harrier, Hen Harrier, Savi's Warblers, Cetti's Warbler, Bearded Tit, Garganey, Pochard.</li> </ul>
Broadland SPA and Ramsar (Onshore)	<ul style="list-style-type: none"> <li>Wintering and passage waterbird assemblage including as named features Bewick's swan, Whooper swan, Pink-footed goose, Wildfowl assemblage, Tundra Swan, Greylag goose</li> </ul>
Flamborough and Filey Coast SPA	<ul style="list-style-type: none"> <li>Breeding kittiwake <i>Rissa tridactyla</i></li> <li>Breeding gannet <i>Morus bassanus</i></li> <li>Breeding common guillemot <i>Uria aalge</i></li> <li>Breeding razorbill <i>Alca torda</i></li> <li>Seabird assemblage</li> </ul>
Greater Wash SPA	<ul style="list-style-type: none"> <li>Non-breeding red-throated diver <i>Gavia stellata</i></li> <li>Non-breeding little gull <i>Hydrocoloeus minutus</i></li> <li>Non-breeding common scoter (<i>Melanitta nigra</i>)</li> </ul>
Haisborough Hammond and Winterton Special Area of Conservation (SAC)	<ul style="list-style-type: none"> <li>Reef</li> <li>Sandbanks slightly covered by seawater all the time</li> </ul>
Humber Estuary SAC	<ul style="list-style-type: none"> <li>Grey seal <i>Halichoerus grypus</i></li> </ul>
Klaverbank SAC	<ul style="list-style-type: none"> <li>Grey seal</li> <li>Harbour seal <i>Phoca vitulina</i></li> </ul>
Noordzeekustzone SAC	<ul style="list-style-type: none"> <li>Grey seal</li> </ul>
Norfolk Valley Fens SAC	<ul style="list-style-type: none"> <li>Alkaline fens</li> <li>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i></li> <li>Calcareous fens <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i></li> </ul>



Site	Qualifying feature
	<ul style="list-style-type: none"> <li>• European dry heaths</li> <li>• Molinia meadows on calcareous peaty or clayey-silt-laden soils</li> <li>• Northern Atlantic wet heaths with <i>Erica tetralix</i></li> </ul>
North Norfolk Coast SPA and Ramsar	<ul style="list-style-type: none"> <li>• Wintering and passage waterbird assemblage including as named features Wigeon, Avocet, Bitter, Common tern, Little tern, Marsh harrier, Montagu's harrier, Sandwich tern, Dark-bellied brent goose, Knot, Pink-footed goose, bar-tailed godwit, Pintail</li> </ul>
Outer Thames Estuary SPA	<ul style="list-style-type: none"> <li>• Nonbreeding red-throated divers, breeding common tern, breeding little tern.</li> </ul>
Paston Great Barn SAC	<ul style="list-style-type: none"> <li>• Barbastelle bat <i>Barbastella barbastellus</i></li> </ul>
River Wensum SAC	<ul style="list-style-type: none"> <li>• Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation</li> <li>•</li> </ul>
Southern North Sea SAC	<ul style="list-style-type: none"> <li>• Harbour porpoise <i>Phocoena phocoena</i></li> </ul>
The Broads SAC	<ul style="list-style-type: none"> <li>• Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.</li> <li>• Natural eutrophic lakes with Magnopotamion or Hydrocharition – type vegetation</li> <li>• Transition mires and quaking bogs</li> <li>• Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i></li> <li>• Alkaline fens</li> <li>• Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>)</li> <li>• Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>)</li> <li>• Fen orchid <i>Liparis loeselii</i></li> <li>• Ramshorn snail <i>Anisus vorticulus</i></li> <li>• Otter <i>Lutra lutra</i></li> </ul>
The Wash and North Norfolk SAC	<ul style="list-style-type: none"> <li>• Harbour seal</li> </ul>

11. A summary of the evidence presented in the determination of the risk of AEOI on the relevant qualifying features is detailed within the footnotes to the integrity matrices below.

12. The following abbreviations are used within the integrity matrices:

- Y – AEOI **cannot** be excluded
- N - AEOI **can** be excluded
- C = construction
- O = operation
- D = decommissioning

13. Where effects are not applicable to a particular feature they are greyed out.

## 2.1 Alde-Ore Estuary SPA and Ramsar

Name of European Site: Alde-Ore Estuary SPA and Ramsar									
Distance to Norfolk Boreas Site: 92km									
Site Features	Adverse Effect on Integrity due to Norfolk Boreas								
	Collision mortality (in-combination)			Displacement/Disturbance			Barrier Effect		
	C	O	D	C	O	D	C	O	D
Breeding lesser black-backed gulls		<b>N (a)</b>							
<p>a) Band model predictions of collision mortality suggest a maximum of 14.3 collisions per year (95% confidence intervals 1.4 – 38.9) for lesser black-backed gulls (REP5-059 Table 2.1). A review of population estimates in Norfolk and Suffolk, combined with use of the Scottish Natural Heritage (SNH) apportioning method suggested that 21% of the breeding season collisions at Norfolk Boreas would be attributed to the Alde Ore Estuary SPA population (REP2-035 paragraph 70), equating to 1.3 individuals (95% c.i.: 0.3 - 3.2; REP5-059 Table 2.7). Using Natural England’s preferred upper apportioning rate of 30% the equivalent breeding season collisions apportioned to the SPA would be 1.9 individuals (95% confidence intervals 0.4 – 4.6; REP5-059 Table 2.7).</p> <p>During the autumn and spring migration periods birds from Alde-Ore Estuary SPA make up 3.3% of the Biologically Defined Minimum Population Scales (BDMPS) population, and in winter these birds make up 5% of the BDMPS (5.03 HRA Norfolk Boreas paragraph 194). The total nonbreeding season mortality apportioned to the SPA was therefore 0.2 individuals (95% confidence intervals 0-0.6, REP5-059, Table 2.7). The total annual collision mortality is therefore between 1.6 (95% c.i. 0.3-3.9) using the Applicant’s breeding season figures and 2.1 (95% c.i. 0.4-5.3) using Natural England’s breeding season figures. Natural mortality for the SPA population (assuming approximately 4,000 adults) would be around 460 individuals at an average adult mortality rate of 11.5% (Horswill and Robinson 2015). A total additional worst case mean annual mortality of up to 1.6 (using the evidence-based breeding season rate of 21%; APP-201) or 2.1 (at Natural England’s precautionary rate of 30%) birds due to collisions at the Norfolk Boreas site would increase the mortality rate by 0.3% to 0.4%.</p> <p>Population modelling of slightly higher mortality rates of 10 and 15 individuals per year found that these levels of mortality would have a very small effect on the population growth rate (REP2-035 paragraph 75); at the upper mortality of 15, which is three times higher than the upper 95% confidence interval value of 5.3 obtained using Natural England’s precautionary methods, reduced the population growth rate by only 0.7%. Consequently, on the basis of the PVA in REP2-035 and the updated collision estimates in REP5-059 it can be concluded that there will be no adverse effect on the integrity of the Alde-Ore Estuary SPA as a result of lesser black-backed gull collisions at the proposed Norfolk Boreas project alone (REP2-035 paragraph 77).</p> <p>In-combination assessment suggests mortality of up to 54.2 birds attributable to the Alde-Ore SPA population of lesser black-backed gulls (calculated on the basis of the Alde-Ore proportion of the wider population of lesser black-backed gulls (ExA.AS-1.D6.V1 Table 2.3). Compared with estimated natural mortality of about 460</p>									

Name of European Site: Alde-Ore Estuary SPA and Ramsar

Distance to Norfolk Boreas Site: 92km

birds per year, the additional in-combination mortality would increase the mortality rate by 11.8%. However, this mortality rate falls to 34, equating to an increase in mortality of 7.4% if as-built wind farm designs are used in place of consented designs (REP2-035 paragraph 84).

A population model was developed (MacArthur Green 2019) to predict the consequences of additional mortality on the population. At an adult mortality of 55 the growth rate of the population was reduced by 0.3% to 1.4% (for density dependent and density independent simulations respectively) REP2-035 paragraph 87). At a mortality of 35 (reflecting the as-built estimate) the growth rate of the population was reduced by 0.2% to 0.9% (for density dependent and density independent simulations respectively; REP2-035 paragraph 87). Thus, even at the more precautionary, density independent prediction for a higher mortality of 55, based on consented rather than built wind farms and over-estimated nocturnal activity, the growth rate reduction was less than 1.5%. This is considered very unlikely to cause a population decline (REP2-035 paragraph 88).

The breeding success, and hence the population trend, of lesser black-backed gulls in the Alde-Ore Estuary SPA population appears to be mainly determined by the amount of predation, disturbance and flooding occurring at this site (Department of Energy and Climate Change 2013a, Thaxter et al. 2015, 5.03 HRA Norfolk Boreas paragraph 217). Increased predation and disturbance by foxes has been considered the main factor causing reductions in breeding numbers. Management measures to reduce access by foxes has resulted in some recovery in the numbers of gulls. The main driver of gull numbers in this SPA therefore appears to be suitable management at the colonies to protect gulls from predators (Department of Energy and Climate Change 2013a). This aspect, taken together with the degree of precaution in reported collision assessments for other offshore wind farms, including the use of the much higher mortality predictions estimated for consented wind farm designs rather than for the as built wind farm designs, means the likelihood of an adverse effect on the integrity of the SPA due to in-combination collisions of lesser black-backed gulls is considered sufficiently small that it can be ruled out (REP2-035 paragraphs 89 – 90 and ExA.AS-1.D6.V1). It is also of note that the Galloper wind farm was consented on the basis of in-combination collision risk estimates of between 119 (the applicant's estimate) and 357 (Natural England's estimate), which even at the lower end is twice the current in-combination estimate of 54.

## 2.2 Breydon Water SPA and Ramsar

Name of European Site: Breydon Water SPA and Ramsar												
Distance to Norfolk Boreas 76km												
Site Features (SPA) / Criterion (Ramsar)	Adverse Effect on Integrity due to Norfolk Boreas											
	Collision mortality			Displacement/Disturbance			Barrier Effect			Cumulative/In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D
SPA features												
Bewick's swan <i>Cygnus columbianus bewickii</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Avocet <i>Recurvirostra avosetta</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Golden Plover <i>Pluvialis apricaria</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Ruff <i>Philomachus pugnax</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Lapwing <i>Vanellus vanellus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Common tern <i>Sterna hirundo</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Waterbird assemblage		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Ramsar features												
Bewick's swan <i>Cygnus columbianus bewickii</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Avocet <i>Recurvirostra avosetta</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Golden Plover <i>Pluvialis apricaria</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Ruff <i>Philomachus pugnax</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Lapwing <i>Vanellus vanellus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Common tern <i>Sterna hirundo</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A

Black-tailed godwit <i>Limosa limosa islandica</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Shoveler <i>Anas clypeata</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Wigeon <i>Anas penelope</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
White-fronted goose <i>Anser albifrons albifrons</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Cormorant <i>Phalacrocorax carbo</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Waterbird assemblage		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
<p>(a) Migrant collision risk modelling undertaken for all the species with potential for connectivity to Norfolk Boreas on passage found that predicted collisions apportioned to this SPA and Ramsar were very small, with none exceeding more than one individual per year (Norfolk Boreas ES Technical Appendix 13.1 Annex 7, paragraph 15). These levels of additional mortality would not increase the background mortality rate by more than 1% and would therefore be undetectable against natural variations. It can therefore be concluded that there would be no adverse effect on the integrity of Breydon Water SPA and Ramsar as a result of collisions at Norfolk Boreas alone. In-combination collision mortality with the adjacent Norfolk Vanguard and East Anglia THREE project were similarly very small (increases in background mortality rates remained less than 1%, Norfolk Boreas ES Technical Appendix 13.1 Annex 7, paragraph 17) leading to the same conclusion of no adverse effect on the integrity of Breydon Water SPA and Ramsar as a result of collisions at Norfolk Boreas in-combination with other plans and projects (Norfolk Boreas ES Technical Appendix 13.1 Annex 7, paragraph 17).</p>												

