

# Norfolk Boreas Offshore Wind Farm Applicant's Comments on Deadline 4 Submissions and Additional Submissions

Applicant: Norfolk Boreas Limited  
Document Reference: ExA.ASR.D5.V1  
Deadline 5

Date: February 2020  
Revision: Version 1  
Author: Royal HaskoningDHV

*Photo: Ormonde Offshore Wind Farm*

Date	Issue No.	Remarks / Reason for Issue	Author	Checked	Approved
19/02/2020	01D	First draft for internal review	ES	CD/DT/JT	JL
24/02/2020	01F	Final draft for Deadline 5 submission	CD/DT/EV/JT/MT	JL/JT/VR	JL



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## Glossary of Acronyms

AEol	Adverse Effect on Integrity
ASI	Accompanied Site Inspection
DCO	Development Consent Order
dDCO	Draft Development Consent Order
DML	Deemed Marine Licences
EIA	Environmental Impact Assessment
ES	Environmental Statement
ExA	Examining Authority
GBBG	Great Black-Backed Gull
HHW	Haisborough, Hammond and Winterton
HRA	Habitats Regulations Assessment
HVDC	High Voltage Direct Current
ICES	International Council for the Exploration of the Sea
IEMA	Institute of Environmental Management and Assessment
IFCA	Inshore Fisheries and Conservation Authority
IPMP	In Principle Monitoring Plan
LID	Lynn and Inner Dowsing
LIG	Land Interest Group
LIR	Local Impact Report
LPA	Local Planning Authority
M	Metres
MMO	Marine Management Organisation
Ms <sup>-1</sup>	Metres Per Second
MSS	Marine Scotland Science
MoU	Memorandum of Understanding
NE	Natural England
NFU	National Farmers Union
NNDC	North Norfolk District Council
NPC	Necton Parish Council
NSIP	Nationally Significant Infrastructure Project
OCoCP	Outline Code of Construction Practice
OLEMS	Outline Landscape and Ecological Management Strategy
OOOMP	Outline Offshore Operations and Maintenance Plan
OWF	Offshore Wind Farm
PHE	Public Health England
PM	Particulate Matter
SAC	Special Area of Conservation
SIP	Site Integrity Plan
SoCG	Statement of Common Ground
SOSS	Strategic Ornithological Support Services
SoS	Secretary of State
UK	United Kingdom
VMS	Vessel Monitoring System
WSI	Written Scheme of Investigation

## 1 Applicant's Comments on Deadline 4 Submissions

1. This document contains the Applicant's comments on submissions by Interested Parties at Deadline 4 of the Norfolk Boreas Examination and submissions accepted at the discretion of the Examining Authority (ExA) between deadlines.

## 1.1 Breckland Council REP4-026

Summary of Submission	Applicant's Comments
<p>The ExA requested Breckland Council to submit their response to issues around the visual impact of external equipment, Works 10A within the document titled 'Action Points arising from the Issue Specific Hearing on Onshore effects including the draft Development Consent Order – 21 January 2020'.</p> <p>Breckland Council responded, requesting a requirement for all external electrical equipment to be powder-coated to minimise any light reflection and glare shining from new aluminium and steel.</p>	<p>The Applicant has provided a response in Q2.5.3.3 in response to the Examining Authority's further Written Questions at Deadline 5 in document ExA.FWQR.D5.V1.</p>

## 1.2 Necton Parish Council REP4-030

Summary of Submission	Applicant's Comments
<p>REP4-030 raised concerns on the pegging out of land:</p> <p><i>'Following the site visit in 23 January it appears there is some confusion over the pegging out of Chris Allhusen's land. We thought it was meant to show the cable corridor but on checking the map it appears to show the edge of the compound. Can Vattenfall please clarify what the pegging out indicates? If it is the compound, it appears to be outside the boundary.'</i></p>	<p>The original request for the pegging out exercise was as follows:</p> <p><i>'ExA requires pegging out with different colour pegs to demonstrate the footprints of the substations, for both scenarios, the pylon locations and any other parts of the assets which will assist understanding of the proposed development'.</i></p> <p>Accordingly the Applicant sought to peg out the extents of the onshore substation compounds themselves under scenarios 1 and 2 as requested. Access restrictions onto the land on which the majority of the substations and other infrastructure would be located meant that it was only possible to peg out the extent of the substation compound under Scenario 1 on Mr Allhusen's land (as access to this land was granted). For clarity, none of Mr Allhusen's land would be required under Scenario 2 for the substation compound.</p>