## 2.3 Broadland SPA and Ramsar (offshore)

Name of European Site: Broadland SPA and Ramsar												
Distance to Norfolk Boreas Site 76km (offshore project area)												
Site Features / Criterion	Adverse Effect on Integrity due to Norfolk Boreas											
	Collision mortality			Displacement/Disturbance			Barrier Effect			Cumulative/In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D
SPA features												
Bittern <i>Botaurus stellaris</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Marsh harrier <i>Circus aeruginosus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Hen harrier <i>Circus cyaneus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Bewick's swan <i>Cygnus columbianus bewickii</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Whooper swan <i>Cygnus cygnus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Ruff <i>Philomachus pugnax</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Gadwall <i>Anas strepera</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Shoveler <i>Anas clypeata</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Wigeon <i>Anas penelope</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Ramsar features												
Bewick's swan <i>Cygnus columbianus bewickii</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Gadwall <i>Anas strepera</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Pink-footed goose <i>Anser brachyrhynchus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Shoveler <i>Anas clypeata</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Wigeon <i>Anas penelope</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A

Marsh harrier <i>Circus aeruginosus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Savi's warblers <i>Locustella luscinioides</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Cetti's warbler <i>Cetti cetti</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Bearded tit <i>Panurus biarmicus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Garganey <i>Anas querquedula</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Pochard <i>Aythya ferina</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Bittern <i>Botaurus stellaris</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A

(a) Migrant collision risk modelling undertaken for all the species with potential for connectivity to Norfolk Boreas on passage found that predicted collisions apportioned to this SPA and Ramsar were very small, with none exceeding more than one individual per year (Norfolk Boreas ES Technical Appendix 13.1 Annex 7, paragraph 15). These levels of additional mortality would not increase the background mortality rate by more than 1% and would therefore be undetectable against natural variations. It can therefore be concluded that there would be no adverse effect on the integrity of Broadland SPA and Ramsar as a result of collisions at Norfolk Boreas alone. In-combination collision mortality with the adjacent Norfolk Vanguard and East Anglia THREE project were similarly very small (increases in background mortality rates remained less than 1%, Norfolk Boreas ES Technical Appendix 13.1 Annex 7, paragraph 17) leading to the same conclusion of no adverse effect on the integrity of Broadland SPA as a result of collisions at Norfolk Boreas in-combination with other plans and projects (Norfolk Boreas ES Technical Appendix 13.1 Annex 7, paragraph 17).

## 2.4 Broadland SPA and Ramsar (onshore)

Name of European Site: Broadland SPA and Ramsar											
Distance to Norfolk Boreas 4.5km (onshore project area)											
Site Features / Criterion	Adverse Effect on Integrity due to Norfolk Boreas										
	Direct effects on ex-situ habitats			Indirect effects on ex-situ habitats			In-combination				
	C	O	D	C	O	D	C	O	D		
SPA features											
Bewick's Swan ( <i>Cygnus columbianus bewickii</i> )	<b>N (a)</b>		<b>N (a)</b>	<b>N (a)</b>		<b>N (a)</b>	<b>N (b)</b>		<b>N (b)</b>		



Name of European Site: Broadland SPA and Ramsar									
Distance to Norfolk Boreas 4.5km (onshore project area)									
Whooper Swan ( <i>Cygnus cygnus</i> )	N (a)		N (a)	N (a)		N (a)	N (b)		N (b)
Pink-footed Goose ( <i>Anser brachyrhynchus</i> )	N (a)		N (a)	N (a)		N (a)	N (b)		N (b)
Wildfowl assemblage	N (a)		N (a)	N (a)		N (a)	N (b)		N (b)
Ramsar features									
Tundra Swan ( <i>Cygnus columbianus</i> )	N (a)		N (a)	N (a)		N (a)	N (b)		N (b)
Pink-footed goose ( <i>Anser brachyrhynchus</i> )	N (a)		N (a)	N (a)		N (a)	N (b)		N (b)
Greylag goose ( <i>Anser anser</i> )	N (a)		N (a)	N (a)		N (a)	N (b)		N (b)
<p>a) The Applicant's position is that there are no likely significant effects which are anticipated to arise in relation to the qualifying features of the Broadland SPA / Ramsar site. This position is set out with Appendix 5.2 of the Information to support HRA report (document reference 5.3), and this site is not assessed further within the Information to Support HRA report (document reference 5.3). Natural England's position is that LSE cannot be ruled out for swan and geese qualifying features of the site, due to the temporary loss of crop stubble which provides overwintering habitat for these species. Following consultation with Natural England during the Norfolk Vanguard examination process, an agreement has been reached to undertake mitigation to ensure that, if these species should be using arable land within the onshore project area, then effects upon these features is reduced as far as possible. This mitigation includes only working on one section of the onshore project located within the Broadland SPA study area at any one time, and providing an alternative food source (e.g. chopped sugar beet residue (tops)) in the section which is not subject to works. This approach is secured within the Outline Landscape and Ecological Management Strategy (document reference 8.7), which provides full details of this agreed mitigation.</p> <p>b) The in-combination assessment for the onshore elements of the assessment for potential for adverse effect upon site integrity has adopted the following principle: in order for Norfolk Boreas to be considered to have the potential to contribute to in-combination effects, there must be sufficient cause to consider that a relevant habitat or species is sensitive to effects due to the project alone. If a potential for adverse effect upon site integrity is not determined with respect to a site due to Norfolk Boreas alone, there is no real prospect of an in-combination effect occurring with another plan or project (see section 9.3.1.4 of the Information to support HRA report). Therefore, under Scenarios 1 and 2 as there is no effect from Norfolk Boreas alone, there is no potential for in-combination effects.</p>									

## 2.5 Flamborough and Filey Coast SPA

Name of European Site: Flamborough & Filey Coast SPA									
Distance to Norfolk Boreas Site: 205km									
Site Features	Adverse Effect on Integrity due to Norfolk Boreas								
	Collision mortality (in-combination)			Displacement/Disturbance (in-combination)			Barrier Effect		
	C	O	D	C	O	D	C	O	D
Breeding kittiwake		<b>N (a)</b>							
Breeding gannet		<b>N (b)</b>			<b>N (c, f)</b>				
Breeding razorbill					<b>N (d)</b>				
Breeding guillemot					<b>N (e)</b>				
Seabird assemblage		<b>N (g)</b>			<b>N (h)</b>				

a) Collision mortality of kittiwakes at the Norfolk Boreas site was estimated at 57.5 birds per year (REP5-059 Table 2.1). The breeding season apportioning rate used in the original assessment (APP-201), estimated from a review of tracking data and other available evidence was a precautionary estimate of 26.1%. In their Relevant Representation (REP-099), Natural England advised that an estimate of 86% was appropriate for FFC SPA. Using the Applicant's rate of 26.1% for the breeding season, the number of kittiwakes apportioned to the Flamborough & Filey Coast SPA population was 6.1 (95% confidence intervals 2.1 – 11.5, REP5-059 Table 2.6) while using Natural England's preferred methods the estimate was 14.0 (95% confidence intervals 4.2 – 27.9; REP5-059 Table 2.6). The background mortality for this population, calculated using the adult mortality rate of 0.146 (Horswill and Robinson 2015) is 13,000. Addition of 6.1 to 14.0 to this increases the background mortality by <0.1% to 0.1%, which represents a negligible addition to natural mortality even allowing for Natural England's preferred precautionary apportioning rate of 86%. Kittiwake collision mortality due to Norfolk Boreas alone will therefore have no adverse effect on the integrity of this SPA (REP5-059, REP2-035 paragraph 44).

The in-combination assessment suggests a collision mortality of between 701 (including Hornsea Projects Three and Four) and 362 without these two projects (ExA.AS-1.D6.V1 Table 2.2). At the adult mortality rate of 0.146, the natural mortality of the population is 13,000. An addition of between 362 and up to 701 to this would increase the mortality rate by 2.8% to 5.4%. Precautionary, density independent population modelling has found that mortality of 750 would reduce the median population growth rate by a maximum of 0.8% (note the reduction in growth rate is 0.2% with the inclusion of density dependence, REP2-035 paragraph 51). These reductions represent a very small risk to the population, which has grown over the last 20 years (REP2-035 paragraph 54). When allowance is made for the over-precaution in the assessment (e.g. consented designs compared with as-built, over-estimated nocturnal activity rates and density independent model predictions) the predicted impacts on the population are very small (no more than a 0.1% reduction in the population growth rate). Therefore, it can be concluded that, even with these highly precautionary assumptions, there will be no adverse effect on the integrity of Flamborough & Filey Coast SPA from impacts on kittiwake due to Norfolk Boreas in-combination with other plans and projects (REP2-035, paragraph 58). In addition, Hornsea Project Three has submitted further design

Name of European Site: Flamborough & Filey Coast SPA

Distance to Norfolk Boreas Site: 205km

mitigations which reduce that project's contribution to the in-combination total by over 100 collisions per year ([https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-003194-HOW03\\_CON02\\_Appendix4%20Annexes\\_Mitigation.EnvelopeModifications.pdf](https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-003194-HOW03_CON02_Appendix4%20Annexes_Mitigation.EnvelopeModifications.pdf)).

b) Collision mortality of gannets at the Norfolk Boreas site was estimated at 30.7 birds per year (95% confidence intervals 8.5 – 62.6; REP5-059 Table 2.1). Apportioning to the Flamborough and Filey Coast SPA population gives an annual mortality of 15.1 individuals (95% confidence intervals 1.1 – 36.3 REP5-059 Table 2.5), from a population of approximately 22,122 birds (5.03 Norfolk Boreas HRA, paragraph 229). At an adult natural mortality rate of 0.081, the baseline mortality is approximately 1,792. An addition of 15.1 to this increases the mortality rate by 0.8%. This is below the 1% threshold of detectability therefore this would not result in an AEoI on the Flamborough and Filey Coast SPA.

The in-combination assessment suggests a maximum collision mortality of 359 birds from Flamborough & Filey Coast SPA population per year with the inclusion of Hornsea Projects Three and Four and 288 without these two projects (ExA.AS-1.D6.V1, Table 2.1). Precautionary, density independent population modelling for higher levels of 325 and 400 (REP2-035 Table 3.4) has found that these levels of mortality would reduce the median population growth rate by a maximum of 1.8%, which compares with the actual annual growth rate of this population over the last 25 years of 10% (REP2-035 paragraph 24). This indicates that this level of in-combination mortality represents a negligible risk to this population. The number of predicted in-combination gannet collisions attributed to the Flamborough & Filey Coast SPA is not at a level which would trigger a risk of population decline, and population modelling in fact indicates that the in-combination mortality predicted would only slow, rather than halt, the population increase currently seen at this colony. Therefore, even with this highly precautionary assessment it can be concluded that there will be no adverse effect on the integrity of Flamborough & Filey Coast SPA from impacts on gannet due to Norfolk Boreas in-combination with other projects (REP2-035 paragraph 27).

c) Annual displacement mortality of gannet at Norfolk Boreas apportioned to the Flamborough and Filey Coast SPA population was estimated for 60% displaced and 1% mortality at 8.1 (95% confidence intervals of 0.5 - 17) and for 80% displaced and 1% mortality at 10.8 (95% c.i. 0.7 – 23) (REP2-035 paragraph 239). This would increase the background mortality by a maximum of 1.3%, with the most precautionary combination of parameters (80% displaced, 1% mortality and upper 95% c.i.; REP2-035 paragraph 239). Precautionary, density independent population modelling has found that this level of mortality would reduce the median population growth rate by a maximum of 0.01%, which compares with the actual annual growth rate of this population over the last 25 years of 10% REP2-035 paragraph 242). This indicates that this level of in-combination mortality represents a negligible risk to this population. It is therefore reasonable to conclude that there will be no adverse effect on the integrity of Flamborough and Filey Coast SPA as a result of gannet displacement from Norfolk Boreas alone (REP2-035 paragraph 246).

In-combination displacement mortality of gannets apportioned to the Flamborough and Filey Coast SPA population was estimated at between 61 (60% displaced, 1% mortality) and 82 (80% displaced, 1% mortality) when Hornsea Projects Three and Four are included and between 41 and 55 with these projects omitted (REP2-035 Table 4.18). These would increase the background mortality by a maximum of between 2.3% and 3.1% (without Hornsea Projects Three and Four) and between 3.4% and 4.6% (including Hornsea Projects Three and Four; REP2-035 paragraph 255). Precautionary, density independent population modelling has found that these levels of mortality would reduce the median population growth rate by a maximum of 0.03%, which compares with the actual annual growth rate of this population over the last 25 years of 10% (REP2-035 paragraph 259). This indicates that this level of in-combination mortality represents a negligible risk to this population. It is

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Distance to Norfolk Boreas Site: 205km

therefore reasonable to conclude that, even with this highly precautionary assessment, there will be no adverse effect on the integrity of Flamborough and Filey Coast SPA as a result of gannet displacement from Norfolk Boreas in-combination with other plans and projects (REP2-035 paragraph 262).

d) Annual displacement mortality of razorbills at Norfolk Boreas apportioned to the Flamborough and Filey Coast SPA population was estimated at between 0.1 (30% displaced, 1% mortality and 95% confidence intervals 0-0.2) and 3.5 (70% displaced, 10% mortality and 95% confidence intervals 1.0-5.7) with an evidence based estimate of 0.2 (50% displaced, 1% mortality and 95% confidence intervals 0.1-0.4) (REP2-035 Table 4.9 and paragraph 207). This would increase the background mortality by a maximum of 0.26% (REP2-035 paragraph 207) which is less than the threshold for detectability (1%). It is therefore reasonable to conclude that there will be no adverse effect on the integrity of Flamborough and Filey Coast SPA as a result of razorbill displacement from Norfolk Boreas alone (REP2-035 paragraph 207).

In-combination displacement mortality of razorbills apportioned to the Flamborough and Filey Coast SPA population was estimated at between 21 (30% displaced, 1% mortality) and 497 (70% displaced, 10% mortality) with an evidence based estimate of 35 (50% displaced, 1% mortality) (REP2-035 Table 4.12). This would increase the background mortality by a maximum of 18.9% (REP2-035 paragraphs 216-217). Precautionary, density independent population modelling has found that mortality up to 500 would reduce the median population growth rate by a maximum of 2.4%, which compares with the actual annual growth rate of this population between 2000 and 2017 of 7.2% (REP2-035 Table 4.13). This indicates that this level of in-combination mortality represents a negligible risk to this population's status. The number of predicted in-combination razorbill displacement mortalities attributed to the Flamborough & Filey Coast SPA is not at a level which would trigger a risk of population decline. Therefore, even with this highly precautionary assessment, it can be concluded that there will be no adverse effect on the integrity of Flamborough & Filey Coast SPA from displacement impacts on razorbill due to Norfolk Boreas in-combination with other plans and projects (REP2-035 paragraphs 225-226).

e) Annual displacement mortality of guillemots at Norfolk Boreas apportioned to the Flamborough and Filey Coast SPA population was estimated at between 1.8 (30% displaced, 1% mortality and 95% confidence intervals 1.1-2.6) and 42.4 (70% displaced, 10% mortality and 95% confidence intervals 25.1-60.5) with an evidence based estimate of 3.0 (50% displaced, 1% mortality and 95% confidence intervals 1.8-4.3) (REP2-035 Table 4.3). This would increase the background mortality by a maximum of 1.2% (REP2-035). Precautionary, density independent population modelling has found that a mortality of 100 would reduce the median population growth rate by a maximum of 0.1% (REP2-035, Table 4.4), which compares with the actual annual growth rate of this population between 2000 and 2008 of 3% and between 2008 and 2017 of 4% (RSPB unpubl. Report 2017; REP2-035 paragraph 168). It is therefore reasonable to conclude that there will be no adverse effect on the integrity of Flamborough and Filey Coast SPA as a result of guillemot displacement from Norfolk Boreas alone (REP2-035 paragraph 171).

In-combination displacement mortality of guillemots apportioned to the Flamborough and Filey Coast SPA population was estimated at between 130 (30% displaced, 1% mortality) and 3,037 (70% displaced, 10% mortality) with an evidence based estimate of 217 (50% displaced, 1% mortality) (REP2-035 Table 4.7). This would increase the background mortality by more than 1%, therefore further assessment was conducted. Precautionary, density independent population modelling estimated that at a mortality of 3,050 the median population growth rate would be reduced by a maximum of 4.1% (REP2-035, Table 4.8), while with the Hornsea Project Three and Project Four wind farms omitted the total in-combination mortality would be 1,697 (at 70% displaced and 10% mortality, Table 4.7), which was found to reduce the population growth rate by 2.3% (REP2-035, Table 4.8). These compare with the actual annual growth rate of this population between 2000 and

2008 of 3.0% and between 2008 and 2017 of 4.0% (REP2-035 paragraph 188). Therefore, the most precautionary prediction would reduce the population growth rate but not result in a population decline. However, given the highly precautionary nature of the methods recommended by Natural England, which at 10% mortality potentially over estimates the impact by a factor of ten, and the fact that Natural England themselves have noted that mortality is unlikely to be at the upper end of the 1% to 10% scale, it is very probable that the effect on the population will be considerably smaller and will not prevent future growth. For example, the evidence-based mortality (using 50% displaced and 1% mortality) for all wind farms was 217 (i.e. including Hornsea Project Three and Project Four). At a mortality of 200, the predicted reduction in the growth rate was 0.27% (0.9973; REP2-035 Table 4.8). Thus, it is clear that this much smaller, evidence-based impact magnitude, would result in no detectable effect on the population growth rate. This indicates that this level of in-combination mortality represents a negligible risk to this population. The number of predicted in-combination guillemot displacement mortalities attributed to the Flamborough & Filey Coast SPA is not at a level which would trigger a risk of population decline. Therefore, it can be concluded that there will be no adverse effect on the integrity of Flamborough & Filey Coast SPA from displacement impacts on guillemot due to Norfolk Boreas in-combination with other projects (REP2-035 paragraph 190).

f) Combined annual gannet displacement and collision mortality (as requested by Natural England) for Norfolk Boreas alone for the Flamborough and Filey Coast SPA population gave a mortality estimate of up to 26 (displacement of 8.1-10.8 from REP2-035 Table 4.14, plus 15.1 collisions REP5-059 Table 2.5). This would increase the background mortality rate by 1.4%. Precautionary, density independent population modelling has found that a mortality of 75 (i.e. three times higher) would reduce the median population growth rate by a maximum of 0.3%, which compares with the actual annual growth rate of this population over the last 25 years of 10% (REP2-035 paragraph 271-272). This indicates that this level of mortality represents a negligible risk to the population. The number of predicted project alone gannet collisions and displacement mortalities attributed to the Flamborough & Filey Coast SPA is not at a level which would trigger a risk of population decline, and population modelling in fact indicates that the predicted mortality would only slow, rather than halt, the population increase currently seen at this colony. Therefore, it can be concluded that there will be no adverse effect on the integrity of Flamborough & Filey Coast SPA from impacts on gannet due to this highly precautionary combined assessment of displacement and collision risk for Norfolk Boreas (REP2-035 paragraph 275).

Combined annual gannet displacement and collision mortality (as requested by Natural England) for all projects with potential connectivity to the Flamborough and Filey Coast SPA gave a mortality estimate range of 343 to 441 (displacement of 41-55 without Hornsea Projects Three and Four and 61-82 with Hornsea Projects Three and Four, REP2-035; and collisions of 288 and 359, without Hornsea Projects Three and Four and with Hornsea Projects Three and Four respectively, ExA.AS-1.D6.V1, Table 2.1). These would increase the background mortality rate by more than 1%. Precautionary, density independent population modelling for 375 and 500 (REP2-035, Table 4.24) has found that the median population growth rate would be reduced by a maximum of 2.3%, which compares with the actual annual growth rate of this population over the last 25 years of 10% (REP2-035 paragraph 291). This indicates that this level of in-combination mortality represents a negligible risk to this population's status. The number of predicted in-combination gannet collisions and displacement mortalities attributed to the Flamborough & Filey Coast SPA is not at a level which would trigger a risk of population decline, and population modelling in fact indicates that the in-combination mortality predicted would only slow, rather than halt, the population increase currently seen at this colony. Therefore, it can be concluded that there will be no adverse effect on the integrity of Flamborough & Filey Coast SPA from impacts on gannet due to this highly precautionary combined assessment of displacement and collision risk for Norfolk Boreas in-combination with other projects (REP2-035 paragraph 294).

g) The seabird assemblage comprises gannet, fulmar, kittiwake, guillemot, razorbill, puffin, herring gull, shag and cormorant. Four of these species have been assessed as individual named features (gannet, kittiwake, guillemot and razorbill) as discussed above and it has been concluded that there will be no adverse effects on integrity for these species due to Norfolk Boreas alone. The remaining assemblage species are considered to either have no likelihood of connectivity (herring gull,

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Distance to Norfolk Boreas Site: 205km

shag and cormorant) due to limited foraging ranges or coastal preferences, not considered to be at risk of impacts at wind farms (fulmar, which flies at very low levels and therefore has negligible collision risk and is not considered to be at risk of displacement) or were recorded in such low numbers (puffin, with observations in February and March only and wind farm plus 2km abundances of 6 and 23 in these months respectively, which gives an apportioned Flamborough and Filey population of <0.1 individual) that there is no risk of an impact on the population. Therefore, on the basis that there are not considered to be any risks of adverse effects on the integrity of the Flamborough and Filey Coast SPA due to impacts on the individual components of the seabird assemblage feature it can be concluded that there will be no risk of adverse effects on the seabird assemblage feature itself (REP2-035 Section 4.6.1).

h) Since it has been concluded that impacts due to Norfolk Boreas will not result in any AEoI on any of the individual components of the seabird assemblage feature for which individual assessments have been undertaken (gannet, kittiwake, guillemot and razorbill), and the additional species (herring gull, fulmar, puffin, shag and cormorant) are not considered to be at risk of adverse effects (as outlined in (h)) it can therefore be concluded that there will not be an adverse effect on the integrity of the Flamborough and Filey Coast SPA due to an in-combination effect of Norfolk Boreas with other plans or projects on the seabird assemblage feature (REP2-035, Section 4.6.2).

## 2.6 Greater Wash SPA

Name of European Site: Greater Wash SPA

Distance to Norfolk Boreas Site: 36km (a)

Site Features	Adverse Effect on Integrity due to Norfolk Boreas								
	Collision mortality			Displacement/Disturbance			Barrier Effect		
	C	O	D	C	O	D	C	O	D
Nonbreeding red-throated divers				<b>N (b)</b>	<b>N (c)</b>				
Nonbreeding little gull		<b>N (d)</b>							
Nonbreeding common scoter				<b>N (e)</b>					

a) Note that this distance refers to the offshore wind farm itself. The export cable will pass through the SPA.

b) Cable laying operations during construction will disturb birds from the immediate vicinity of (up to two) cable-laying vessels (5.03 HRA Norfolk Boreas, paragraph 336). Assessment indicates that between 34 and 85 red-throated divers could be displaced at any one time during cable laying, but only if both vessels are operating within the SPA at the same time (5.03 HRA Norfolk Boreas, paragraph 338). This would lead to a 0.7% increase in diver density in other parts of the SPA, and on the



basis of a highly precautionary maximum mortality rate associated with the displacement of red-throated diver by vessels in the wintering period of 10% (i.e. 10% of displaced individuals suffer mortality as a direct consequence). This leads to a highly precautionary assumption that a single instance of displacement is equivalent to nearly half the total annual adult mortality rate. At this level of additional mortality, a maximum of between 4 and 8 birds could be at risk of mortality across the entire winter period (September to April) as a result of any potential displacement effects from the offshore cable installation activities. However, owing to the Rochdale envelope approach and the nature of the calculations employed, this almost certainly over-estimates the duration of cable laying by a factor of around 7, since even travelling at the minimum speed of 30m per hour, if a working day lasts for 12 hours the vessel would traverse the SPA in approximately 40 days (assuming the cable route through the SPA is around 15km). Baseline average mortality is 0.228, therefore the estimated natural mortality for the SPA population (1,407), would be 321. The addition of a maximum of 4 to 8 to this total during a single year would increase the mortality rate in that year by approximately 1.3% to 2.6% (5.03 HRA Norfolk Boreas, paragraph 345). However, as this is based on highly precautionary assumptions about the magnitude and impact of displacement and would only be expected to apply during a single nonbreeding season (and only then if cable laying by two vessels occurs simultaneously within the SPA during the nonbreeding period), it is reasonable to conclude that there will be no adverse effect on the integrity of the Greater Wash SPA as a result of red-throated diver displacement due to cable laying for Norfolk Boreas alone (5.03 HRA Norfolk Boreas, paragraph 346). There is potential that the export cable for Hornsea Project Three could be installed during the same period as for Norfolk Boreas (however it should be noted that the cable for Norfolk Vanguard would not be installed at the same time), giving rise to a potential in-combination effect. The in-combination mortality for Norfolk Boreas and Hornsea Project Three is between 6 and 10 individuals, although the likelihood of construction occurring over the same period is considered to be very small. The addition of a maximum of 6 to 10 to the baseline mortality of 300 during a single year would increase the mortality rate in that year by approximately 2% to 3.3%, while at the Applicant's evidence based rates this would be 0.3% (5.03 HRA Norfolk Boreas, paragraph 352). However, this assessment is based on a combination of highly precautionary assumptions about the magnitude and impact of displacement and the potential for temporal overlap between the projects. This in-combination effect would only be expected to occur during a single nonbreeding season, if both cable laying vessels planned for Norfolk Boreas are present at the same time, and this was also at the same time when those for Hornsea Project Three are present, and furthermore that this combination of events occurs within the SPA during the nonbreeding period (which is the least favoured period for such work due to less suitable weather conditions). If any of these conditions is not met, then there would not be an in-combination impact (5.03 HRA Norfolk Boreas, paragraph 354). Therefore, it is concluded that there is a negligible risk of an adverse effect on the integrity of the Greater Wash SPA due to this potential in-combination construction impact.