### 1.3 North Norfolk District Council REP4-031

Summary of Submission	Applicant's Comments
Traffic and Transport	
<p><b>Link 69 – North Walsham, Little London Road</b></p> <p>NNDC state that the ExA has held over for written questions regarding Link 69 and asked about the impacts on residents and local traffic movements.</p> <p>NNDC have provided details of this in their Deadline 4 submission [REP4-031].</p>	<p>The Applicant has provided a response in Q2.14.3.12 to the Examining Authority's further Written Questions at Deadline 5 in document ExA.FWQR.D5.V1.</p>
<p><b>Communication Plan</b></p> <p>NNDC notes that, while the Community Liaison Committee and Officer, and the Complaints System, could flag socio-economic impacts and other impacts on tourism, there is presently no mechanism for mitigating or addressing these impacts.</p> <p>NNDC considers there is a need for a tourism requirement to be included in the DCO, for complaints or issues to be raised through the mechanisms set up by the Communications Plan.</p>	<p>The Applicant has provided a response in Q2.14.3.12 to the Examining Authority's further Written Questions at Deadline 5 in document ExA.FWQR.D5.V1.</p>
<p><b>Trenchless crossing at Colby</b></p> <p>NNDC welcomes the Applicant's oral submissions. NNDC's position remains that the environmental and landscape impact of removing the trees at Colby (see the photos at Appendix F of NNDC's LIR REP 2-087) would have a significant effect.</p>	<p>Noted. The Applicant submitted a Clarification Note on Trenchless Crossing at B1149 and Church Road Colby, at Deadline 4 [REP4-017].</p>
<p><b>Outline Traffic Management Plan</b></p> <p>NDC's view is that the Outline Traffic Management Plan should be further updated, particularly regarding additional mitigation at Little London Road.</p> <p>Additional updates on traffic management, mitigation for works within the more sensitive non-standard construction hours including unexpected and extended duration working in specific locations would be required.</p>	<p>The Applicant has provided further information on the Little London Road crossing in response to Q2.14.3.11 to the Examining Authority's further Written Questions at Deadline 5 in document ExA.FWQR.D5.V1.</p> <p>Mitigation measures for Little London Road are detailed in Table 4.3 of the OTMP [REP1-022].</p>
Construction Effects	



Summary of Submission	Applicant's Comments
<p><b>Construction hours</b></p> <p>NNDC provided a list of sensitive receptors at the hearings, which they welcome have been agreed as sensitive receptors with the Applicant.</p> <p><i>'This understanding of Noise Sensitive Receptors can be captured in the dDCO, including in the interpretation section. NNDC has provided the definition to the Applicant for it to be included in the OCoCP. NNDC will consider further whether amendments can be made to the dDCO to reflect the definition. NNDC will also work further with the Applicant to agree the process for and locations of assessment of site specific noise sensitive receptors.</i></p> <p><i>North Norfolk District Council and the Applicant are working together to agree a process and locations of noise sensitive receptors during construction and will provide a joint position statement on this for Deadline 5.'</i></p>	<p>The Applicant has produced a Position Statement on Noise Sensitive Receptors, submitted at Deadline 5 [ExA.AS-8.D5.V1]. The Applicant is seeking input from NNDC to clarify their position further.</p>
<p><b>Cable Duct Installation</b></p> <p><i>'Exclusions in the Outline Landscape and Ecological Management Scheme may result in changes to the duct installation strategy, where alternative methods are required to protect landscape or ecology. Changes in methodology, works location and importantly duration of works, will require updated and enhanced noise and pollution mitigation. In particular, extended duration works in nonstandard construction hours may result in adverse impacts on receptors.</i></p> <p><i>It is suggested that the identification of noise sensitive receptors and the mitigation measures are progressed, and agreed where possible, at this early stage. This work would be advantageous both in terms of protecting amenity and for project planning.'</i></p>	<p>The Applicant has provided a response in Q2.12.0.1 to the Examining Authority's further Written Questions at Deadline 5 in document ExA.FWQR.D5.V1.</p>
<p><b>Landfall at Happisburgh</b></p> <p><i>'NNDC's position is neutral on the choice of technique for landfall, so long as it is a drilling-style technique rather than open trench. The technique needs to be appropriate and, following ground investigations, there needs to be a process for determining the most appropriate technique.'</i></p>	<p>Noted.</p>
Landscape and Visual Effects	
<p><b>Trees and hedgerows, OLEMS</b></p> <p>NNDC has set out across paragraphs 13.15 to 13.17 of its LIR [REP2-087] its understanding of the worst case scenario in which the Applicant identified 36 trees to be lost in North Norfolk, the removal of which it considers would have a negative landscape impact.</p>	<p>The Applicant has committed to tree replacement within North Norfolk as detailed in the OLEMS [REP1-020].</p> <p>The Applicant submitted a Clarification Note on Trenchless Crossing at the B1149 and Church Road Colby, at Deadline 4 [REP4-017].</p>