c) Natural England consider that vessels transiting the Greater Wash SPA between the operations and maintenance port (the location of which is not yet confirmed) and the wind farm site could cause disturbance to red-throated divers. However, for other recent projects Natural England has stated that their concerns would be removed if best practice management measures were put in place to minimise such risks (see Norfolk Vanguard assessment). The Applicant will engage with Natural England to ensure that such measures will be included in the DCO. As a consequence, there will be no adverse effect on the integrity of the Greater Wash SPA due to operation and maintenance vessel traffic (5.03 HRA Norfolk Boreas, paragraph 335).

d) Collision mortality of little gull at the Norfolk Boreas site was estimated to be 1.1 individuals with 95% confidence intervals of 0 – 3.9 (REP5-059, Table 2.1). The estimated regional population of little gull is approximately 10,000 to 20,000, of which the Greater Wash SPA population of 1,255 represents 6.3% to 12.6%. Collisions at Norfolk Boreas would therefore affect between 0.07 and 0.14 individuals from the Greater Wash SPA. This would increase the background mortality rate for the SPA population by less than 0.1% or up to 0.2% using the upper 95% c.i. estimate. This level of additional mortality due to collisions at Norfolk Boreas alone will have an undetectable effect on the population and would not result in an adverse effect on the integrity of the Greater Wash SPA (ExA; AS-1.D2.V1, paragraph 89) and this has been agreed by Natural England (REP4-039, Table 1). An in-combination assessment estimated the total collision mortality for wind farms in the southern North



Name of European Site: Greater Wash SPA

Distance to Norfolk Boreas Site: 36km (a)

Sea with potential connectivity to the Greater Wash SPA to be 61.4(REP5-059 , Table 2.6), of which a maximum of 7.7 would be attributed to the SPA population (61.4 x 12.6%). For wider population estimates of 10,000, 20,000 and 75,000 a mortality of 8 would increase the background mortality for the SPA population by 3.2%, 1.6% and 0.5% respectively (ExA; AS-1.D2.V1 ). This increase in mortality rate is based on consented wind farm designs rather than as-built ones. Updating for this, and also the recently revised design for Triton Knoll (turbine number reduction from 288 to 90) would therefore reduce the increase in background mortality to 1%, which would be undetectable against natural variations (ExA; AS-1.D2.V1 ). The Secretary of State assessed an in-combination total mortality of 7 for the Greater Wash SPA population in relation to the application for a non-material change at Triton Knoll and concluded that '*such a small impact would be undetectable in the SPA population*' (5.03 HRA Norfolk Boreas, paragraph 329). Thus, on the basis of the very small magnitude of impact on the little gull population of the Greater Wash SPA and given the extremely low level of impacts at the Norfolk Boreas site, it is considered that the project will not contribute to an in-combination impact. Thus, the likelihood of an adverse effect on the integrity of the Greater Wash SPA population of little gull can be ruled out for Norfolk Boreas in-combination with other plans and projects (ExA; AS-1.D2.V1 ).

e) There is potential for disturbance and displacement of non-breeding common scoter resulting from the presence of vessels installing the offshore cables for Norfolk Boreas through the Greater Wash SPA, however the offshore cable corridor does not pass through the species' boundary used for determining the SPA boundary (Natural England and JNCC 2016). The estimated density of common scoter within the section of the offshore cable corridor which traverses the Greater Wash SPA was in the range 0.0-0.7 birds/km<sup>2</sup>, which was the lowest density band identified (ExA; AS-1.D2.V1 , paragraph 252). The potential effect was based on a worst case assumption of 100% displacement within 2km of up to two cable laying vessels which gave a range of 0-18 birds at risk of displacement during up to two nonbreeding seasons (ExA; AS-1.D2.V1 , paragraph 254). Application of a highly precautionary range of mortality rates of between 1% and 10% suggests that between 0 and 2 individuals could die as a consequence in up to two nonbreeding seasons. This would increase the background mortality rate of the species by a maximum of 0.3% which would be undetectable against natural variations (ExA; AS-1.D2.V1 , paragraph 256). Therefore it is concluded that there is no risk of an adverse effect on the integrity of the Greater Wash SPA due to displacement of common scoter by cable installation vessels (ExA; AS-1.D2.V1 , paragraph 258).

## 2.7 Haisborough, Hammond and Winterton SAC

Name of European Site: Haisborough, Hammond and Winterton SAC															
Distance to Norfolk Boreas: 0km (cable route intersects the SAC)															
Site Features	Adverse Effect on Integrity due to Norfolk Boreas														
	Temporary physical disturbance			Permanent habitat loss			New substrate			Increased suspended sediment and smothering			In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Annex I Sandbank slightly covered by seawater all the time	N (a)	N (b)	N (h)		N (c)			N (c)					N (d)	N (d)	N (h)
Annex I Reef ( <i>Sabellaria spinulosa</i> reefs)	N (e, g)	N (b)	N (h)		N (c)			N (f)		N (g)		N (h)	N (d, e, g)	N (b, c, f)	N (h)
<p>a) The maximum area of temporary physical disturbance (2.45km<sup>2</sup>) due to cable laying operations, including pre-sweeping equates to 0.37% of the sandbanks<sup>1</sup> and 0.17% of the total area of the SAC<sup>2</sup>. Any additional area associated with sediment disposal will be a factor of the disposal areas to be agreed with the MMO in consultation with Natural England and as discussed above, deposited sediment will immediately re-join the local and regional sediment transport system. A sandwave study undertaken by ABPmer (Appendix 7.1 of the Information to Support HRA report) concluded that as the cable corridor is oriented in most cases transverse to the sand wave crests which require levelling, only a small width of each sand wave would be disturbed with the sand wave continuing to evolve and migrate along most of its length. As a result, the overall form and function of any particular sand wave, or the SAC sandbank system as a whole, would not be disrupted by cable installation activities. The cable corridor is in an active and highly dynamic environment, governed by current flow speeds, water depth and sediment supply, all of which are conducive for the development and maintenance of sandbanks. As a result, there would be no adverse effect on site integrity (see section 7.4.1.2 and 7.4.2.2 of the Information to support HRA report). Given the ephemeral nature of <i>Sabellaria spinulosa</i> and its potential for recovery with the HHW SAC between the point of consenting and cable installation, the Applicant originally proposed wording for Condition 9(1)(m) of Schedules 11 and 12 (the Transmission DMLs) of the draft DCO (document reference 3.1), that construction could not commence until the MMO was satisfied, in consultation with Natural England, that there was ‘no adverse effect beyond reasonable scientific doubt’ on the Haisborough, Hammond and Winterton (HHW) SAC. The condition required that a HHW SAC Site Integrity Plan (SIP), in accordance with the Outline HHW SAC SIP (document reference 8.20), was agreed with the MMO in consultation with</p>															

<sup>1</sup> The area of the Annex 1 Sandbank feature in the Haisborough, Hammond and Winterton SAC is 668.928km<sup>2</sup> (66,892.8ha) as quoted in the Natura 2000 Standard Data Form <http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=UK0030369>

<sup>2</sup> The Haisborough, Hammond and Winterton SAC is 1,467.59 km<sup>2</sup>

Name of European Site: Haisborough, Hammond and Winterton SAC

Distance to Norfolk Boreas: 0km (cable route intersects the SAC)

Natural England prior to construction. This was intended to provide comfort to the MMO and NE that a conclusion of no AEOI could be made at the consenting stage. However, following concerns raised in relation to this condition by both the MMO and NE, an alternative version of the condition has been proposed which does not require any further consideration of AEOI by the MMO, but still secures all mitigation originally proposed in the HHW SAC SIP, via a new HHW SAC Cable Specification Installation and Monitoring Plan. Both conditions (and their relevant mitigation plans) have been proposed as alternatives, and the plans are collectively referred to as the HHW SAC control document below.

The installation strategy for cables in the SAC would be to bury cables below the mobile sandwaves to avoid or minimise the requirement for routine re-burial of cables during the operational phase to ensure the effects are localised and temporary. Sediment arising from any pre-sweeping (a discrete dredging operation designed to lower the seabed level within a distinct identified channel to enable marine cables to be installed to a depth which reduces the risk of cable exposure and minimises the likelihood of reburial operations) within the SAC must be deposited within the SAC in accordance with section 5.4 of the HHW SAC control document (Document reference 8.20). The sandwave study by ABPmer (Appendix 7.1 of the Information to Support HRA Report) concluded that, as sediment will remain within the boundaries of the SAC within the natural limits, there will be no significant change to sandbank extent, topography and sediment composition. Once re-deposited on the seabed, the sediment will immediately re-join the local and regional sediment transport system and therefore the dredging and associated disposal will not affect the form or function of the sandbanks or the sandbank communities which are adapted to natural disturbance and are therefore likely to be able to recover within a few tidal cycles. The location(s) of sediment disposal will be informed by the pre-construction surveys and a primary aim of the sediment disposal strategy (i.e. locations and methodology for disposal) will be to facilitate recovery. Mitigation measures such as disposing of sediment as close to and updrift of where it was dredged from and using a fall pipe to ensure the accuracy of the disposal operations are secured within the outline HHW SAC control document (document reference 8.20). The cable installation strategy will also be informed by any available evidence regarding recovery from other relevant projects. The installation strategy including the sediment disposal strategy must be agreed with the MMO in consultation with Natural England through the HHW SAC control document (document reference 8.20) before works can commence.

- b) The Outline HHW SAC control document (document reference 8.20) shows that the aim of the installation strategy for cables in the SAC would be to bury cables below the mobile sandwaves (to a “seabed reference level”, below which sediment is not mobile) to avoid or minimise the requirement for routine re-burial of cables during the operational phase to ensure the effects are localised and temporary. The Information to Support HRA report (document 5.3) considers a worst case scenario disturbance area (which assumes cables have not been buried to the seabed reference level) for cable reburial activities within the SAC which equates to 0.4km<sup>2</sup> over the life of the project (0.03% of the total area of the SAC or 0.07% of the sandbank area). This is estimated using a worst case scenario of 4km per cable pair within the SAC, and a disturbance width of 10m. However, if reburial is required, it is likely that this would be for shorter sections (e.g. 1km) at any one time (see paragraph 476 of the Information to Support HRA report) and recovery of both *S.spinulosa* reef and Sandbanks would occur following reburial operations.

While it is not possible to determine the number and location of any repair works that may be required during the life of the project, an estimated average of one export cable repair every 10 years within the SAC is included in the Information to Support HRA (document reference 5.3). It is estimated that 300m sections would be removed and replaced per repair with a disturbance width of 10m and therefore an area of 3,000m<sup>2</sup> (0.003km<sup>2</sup>) per repair combined with

Name of European Site: Haisborough, Hammond and Winterton SAC

Distance to Norfolk Boreas: 0km (cable route intersects the SAC)

approximately 150m<sup>2</sup> for any anchor placement associated with repair works (based on 6 anchors per vessel). Due to the short term, temporary and small scale nature of any maintenance works (if required) there would be no effect on the form or function of the sandbank systems and the sandbank communities and *S.spinulosa* reef would rapidly recover. Therefore there would be no adverse effect on site integrity (see section 7.4.1.1.2 and 7.4.2.1.2 of the Information to support HRA report).

- c) The worst case total area of cable protection installed within the SAC could be 0.032km<sup>2</sup> which includes cable protection required for crossing existing cables as well as a contingency in the unlikely event that cable burial is not possible. Analysis of geophysical data has shown that the substrate along the vast majority of the offshore cable corridor is expected to be suitable for cable burial. Following its DCO application Norfolk Boreas Limited has committed to reducing the cable protection contingency. The total worst case scenario footprint of cable protection installed to protect cable which cannot be buried to the optimum depth now equates to less than 0.002% of the total area of the SAC (1,468km<sup>2</sup>)<sup>1</sup> and 0.004% of the area of sandbanks within the SAC (669km<sup>2</sup>)<sup>2</sup>. Due to the very small extent of potential persistent loss of Sandbank within the SAC, there would be no change to the physical processes associated with the sandbank form and function and no significant loss of the low abundance and low diversity sandbank communities. As a result, there would be no AEOI on the Annex 1 Sandbank. Further to the commitments made in the Norfolk Boreas DCO Application, Norfolk Boreas Limited has made commitments not to install any cable protection in the priority areas to be managed as *S.spinulosa* reef (shown as dark Purple in Figure 5.1 of the control document, document reference 8.20) identified by Natural England within the HHW SAC, unless otherwise agreed with the MMO in consultation with Natural England, and to decommission cable protection at the end of the project life where it is associated with unburied cables due to ground conditions (where required for crossings this will be left *in situ*). These two additional commitments ensure that areas to be managed as *S.spinulosa* reef will be avoided and that there will be no permanent habitat loss as a result of cable protection. This provides additional confidence to the conclusion of no AEOI of the HHW SAC. The commitment to 95% cable burial, avoidance of cable protection in areas to be managed as *S.spinulosa* reef, and decommissioning of cable protection were made by Norfolk Boreas Limited following the DCO application submission (11 June 2019) and therefore the Information to support HRA report (document reference 5.3) does not reflect these additional measures. However, informed by the permanent and larger area of impact, the assessment concluded no AEOI without these additional measures.
- d) Chapter 8 Marine Geology, Oceanography and Physical Processes of the Norfolk Boreas ES (DCO document reference 6.1.8) states that theoretical bed level changes of up to 2mm are estimated as a result of cumulative effects of Norfolk Boreas cable installation and dredging at nearby aggregate sites. This level of effect has no potential to affect the SAC and therefore the only project screened in to the in-combination assessment is Norfolk Vanguard. As Norfolk Boreas and Norfolk Vanguard share an offshore cable corridor there is potential for in-combination effects associated with construction, operation and maintenance, and decommissioning of the projects. It is likely that installation of the Norfolk Boreas export cables will follow the Norfolk Vanguard export cables with no temporal overlap. There will be a minimum separation of 75m between cable pairs (as shown in Figure 11 of the Export Cable Installation Study, ES Appendix 5.2) and the maximum width of disturbance from pre-sweeping is 37m (section 7.3.3.2.1 of the Information to Support HRA report), therefore there would be no repeated disturbance of the same footprint during construction. The spatial footprint of installation works for both Norfolk Boreas and Norfolk Vanguard is likely to be double that of Norfolk Boreas alone as a worst case scenario, however the Sandwave study by ABPmer (Appendix 7.1 of the Information to Support HRA report) considered Norfolk Boreas and Norfolk Vanguard, and as discussed above, the study concluded that as the cable corridor is oriented in most cases transverse to

Name of European Site: Haisborough, Hammond and Winterton SAC

Distance to Norfolk Boreas: 0km (cable route intersects the SAC)

the sand wave crests which require levelling, only a small width of each sand wave would be disturbed, with the sand wave continuing to evolve and migrate along most of its length. As a result, the overall form and function of any particular sand wave, or the SAC sandbank system as a whole, would not be disrupted by cable installation activities of Norfolk Boreas and Norfolk Vanguard. The cable corridor is in an active and highly dynamic environment, governed by current flow speeds, water depth and sediment supply, all of which are conducive for the development and maintenance of sandbanks and their biological communities. As a result, there would be no adverse effect on site integrity (see section 7.4.1.2 of the Information to support HRA report).

- e) Norfolk Boreas Limited have made the commitment to microsite around Annex I *S. spinulosa* reef wherever possible and have committed to not using Jack-up vessels within the HHW SAC. Due to the width available for micrositing to avoid Annex I *S. spinulosa* reef where identified during pre-construction surveys, and the fact that Jack-up vessel legs will not disturb the seabed, it is likely that no physical disturbance will occur in the offshore cable corridor. In the unlikely event of disturbance, *S. spinulosa* reef shows good recoverability to disturbance, depending on the degree of impact and local conditions. Due to the existing presence of *S. spinulosa* reef, local environmental conditions in the area are suitable for *S. spinulosa* reef growth and therefore recovery. Therefore, there would be no AEOI (see paragraphs 510 to 535 and 542 to 548 of the Information to support HRA report). Condition 9(1)(m) of Schedules 11 and 12 (the Transmission DMLs) of the draft DCO (document reference 3.1) requires that the cable route through the HHW SAC, including any micrositing must be agreed with the MMO in consultation with Natural England, in accordance with the Outline HHW SAC control document (document reference 8.20).
- f) Any new substrata created by cable protection may provide a larger area of substrate suitable for *S. spinulosa* colonisation than was previously present. Therefore, there will be no adverse effect on the integrity of the SAC in relation to the conservation objectives for Annex I *S. spinulosa* reefs due to introduction of a new substrate during operation (see paragraphs 549 to 558 of the Information to support HRA report). Norfolk Boreas Limited recognises that Natural England does not consider reef on artificial substrate (i.e. cable protection) to be Annex I reef, however Norfolk Boreas Limited maintains that any reef, regardless of what it is growing on, would have the same effect on biodiversity and would also provide spawning stock of *S. spinulosa* which would help to ensure re-establishment of reef on nearby natural substrates. The large area to be managed as reef which has been identified in relation to the DEFRA joint recommendation area is located on existing pipelines and Annex B of Natural England's Deadline 6 submission for Norfolk Vanguard's Examination, in relation to The Joint Nature Conservation Committee's and Natural England's advice to the MMO for protecting designated features in Haisborough Hammond and Winterton SCI/cSAC (document reference REP6-032) states that "*Sabellaria spinulosa* reef extent is identified along the Baird Bacton pipeline, as in the HHW SAC SAD [Selection Assessment Document] and Regulation 35 package".
- g) As part of the embedded mitigation, sediment would not be disposed of within 50m of *S. spinulosa* reef and therefore changes to the extent or structure of the reef due to increased suspended solids and smothering are not anticipated. The location(s) and methodology for disposal (i.e. release using a fall pipe) must be agreed with the MMO in consultation with Natural England before works can commence in accordance with the Outline HHW SAC control document (secured by Condition 9(1)(m) of Schedules 11 and 12 (the Transmission DMLs)) of the DCO. Therefore, there would be no AEOI (see paragraph 536 to 541 of the Information to support HRA report). It should be noted that the conclusions of information to support HRA (document reference 5.3) were made without the further commitments to use a fall pipe to ensure the accuracy of sediment disposal.
- h) It is expected that the potential effects during decommissioning will be no worse than construction. The effect of leaving infrastructure *in situ* is captured in the

**Name of European Site: Haisborough, Hammond and Winterton SAC**

**Distance to Norfolk Boreas: 0km (cable route intersects the SAC)**

consideration of permanent impacts above (see sections 7.4.1.1.3 and 7.4.2.1.3 of the Information to support HRA report). However, Norfolk Boreas Limited has made the commitment to decommission cable protection at the end of the project life where it is associated with unburied cables due to ground conditions and therefore removing any permanent effects.

## 2.8 Humber Estuary SAC

**Name of European Site: Humber Estuary SAC**

**Distance to Norfolk Boreas 112km**

Site Features	Adverse Effect on Integrity due to Norfolk Boreas																	
	Underwater Noise			Disturbance at seal haul out sites			Vessel interactions (collision risk)			Changes to water quality			Indirect effects through effects on prey species			In-combination effects		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Grey seal	<b>N(a)</b>	<b>N(b)</b>	<b>N(a)</b>	<b>N(c)</b>	<b>N(c)</b>	<b>N(c)</b>	<b>N(d)</b>	<b>N(d)</b>	<b>N(d)</b>	<b>N(e)</b>		<b>N(e)</b>	<b>N(f)</b>	<b>N(f)</b>	<b>N(f)</b>	<b>N(g)</b>	<b>N(g)</b>	<b>N(g)</b>

- The maximum potential area of disturbance is based on a 26km range for piling and Unexploded Ordnance (UXO). Any potential effects through the decommissioning phase are expected to be the same or less than those described above for construction. The Humber Estuary SAC is located 175km from Norfolk Boreas site and 112km from the offshore cable corridor (at its closest point). It is highly unlikely, especially taking into account the movements of tagged seals, that all grey seal in the offshore project area are from the Humber Estuary SAC. Therefore, there is no AEOI of the Humber Estuary SAC in relation to the conservation objectives for grey seal (see sections 8.3.3.1.1, 8.3.3.1.2, 8.3.3.1.3 and 8.3.3.1.5 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).
- Current data suggests that there is no lasting disturbance or exclusion of grey seal around wind farm sites during operation. In addition, as stated above, it is highly unlikely that all grey seal in the offshore project area are from the Humber Estuary SAC, therefore there is no AEOI of the Humber Estuary SAC in relation to the conservation objectives for grey seal (see section 8.3.3.1.4 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).
- Whether during construction, operation or decommissioning phases of the project, when approaching the port, vessels would likely be within existing shipping routes and would be highly unlikely to be within 300m of the coast where seals are hauled out, therefore there would be no potential to directly disturb seals hauled out at sites such as Donna Nook in the Humber Estuary SAC. Therefore, it is concluded that there would be no AEOI of the Humber

Name of European Site: Humber Estuary SAC

Distance to Norfolk Boreas 112km

- Estuary SAC in relation to the conservation objectives for grey seal (see section 8.3.3.2 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).
- d) Approximately 1,180 vessel movements are estimated over the two to four year indicative offshore construction window, an average of approximately two movements per day. Therefore, the increase in vessel movements during construction would be relatively small compared to existing vessel traffic. It is expected that seals would be able to detect the presence of vessels and, given that they are highly mobile, would be able to largely avoid vessel collision. Taking into account good practice, any increased collision risk is highly unlikely. Therefore, it is concluded that there would be no AEOI of the Humber Estuary SAC in relation to the conservation objectives for grey seal (see section 8.3.3.3 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).
  - e) The risk of any changes to water quality as a result of any accidental release of contaminants (e.g. through spillage or vessel collision) is negligible and the re-suspension of contaminated sediment from construction activities is anticipated to be negligible. Any increase in suspended sediments as a result of construction activities, such as installation of foundations, cable installation and during any levelling or dredging activities, would be temporary and over a relatively small area, as the majority of the sediment released during seabed preparation would be coarse and would fall within seconds / minutes to the seabed as a highly turbid dynamic plume immediately upon its discharge (within tens of metres along the axis of tidal flow). Therefore, any changes to water quality during construction or decommissioning is highly unlikely to have a significant, if any, impact on foraging grey seal. Therefore, it is concluded that there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (see section 8.3.3.5 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).
  - f) The maximum (worst-case scenario) potential area of physical disturbance and/or temporary loss of habitat to fish during construction could be 15.4km<sup>2</sup> in total for the wind farm site and the total area of potential habitat loss during construction is estimated to be up to 23.31km<sup>2</sup>. During operation, the worst-case total area of habitat loss has been estimated to be up to 11.75km<sup>2</sup> in total. The potential for effect on prey from any increased suspended sediment concentrations and sediment re-deposition would be low, with only a small proportion of fine sand and mud staying in suspension long enough to form a passive plume. Any increase in noise above background noise levels during operation is expected to be negligible and localised, therefore there would be no significant effect on fish species. Electromagnetic Fields are expected to attenuate rapidly in both horizontal and vertical planes with distance from the source. Therefore, there is no AEOI of the Humber Estuary SAC in relation to the conservation objectives for grey seal (see section 8.3.3.6 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).
  - g) Given the wide range of locations over the southern North Sea area used in the in-combination assessment, it is highly unlikely that the grey seal that could potentially be disturbed would all be from the Humber Estuary SAC. In addition, considering the distance between the projects offshore and their distance from the coast, it is not anticipated that foraging grey seal would be significantly displaced from foraging areas or moving between haul-out sites and foraging areas, therefore there is no AEOI of the Humber Estuary SAC in relation to the conservation objectives for grey seal (see section 8.3.3.1.6 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).



## 2.9 Klaverbank SAC

Name of European Site: Klaverbank SAC																		
Distance to Norfolk Boreas: 67km																		
Site Features	Adverse Effect on Integrity due to Norfolk Boreas																	
	Underwater noise			Disturbance at seal haul-out sites			Vessel interactions			Indirect effects through effects on prey			Changes in water quality			In-combination effects		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Grey seal	<b>N(a)</b>	<b>N(a)</b>	<b>N(a)</b>															
Harbour seal	<b>N(a)</b>	<b>N(a)</b>	<b>N(a)</b>															
<p>a) In total, piling at offshore windfarm projects, offshore wind farm construction activities and vessels, offshore wind farm operation and maintenance, including vessels, up to two UXO clearance operations, and up to two seismic surveys has a maximum total area of up to 19,440km<sup>2</sup>, as a worst-case scenario. Any potential effects through the decommissioning phase are expected to be the same or less than those described above for construction. Disturbance from in-combination effects, including Norfolk Boreas, of underwater noise is unlikely to have any significant disturbance or barrier effects for foraging harbour and grey seal, especially taking into account the SIP proposed for harbour porpoise in the Southern North Sea SAC. Under these circumstances, there is no AEOI of the Klaverbank SAC in relation to the conservation objectives for grey seal and harbour seal (see section 8.3.5 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3)).</p>																		

## 2.10 Noordzeekustzone SAC

Name of European Site: Noordzeekustzone SAC																		
Distance to Norfolk Boreas: 94km																		
Site Features	Adverse Effect on Integrity due to Norfolk Boreas																	
	Disturbance of seals foraging at sea			Disturbance at seal haul-out sites			Vessel interactions			Indirect effects on prey			Changes in water quality			In-combination effects		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Grey seal	<b>N(a)</b>	<b>N(a)</b>	<b>N(a)</b>															

Name of European Site: Noordzeekustzone SAC																		
Distance to Norfolk Boreas: 94km																		
Site Features	Adverse Effect on Integrity due to Norfolk Boreas																	
	Disturbance of seals foraging at sea			Disturbance at seal haul-out sites			Vessel interactions			Indirect effects on prey			Changes in water quality			In-combination effects		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
<p>a) In total, piling at offshore windfarm projects, offshore windfarm construction activities and vessels, offshore windfarm operation and maintenance, including vessels, up to two UXO clearance operations, and up to two seismic surveys has a maximum total area of up to 19,440km<sup>2</sup>, as a worst-case scenario. Any potential effects through the decommissioning phase are expected to be the same or less than those described above for construction. Disturbance from in-combination effects, including Norfolk Boreas, of underwater noise is unlikely to have any significant disturbance or barrier effects for foraging grey seal, especially taking into account the SIP proposed for harbour porpoise in the Southern North Sea SAC. Under these circumstances, there is no AEOI of the Noordzeekustzone SAC in relation to the conservation objectives for grey seal (see section 8.3.5 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3)).</p>																		

## 2.11 Norfolk Valley Fens SAC

Name of European Site: Norfolk Valley Fens SAC						
Distance to Norfolk Boreas 0.6 – 5km (5 sites within 5km)						
Site Features	Adverse Effect on Integrity due to Norfolk Boreas					
	Indirect effects on features present within ex-situ habitats of the SAC arising from air quality and groundwater / hydrology effects			In-combination		
	C	O	D	C	O	D
Alkaline fens	<b>N (a)</b>	<b>N (a)</b>	<b>N (a)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (b)</b>
Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>	<b>N (a)</b>	<b>N (a)</b>	<b>N (a)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (b)</b>

**Name of European Site: Norfolk Valley Fens SAC**

**Distance to Norfolk Boreas 0.6 – 5km (5 sites within 5km)**

Calcareous fens <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i>	<b>N (a)</b>	<b>N (a)</b>	<b>N (a)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (b)</b>
European dry heaths	<b>N (a)</b>	<b>N (a)</b>	<b>N (a)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (b)</b>
Molinia meadows on calcareous, peaty or clayey-silt-laden soils	<b>N (a)</b>	<b>N (a)</b>	<b>N (a)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (b)</b>
Northern Atlantic wet heaths with <i>Erica tetralix</i>	<b>N (a)</b>	<b>N (a)</b>	<b>N (a)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (b)</b>

- a) Out of the five component SSSIs, only one (Booton Common) has a functional connection to the onshore project area (see section 9.3.3.2 and Table 9.18 of the Information to support HRA report). Under Scenario 2, where the onshore cable route crosses two tributaries of the Blackwater Drain, trenched crossing techniques are proposed. Following construction at these locations, reinstatement of the trench would be conducted to the pre-construction depth of the watercourse and the dams removed. As water flow would be maintained, and given the distance of these sites from Booton Common, effects from trenching works at these locations upon the Blackwater Drain will be minimal. Furthermore, given that Booton Common is predominantly groundwater-fed from the underlying Chalk aquifer and there will be no excavation into or within 7m depth of the Chalk aquifer during construction of the works, there will be no direct and indirect interaction between cable installation works for Norfolk Boreas and the groundwater supply mechanisms to Booton Common (see section 9.3.3.2 and Figure 9.10 of the Information to support HRA report). Under Scenario 1, a haul road only is required within the catchment of the Blackwater Drain, so works are localised and fit within the design envelope for Scenario 2 (see section 9.3.3.2 of the Information to support HRA report). As a result, there would be no AEOI for either Scenario 1 or Scenario 2.

Under Scenarios 1 and 2, an air quality impact assessment in line with IAQM guidance (IAQM, 2014) has been conducted for Norfolk Boreas to understand the potential effects of dust and fine particle emissions. Booton Common is located approximately 1.4km south of the nearest access route for construction vehicles for the proposed project, and is located 600m from the onshore project area. As such, following IAQM guidance, it is considered to be outside the potential zone of influence of the project in terms of air quality emissions (see section 9.3.3.2 of the Information to support HRA report). As a result, there would be no AEOI for either Scenario 1 or Scenario 2.

- b) The in-combination assessment for the onshore elements of this assessment for potential for adverse effect upon site integrity has adopted the following principle: in order for Norfolk Boreas to be considered to have the potential to contribute to in-combination effects, there must be sufficient cause to consider that a relevant habitat or species is sensitive to effects due to the project itself. If a potential for adverse effect upon site integrity was not determined with respect to a site due to Norfolk Boreas, there is no real prospect of an in-combination effect occurring with another plan or project.

Name of European Site: Norfolk Valley Fens SAC

Distance to Norfolk Boreas 0.6 – 5km (5 sites within 5km)

Therefore, under Scenarios 1 and 2 as there is no effect from Norfolk Boreas alone, there is no potential for in-combination effects (see section 9.3.3.3 of the Information to support HRA report).

## 2.12 North Norfolk Coast SPA and Ramsar

Name of European Site: North Norfolk Coast SPA and Ramsar												
Distance to Norfolk Boreas 142km												
Site Features	Adverse Effect on Integrity due to Norfolk Vanguard											
	Collision mortality			Displacement/Disturbance			Barrier Effect			Cumulative/In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D
SPA features												
Avocet <i>Recurvirostra avosetta</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Bittern <i>Botaurus stellaris</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Common tern <i>Sterna hirundo</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Little tern <i>Sterna hirundo</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Marsh harrier <i>Circus aeruginosus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Montagu's harrier <i>Circus pygargus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Sandwich tern <i>Sterna sandvicensis</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Dark-bellied brent goose <i>Branta bernicla bernicla</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Knot <i>Calidris canutus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Pink-footed goose <i>Anser brachyrhynchus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A

Wigeon <i>Anas penelope</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Assemblage		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Ramsar features												
Little tern <i>Sterna albifrons</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Sandwich tern <i>Sterna sandvicensis</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Bar-tailed godwit <i>Limosa lapponica</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Dark-bellied brent goose <i>Branta bernicla bernicla</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Knot <i>Calidris canutus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Pink-footed goose <i>Anser brachyrhynchus</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Wigeon <i>Anas penelope</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Pintail <i>Anas acuta</i>		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A
Assemblage		N (a)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N (a)	N/A

a) Migrant collision risk modelling undertaken for all the species with potential for connectivity to Norfolk Boreas on passage found that predicted collisions apportioned to this SPA and Ramsar were very small, with none exceeding more than one individual per year (Norfolk Boreas ES Technical Appendix 13.1 Annex 7, paragraph 15). These levels of additional mortality would not increase the background mortality rate by more than 1% and would therefore be undetectable against natural variations. It can therefore be concluded that there would be no adverse effect on the integrity of North Norfolk Coast SPA and Ramsar as a result of collisions at Norfolk Boreas alone. In-combination collision mortality with the adjacent Norfolk Vanguard and East Anglia THREE project were similarly very small (increases in background mortality rates remained less than 1%, Norfolk Boreas ES Technical Appendix 13.1 Annex 7, paragraph 17) leading to the same conclusion of no adverse effect on the integrity of North Norfolk Coast SPA and Ramsar as a result of collisions at Norfolk Boreas in-combination with other plans and projects (Norfolk Boreas ES Technical Appendix 13.1 Annex 7, paragraph 17).

## 2.13 Outer Thames Estuary SPA

Name of European Site: Outer Thames Estuary SPA									
Distance to Norfolk Vanguard Site: 40km									
Site Features	Adverse Effect on Integrity due to Norfolk Vanguard								
	Collision mortality			Displacement/Disturbance			Barrier Effect		
	C	O	D	C	O	D	C	O	D
Nonbreeding red-throated divers	N/A	N/A	N/A	N/A	<b>N (a)</b>				
<p>a) Natural England consider that vessels transiting the Greater Wash SPA between the operations and maintenance port (the location of which is not yet confirmed) and the wind farm site could cause disturbance to red-throated divers. However, for other recent projects Natural England has stated that their concerns would be removed if best practice management measures were put in place to minimise such risks (see Norfolk Vanguard assessment). The Applicant will engage with Natural England to ensure that such measures will be included in the DCO. As a consequence, there will be no adverse effect on the integrity of the Greater Wash SPA due to operation and maintenance vessel traffic (5.03 HRA Norfolk Boreas, paragraph 355).</p>									

## 2.14 Paston Great Barn SAC

Name of European Site: Paston Great Barn SAC									
Distance to Norfolk Boreas 3km									
Site Features	Adverse Effect on Integrity due to proposed Norfolk Boreas project								
	Direct effects on barbastelle present in ex-situ habitats of the SAC (hedgerows / watercourses)			Indirect effects on barbastelle present within ex-situ habitats of the SAC (hedgerows / watercourses) arising from light and groundwater / hydrology effects			In-combination		
	C	O	D	C	O	D	C	O	D
Barbastelle bats	<b>N (a)</b>	<b>N (a)</b>	<b>N (a)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (c)</b>
<p>a) Under Scenario 2, hedgerows to be removed as part of pre-construction and construction works will be minimised by reducing the cable route working width at these locations to 13m (at perpendicular crossings with the cable) and a maximum of 16.5m (where the cable crosses at a diagonal). The hedgerow will be removed in advance of construction phase works at each important barbastelle feature, and the land will remain open during the construction phase works at each location (for approximately one week, with the exception of Dilham Canal and land east of Dilham Canal, where works will take place over up to eight weeks due to trenchless drilling techniques at this location). Hedgerows will be replanted following works at each location. To minimise the potential effect upon commuting and foraging barbastelle arising from this temporary loss of habitat, several mitigation measures will be implemented as set out in a Hedgerow Mitigation Plan to be agreed post-consent and Norfolk Boreas will seek to avoid mature trees within hedgerows through the micro-siting of individual cables where possible. Once replanted hedgerows have reached maturity (expected to be 3-7 years following planting on completion of construction), they will provide an improved commuting and foraging habitat for bats (see section 9.3.2.1 of the Information to support HRA report).</p> <p>Across the five important barbastelle habitat features potentially present within the onshore project area, a total of approximately 11ha of habitat used by barbastelles of the Paston Great Barn maternity colony is anticipated to be isolated by hedgerow removal during the project construction phase. This represents approximately 0.6% of the home range of the Paston Great Barn maternity colony (see section 9.3.2.1 and Table 9.15 of the Information to support HRA report).</p> <p>Following mitigation, these small-scale, temporary effects are not anticipated to result in any potential for adverse effect on site integrity upon the qualifying habitats and species of the Paston Great Barn SAC.</p> <p>Under Scenario 1, any hedgerow removal required within the onshore project area to facilitate construction of the Norfolk Boreas project will have been undertaken by the Norfolk Vanguard project. Approximately 20% of the running track originally installed to facilitate construction of Norfolk Vanguard is to remain in place to facilitate construction of Norfolk Boreas. This will include retention of a 6m gap in 20% of hedgerows along the route. These gaps will be reinstated following the same mitigation for Scenario 2. All UK bat species are considered able to traverse gaps of 10m or less, and retention of this 6m gap for up to 2 years following completion of the Norfolk Vanguard project is not anticipated to result in any potential for adverse effect on site integrity upon</p>									



Name of European Site: Paston Great Barn SAC

Distance to Norfolk Boreas 3km

the qualifying habitats and species of the Paston Great Barn SAC (see section 9.3.2.1 of the Information to support HRA report). Furthermore, no AEOL is anticipated to arise during decommissioning of Norfolk Boreas (see section 9.3.2.1.3 of the Information to support HRA report).

- b) Under Scenarios 1 and 2, the proposed works will involve ground excavation, and therefore will have a small, localised effect upon surface water flows. However, due to removal of hedgerows, commuting and foraging habitats will not be present in these locations during the construction phase, and therefore the habitat within this location will not be affected. Furthermore, a pre-construction drainage plan will also be developed and implemented to minimise water within the cable trench and ensure ongoing drainage of surrounding land (see section 9.3.2.1 of the Information to support HRA report). As a result, there would be no AEOL.

Under Scenarios 1 and 2, construction phase lighting for cable duct installation and cable jointing will be used between 7am-7pm, only if required (i.e. in low light conditions). Lighting will not be used overnight, except at trenchless crossing locations (Scenario 2 only). In these instances, lighting may be needed for eight weeks at Dilham Canal and land east of Dilham Canal. Any lighting used will be directional i.e. angled downwards and a cowl provided for the light to minimise light spill. There will be no lighting required during the operational phase of Norfolk Boreas (see section 9.3.2.1 of the Information to support HRA report). As a result, there would be no AEOL.

- c) The in-combination assessment for the onshore elements of this assessment for potential for adverse effect upon site integrity has adopted the following principle: in order for Norfolk Boreas to be considered to have the potential to contribute to in-combination effects, there must be sufficient cause to consider that a relevant habitat or species is sensitive to effects due to the project itself. If a potential for adverse effect upon site integrity was not determined with respect to a site due to Norfolk Boreas, there is no real prospect of an in-combination effect occurring with another plan or project (see section 9.3.2.2 of the Information to support HRA report). Therefore, under Scenarios 1 and 2 as there is no effect from Norfolk Boreas alone, there is no potential for in-combination effects.

## 2.15 River Wensum SAC

Name of European Site: River Wensum SAC															
Distance to Norfolk Boreas 0km (onshore cable route intersects the SAC)															
Site Features	Adverse Effect on Integrity due to Norfolk Boreas														
	Direct effects within the SAC boundary			Direct effects within ex-situ habitats of the SAC			Indirect effects within the SAC boundary arising from geology / contamination and groundwater / hydrology effects			Indirect effects within ex-situ habitats of the SAC arising from geology / contamination and groundwater / hydrology effects			In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation	<b>N (a)</b>	<b>N (a)</b>	<b>N (a)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (d)</b>	<b>N (d)</b>	<b>N (d)</b>
Desmoulin's whorl snail	<b>N (a)</b>	<b>N (a)</b>	<b>N (a)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (d)</b>	<b>N (d)</b>	<b>N (d)</b>
<p>a) The Applicant's position is that there are no direct likely significant effects which are anticipated to arise in relation to the qualifying features of the River Wensum SAC within the SAC boundary, due to the use of trenchless crossing techniques to install cables at this location. This position is set out within Appendix 5.2 of the Information to support HRA report (document reference 5.3), and direct effects are not assessed further within the Information to Support HRA report (document reference 5.3). Natural England's position is that LSE from direct effects upon qualifying features of the site cannot be ruled out, due to the potential effects which could arise during a drilling fluid breakout.</p> <p>Following consultation with Natural England during the Norfolk Boreas examination process, details of the likelihood and nature of possible effects from a drilling fluid breakout were provided by the Applicant to Natural England within a Clarification Note (document reference: ExA.AS-3.D1.V1; REP1-039) which supported the Applicant's view that no LSE is likely to arise from drilling fluid breakout. Following review of this note, Natural England confirmed that "[we] are content with the detail currently provided in the Clarification Note and Method Statement [and] look forward to being consulted on the site specific water crossing plans post consent as specified within oCoCP.". Appropriate site specific measures to contain the breakout will be detailed in the drilling fluid contingency plan once the specific design of the trenchless crossing is known and a contractor engaged, which will be included in the final Code of Construction Practice (CoCP), developed in consultation with Natural England and the Environment Agency. This commitment is secured within</p>															

Name of European Site: River Wensum SAC

Distance to Norfolk Boreas 0km (onshore cable route intersects the SAC)

the outline Code of Construction Practice (OCoCP) (document reference: 8.1; REP1-018).

- b) These qualifying features are not present within the drains and ditches of the floodplain habitats of the River Wensum or in the drains and ditches of the floodplain habitats of the River Wensum on the right-hand (southern) bank or left-hand (northern) bank of the river (see section 9.3.1.2 and 9.3.1.3 of the Information to support HRA report). Therefore, under Scenario 1 and 2 potential direct effects upon this habitat have been avoided at this location.
- c) There are no springs or seepages located within the floodplain habitats on the right-hand bank or left-hand bank of the River Wensum. As such, Under Scenario 2 works in this area will not result in direct changes to any springs directly connected to the River Wensum. Introduction of cable ducts is not anticipated to have any effect upon groundwater flows for the River Wensum. Furthermore, for a river crossing, trenchless crossing ducts would be installed 5-15m below the floodplain, and at least 2m below the river bed. As a result, the buried ducts will have no effect upon surface water flows and no adverse effect on integrity.

Under Scenario 2, mitigation measures will be put in place to minimise the risk of sediment or pollutant release into the watercourses which are functionally connected to the River Wensum (see section 9.3.1.2 of the Information to support HRA report). These are considered suitable for minimising the risk of sediment / pollutant release (including bentonite breakout) into watercourses functionally connected with the River Wensum to a negligible level, such that there will be no adverse effect on integrity.

Under Scenario 1, a small area of 6m wide running track will be required within other areas of the River Wensum catchment. The mitigation measures in place for Scenario 2 will also be applied under Scenario 1.

- d) The in-combination assessment for the onshore elements of the assessment for potential for adverse effect upon site integrity has adopted the following principle: in order for Norfolk Boreas to be considered to have the potential to contribute to in-combination effects, there must be sufficient cause to consider that a relevant habitat or species is sensitive to effects due to the project alone. If a potential for adverse effect upon site integrity is not determined with respect to a site due to Norfolk Boreas alone, there is no real prospect of an in-combination effect occurring with another plan or project (see section 9.3.1.4 of the Information to support HRA report). Therefore, under Scenarios 1 and 2 as there is no effect from Norfolk Boreas alone, there is no potential for in-combination effects.

## 2.16 Southern North Sea SAC

Name of European Site: Southern North Sea SAC																		
Distance to Norfolk Boreas 0km (the site is within the Southern North Sea SAC)																		
Site Features	Adverse Effect on Integrity due to Norfolk Boreas																	
	Underwater noise			Disturbance from vessels			Vessel interactions			Indirect effects through effects on prey species, including habitat loss			Changes to water quality			In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Harbour porpoise	<b>N (a)</b>	<b>N (b)</b>	<b>N (c)</b>	<b>N (d)</b>	<b>N (b, d)</b>	<b>N (c, d)</b>	<b>N (e)</b>	<b>N (b)</b>	<b>N (c, e)</b>	<b>N (f)</b>	<b>N (b, f)</b>	<b>N (c, f)</b>	<b>N (g)</b>	N/A	<b>N (c, g)</b>	<b>N (h)</b>	<b>N (i)</b>	<b>N (c, h)</b>
<p>a) Noise disturbance during piling and other construction activities is anticipated to be low, with a worst-case scenario of up to 2.2% overlap with the Southern North Sea (SNS) SAC winter area or up to 9.0% overlap with the summer SNS SAC area and a 1.3% seasonal average for the summer or winter areas. Therefore, temporary disturbance of harbour porpoise would be less than thresholds recommended by the Joint Nature Conservation Committee (JNCC) and Natural England of 20% of the seasonal component of the SAC area at any one time and less than 10% of the average seasonal component of the SAC area over the duration of that season (see section 8.3.1.1.1, 8.3.1.1.2 and 8.3.1.1.3 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).</p> <p>b) Operational and maintenance impacts are likely to be highly localised around the project infrastructure, and any maintenance impacts would be intermittent and temporary, therefore no AEOI would occur (see section 8.3.1.2 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).</p> <p>c) It expected that the activity levels and potential effects during decommissioning will be no worse than construction (with no pile driving) (see section 8.3.1.3 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).</p> <p>d) The Norfolk Boreas offshore project area (1,178km<sup>2</sup>) is approximately 4% of the summer SNS SAC area 1.31% of the winter SAC area. It is unlikely that vessels would cause disturbance from the whole project areas and therefore this provides a conservative assessment. Disturbance from vessels is likely to be localised to areas of activity, thus there would be no exceedance of the 20% seasonal component at any one time or 10% of the average seasonal component thresholds and therefore there will be no AEOI (see section 8.3.1.1.4, 8.3.1.2.3 and 8.3.1.3.2 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).</p> <p>e) Approximately 1,180 vessel movements are estimated over the two to four year indicative offshore construction window, an average of approximately two vessel movements per day. Therefore, the increase in vessel movements during construction would be relatively small compared to existing vessel traffic. It is expected that harbour porpoise would be able to detect the presence of vessels and, given that they are highly mobile, would be able to largely avoid vessel collision, therefore there would be no AEOI (see sections 8.3.1.1.5 and 8.3.1.3.3 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).</p> <p>f) Potential effects on fish species include physical disturbance, loss or changes of habitat, increased suspended sediment concentrations, and underwater noise. It is anticipated that as a worst-case scenario effects from the Norfolk Boreas offshore project area (1,178km<sup>2</sup>) would impact approximately 4% of the SNS SAC area, and</p>																		

Name of European Site: Southern North Sea SAC

Distance to Norfolk Boreas 0km (the site is within the Southern North Sea SAC)

1.31% of the winter SAC area. However, it is more likely that effects would be restricted to an area around the working sites, therefore there will be no AEOI (see sections 8.3.1.1.6, 8.3.1.2.5 and 8.3.1.3.4 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).

g) The Norfolk Boreas offshore project area (1,178km<sup>2</sup>) would impact approximately 4% of the SNS SAC area, and 1.31% of the winter SAC area. It is highly unlikely that any changes in water quality (suspended sediment) could occur over the entire offshore project area during construction therefore this is a highly conservative assessment. It is more likely that effects would be restricted to an area around the working sites, therefore there would be no exceedance of the 20% seasonal component at any one time or 10% of the average seasonal component thresholds and therefore there will be no AEOI (see sections 8.3.1.1.7 and 8.3.1.3.5 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).

h) It is anticipated that through the Site Integrity Plan (SIP), impacts of underwater noise from construction and decommissioning will be mitigated. The SIP will set out the approach for Norfolk Boreas Limited to deliver any project mitigation or management measures in relation to the SNS SAC in agreement with the Marine Management Organisation (MMO) and relevant Statutory Nature Conservation Bodies (SNCBs) to an extent whereby no AEOI is expected (see section 8.3.1.5 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).

(i) Current data suggests that there is no lasting disturbance or exclusion of harbour porpoise around wind farm sites during operation and therefore there would be no AEOI (see section 8.3.1.5.4 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3).

## 2.17 The Broads SAC

Name of European Site: The Broads SAC

Distance to Norfolk Boreas 4.5km

Site Features	Adverse Effect on Integrity due to proposed Norfolk Boreas project												
	Direct effects upon ex-situ habitats which may support the qualifying feature otter, due to suitable ex-situ habitats for this feature being present			Indirect effects upon habitats and species within the SAC boundary arising from changes in local groundwater / hydrology conditions			Indirect effects upon ex-situ habitats which may support the qualifying feature otter, arising from changes in groundwater / hydrology conditions			In-combination			
	C	O	D	C	O	D	C	O	D	C	O	D	
Hard oligo-mesotrophic waters with				<b>N (a)</b>							<b>N (a)</b>		

Name of European Site: The Broads SAC												
Distance to Norfolk Boreas 4.5km												
Site Features	Adverse Effect on Integrity due to proposed Norfolk Boreas project											
	Direct effects upon ex-situ habitats which may support the qualifying feature otter, due to suitable ex-situ habitats for this feature being present			Indirect effects upon habitats and species within the SAC boundary arising from changes in local groundwater / hydrology conditions			Indirect effects upon ex-situ habitats which may support the qualifying feature otter, arising from changes in groundwater / hydrology conditions			In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D
benthic vegetation of <i>Chara spp.</i>												
Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation				N (a)						N (c)		
Transition mires and quaking bogs				N (a)						N (c)		
Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [Priority feature]				N (a)						N (c)		
Alkaline fens				N (a)						N (c)		
Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> ( <i>Alno-Padion</i> ,				N (a)						N (c)		

Name of European Site: The Broads SAC												
Distance to Norfolk Boreas 4.5km												
Site Features	Adverse Effect on Integrity due to proposed Norfolk Boreas project											
	Direct effects upon ex-situ habitats which may support the qualifying feature otter, due to suitable ex-situ habitats for this feature being present			Indirect effects upon habitats and species within the SAC boundary arising from changes in local groundwater / hydrology conditions			Indirect effects upon ex-situ habitats which may support the qualifying feature otter, arising from changes in groundwater / hydrology conditions			In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D
<i>Alnion incanae</i> , <i>Salicion albae</i> [Priority feature]												
<i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils ( <i>Molinion caeruleae</i> )				<b>N (a)</b>							<b>N (c)</b>	
Desmoulin's whorl snail				<b>N (a)</b>							<b>N (c)</b>	
Fen orchid				<b>N (a)</b>							<b>N (c)</b>	
Ramshorn snail				<b>N (a)</b>							<b>N (c)</b>	
Otter	<b>N (b)</b>	<b>N (b)</b>	<b>N (b)</b>				<b>N (b)</b>	<b>N (b)</b>	<b>N (b)</b>	<b>N (c)</b>	<b>N (c)</b>	<b>N (c)</b>
<p>a) As part of the project's embedded mitigation, under Scenario 2 the North Walsham and Dilham Canal will be crossed using a trenchless crossing technique (e.g. HDD). This means that the North Walsham and Dilham Canal will be avoided, and no works will take place within this watercourse. The East Ruston Stream is proposed to be crossed using a trenching methodology, however, given the distance to The Broads SAC (4.6km), the risk of groundwater pollution of The Broads SAC is low. Good practice pollution prevention measures will also be employed. For watercourses which are shallower than 1.5m, temporary damming and diverting of the watercourse may be employed during trenching works. The suitability of this method would be advised at detailed design. Several mitigation measures will be employed, and the trench would be reinstated to the pre-construction depth of the watercourse. Where culverts may be required, additional</p>												

Name of European Site: The Broads SAC

Distance to Norfolk Boreas 4.5km

Site Features	Adverse Effect on Integrity due to proposed Norfolk Boreas project											
	Direct effects upon ex-situ habitats which may support the qualifying feature otter, due to suitable ex-situ habitats for this feature being present			Indirect effects upon habitats and species within the SAC boundary arising from changes in local groundwater / hydrology conditions			Indirect effects upon ex-situ habitats which may support the qualifying feature otter, arising from changes in groundwater / hydrology conditions			In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D
<p>mitigation measures will be employed (see section 9.3.4.3 of the Information to support HRA report). Under Scenario 1, works to install ducts will have already taken place as part of the Norfolk Vanguard project, and only joint pits and a 6m wide haul road will be required within the North Walsham and Dilham Canal and Hundred Stream catchments, so works are localised and fit within the design envelope for Scenario 2. As a result, there would be no AEOI.</p> <p>b) A review of the desk-based records obtained from Norfolk Biodiversity Information Service (NBIS) in July 2016 indicates that there are no records of otter on the Hundred Stream. There is one record of an otter spraint on the North Walsham and Dilham Canal, recorded in 2015 and located at TG28863183. This is located approximately 700m upstream of the onshore project area. The absence of records of otter on the Hundred Stream is not conclusive proof of the absence of this species from the watercourse. However, water depths are likely to be too shallow to form part of an otter's home range, especially given the superior habitat available downstream on other parts of the river network connected to The Broads SAC (see section 9.3.4.2 of the Information to support HRA report). In light of this it is considered unlikely that otter are present within the reaches of the Hundred Stream in which the onshore project area is located.</p> <p>It is considered that otters may be commuting along the North Walsham and Dilham Canal within the onshore project area, but that they are not resting or making other use of bankside habitat in these locations (see section 9.3.4.2 of the Information to support HRA report). Under Scenario 2, as part of the project's embedded mitigation, the North Walsham and Dilham Canal will be crossed using a trenchless crossing technique (e.g. HDD), to minimise impacts to the watercourse at this location. This means that the North Walsham and Dilham Canal and its immediate bankside habitat will be avoided, and no works will take place within these habitats. As a precaution, while works are taking place within 100m of North Walsham and Dilham Canal, all excavations will be either covered overnight or left with escape ramps to allow otters to escape if they enter, and all vehicles wheels / tracks will be checked in the morning for the presence of sleeping otter (see section 9.3.4.2 of the Information to support HRA report). Under Scenario 1, no works are taking place within 100m of the North Walsham and Dilham Canal and no impact pathway is present. As a result, there would be no AEOI for either Scenario 1 or Scenario 2.</p> <p>c) Assessment for the onshore elements of the assessment for potential for adverse effect upon site integrity has adopted the following principle: in order for Norfolk Boreas to be considered to have the potential to contribute to in-combination effects, there must be sufficient cause to consider that a relevant habitat or species is sensitive to effects due to the project alone. If a potential for adverse effect upon site integrity is not determined with respect to a site due to Norfolk Boreas alone, there is no real prospect of an in-combination effect occurring with another plan or project (see section 9.3.4.4 of the Information to support HRA report). Therefore, under Scenarios 1 and 2 as there is no effect from Norfolk Boreas alone, there is no potential for in-combination effects.</p>												



## 2.18 The Wash and North Norfolk Coast SAC

Name of European Site: The Wash and North Norfolk Coast SAC																		
Distance to Norfolk Boreas 33km																		
Site Features	Adverse Effect on Integrity due to Norfolk Boreas																	
	Underwater noise			Disturbance at seal haul out sites			Vessel interaction			Changes in water quality			Indirect effects through effects on prey species			In-combination effects		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Harbour seal	<b>N(a)</b>	<b>N(b)</b>	<b>N(a)</b>	<b>N(c)</b>	<b>N(c)</b>	<b>N(c)</b>	<b>N(d)</b>	<b>N(d)</b>	<b>N(d)</b>	<b>N(e)</b>		<b>N(e)</b>	<b>N(f)</b>	<b>N(f)</b>	<b>N(f)</b>	<b>N(g)</b>	<b>N(g)</b>	<b>N(g)</b>
<p>a) The maximum potential area of disturbance is based on a 26km range for piling and Unexploded Ordnance (UXO). Any potential effects through the decommissioning phase are expected to be the same or less than those described above for construction. The Wash and North Norfolk Coast SAC is located 110km from Norfolk Boreas site and 33km from the offshore cable corridor (at its closest point). It is highly unlikely, especially taking into account the movements of tagged seals, that all grey and harbour seal in the offshore project area are from The Wash and North Norfolk Coast SAC. Therefore, there is no AEOI of The Wash and North Norfolk Coast in relation to the conservation objectives for grey seal or harbour seal (see sections 8.3.2.1.1, 8.3.2.1.2, 8.3.2.1.3 and 8.3.2.1.5 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3)).</p> <p>b) Current data suggests that there is no lasting disturbance or exclusion of grey or harbour seal around wind farm sites during operation. In addition, as stated above, it is highly unlikely that all grey seal and harbour seal in the offshore project area are from The Wash and North Norfolk Coast, therefore there is no AEOI of The Wash and North Norfolk Coast in relation to the conservation objectives for grey seal or harbour seal (see section 8.3.2.1.4 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3)).</p> <p>c) Whether during construction, operation or decommissioning phases of the project, when approaching the port, vessels would likely be within existing shipping routes and would be highly unlikely to be within 300m of the coast where seals are hauled out, therefore there would be no potential to directly disturb seals hauled out at sites such as in The Wash and North Norfolk Coast. Therefore, it is concluded that there would be no AEOI of The Wash and North Norfolk Coast in relation to the conservation objectives for grey seal or harbour seal (see section 8.3.2.2 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3)).</p> <p>d) Approximately 1,180 vessel movements are estimated over the two to four year indicative offshore construction window, an average of approximately two movements per day. Therefore, the increase in vessel movements during construction would be relatively small compared to existing vessel traffic. It is expected that seals would be able to detect the presence of vessels and, given that they are highly mobile, would be able to largely avoid vessel collision. Taking into account good practice, any increased collision risk is highly unlikely. Therefore, it is concluded that there would be no AEOI of The Wash and North Norfolk Coast in relation to the conservation objectives for grey seal or harbour seal (see section 8.3.2.3 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3)).</p> <p>e) The risk of any changes to water quality as a result of any accidental release of contaminants (e.g. through spillage or vessel collision) is negligible and the</p>																		

Name of European Site: The Wash and North Norfolk Coast SAC

Distance to Norfolk Boreas 33km

Site Features	Adverse Effect on Integrity due to Norfolk Boreas																	
	Underwater noise			Disturbance at seal haul out sites			Vessel interaction			Changes in water quality			Indirect effects through effects on prey species			In-combination effects		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
	<p>re-suspension of contaminated sediment from construction activities is anticipated to be negligible. Any increase in suspended sediments as a result of construction activities, such as installation of foundations, cable installation and during any levelling or dredging activities, would be temporary and over a relatively small area, as the majority of the sediment released during seabed preparation would be coarse and would fall within seconds / minutes) to the seabed as a highly turbid dynamic plume immediately upon its discharge (within tens of metres along the axis of tidal flow). Therefore, any changes to water quality during construction or decommissioning is highly unlikely to have a significant, if any, impact on foraging grey seal or harbour seal. Therefore, it is concluded that there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal or harbour seal (see section 8.3.2.5 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3)).</p> <p>f) The maximum (worst-case scenario) potential area of physical disturbance and/or temporary loss of habitat to fish during construction could be 15.4km<sup>2</sup> in total for the wind farm site and the total area of potential habitat loss during construction is estimated to be up to 23.31km<sup>2</sup>. During operation, the worst-case total area of habitat loss has been estimated to be up to 11.75km<sup>2</sup> in total. The potential for effect on prey from any increased suspended sediment concentrations and sediment re-deposition would be low, with only a small proportion of fine sand and mud staying in suspension long enough to form a passive plume. Any increase in noise above background noise levels during operation is expected to be small and localised, therefore there would be no significant effect on fish species. EMFs are expected to attenuate rapidly in both horizontal and vertical plains with distance from the source. Therefore, there is no AEOI of The Wash and North Norfolk Coast in relation to the conservation objectives for grey seal or harbour seal (see section 8.3.2.6 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3)).</p> <p>g) Given the wide range of locations over the southern North Sea area used in the in-combination assessment, it is highly unlikely that the grey seal or harbour seal that could potentially be disturbed would all be from The Wash and North Norfolk Coast. In addition, considering the distance between the projects offshore and their distance from the coast, it is not anticipated that foraging grey seal or harbour seal would be significantly displaced from foraging areas or moving between haul-out sites and foraging areas. Therefore, there is no AEOI of The Wash and North Norfolk Coast in relation to the conservation objectives for grey seal or harbour seal (see section 8.3.2.1.6 of the Information to Support Habitats Regulation Assessment Report (document reference 5.3)).</p>																	