Summary of Submission	Applicant's Comments
<p>This is in addition to one hedgerow which has significant susceptibility from a landscape character perspective that will be impacted, with the loss of 3-4 trees. This reaffirms the need to ensure trenchless crossing techniques are used where loss of trees would result in significant effects to the landscape.</p>	
<p>Tourism Impacts</p>	
<p>NNDC's LIR [REP2-087] provided significant detail and evidence in relation to tourism impacts, starting from paragraph 14.21, including suggested wording for a DCO Requirement relating to tourism and associated businesses.</p> <p><i>'Where a potential risk such as a negative impact on tourism is being considered, it is a risk that, if it materialises, would have a potentially significant impact. This shows that a requirement is necessary. If business owners in NNDC suffer as a result of the Actual Tourism Impact of Negative Perceptions associated with the individual and cumulative impact of windfarm cable route works, it would be neither fair or reasonable that those businesses should be affected as a result of the turbine project without some form of mitigation strategy being in place.'</i></p>	<p>The Applicant maintains its position stated in the Applicant's Response to North Norfolk District Council's Local Impact Report [REP3-011].</p> <p>The Applicant assessed the impact of tourism to the local economy using 3<sup>rd</sup> party literature. Many of the impacts to tourism and recreation are based on qualitative assessment, using a predicted perception of how (and if) local communities and tourists might change their activities particularly during construction. The Applicant explains this further in ES Chapter 30 Tourism and Recreation [APP-243] and the Appendix to the Response to North Norfolk District Council's Local Impact Report [REP3-011].</p>
<p>Discharge of Post Consent Approvals</p>	
<p>NNDC would not have specific resources allocated for the task of discharging post consent approvals. The key element necessary to assist with post consent approvals is for the timeframe within which they would be submitted to be known and set well in advance so that NNDC can gear up to have resources in place. There are opportunities for Planning Performance Agreements to help fund a dedicated resource of local authority officer time to process the discharge of Requirements, but these agreements take a lot of work to put together which would not be practicable to undertake at this stage in the process.</p> <p>The Applicant and the relevant authorities could enter into an agreement at this stage that Planning Performance Agreements would be put in place to cover the reasonable costs of those LPAs and relevant consultees involved in the discharge of DCO Requirements.</p>	<p>The Applicant has provided a response in Q2.5.7.1 to the Examining Authority's further Written Questions at Deadline 5 in document ExA.FWQR.D5.V1.</p>

## 1.4 Oulton Parish Council REP4-032

Summary of Submission	Applicant's Comments
Cable Logistics Area	
<p>REP4-032 <i>'seek clarification as to the nature of what constitutes "essential activities", for which permission might be granted to work outside of the agreed working hours.'</i></p>	<p>Working outside of these hours is only permitted for essential activities, and their duration and timing must be agreed in advance of the works with the relevant planning authority (save for emergency works).</p> <p>The Secretary of State's letter for Norfolk Vanguard proposes an amendment to DCO Requirement 26 to state that 'full details, including but not limited to type of activity, vehicle movements and type, timing and duration and any proposed mitigation' of all works undertaken outside of standard working hours must be agreed with the relevant planning authority in advance of the works [REP3-012].</p> <p>The Applicant confirms that any mitigation required as a result of non-standard working hours will be agreed with the relevant planning authority pursuant to Requirement 26 of the dDCO, and the Applicant has updated the dDCO with the proposed change from the Secretary of State's letter.</p>
Pilot Vehicles and Traffic Management	
<p>REP4-032 <i>'is obliged to bring to the attention of the ExA that, were this entirely likely eventuality to occur, then the environmental implications for the residents of Oulton Street village – whose homes abut the road directly - in terms of noise, vibration and emissions, would be unacceptably adverse. These impacts have nowhere been considered, let alone assessed, in this application.'</i></p>	<p>The Applicant addressed increased emissions from vehicles in Section 26.4.1.2, Chapter 26 of the ES, Air Quality [APP-239]. The Applicant also addressed noise and vibration impacts in Chapter 25 of the ES, Noise and Vibration [APP-238].</p>
B1149 Traffic Works	
<p>REP4-032 <i>'is still concerned that, depending on the timing and duration of the proposed works, if trenchless crossing is not forthcoming then this may result in the narrowing of the delivery window in respect of Hornsea Three's Main Construction Compound traffic. This would create a situation in</i></p>	<p>The Applicant submitted a Clarification Note on Trenchless Crossing at the B1149 and Church Road Colby, at Deadline 4 [REP4-017]</p>

Summary of Submission	Applicant's Comments
<p><i>which more HGV traffic had to be fitted into fewer weeks, especially in respect of HOW3 Abnormal Indivisible Loads (AILs). If the road works on the B1149 cause restricted access due to the narrow carriageway, then these deliveries may have to be suspended while a trenched crossing is carried out.'</i></p>	<p>including traffic management drawings incorporating any potential AILs required for Hornsea Project Three.</p>
<p>LINK 75 Blickling Road</p>	
<p>REP4-032 'seeks clarification as to the increase in traffic numbers for Scenario 1; what is the type and purpose of the additional vehicles?'</p>	<p>The traffic numbers for Scenario 1 reflect a higher number of total vehicle movements to account for movements of staff and equipment to and from the cable pulling works along the cable route. There is no increase in HGV movements.</p>

## 1.5 Eastern Inshore Fisheries and Conservation Authority (IFCA) REP4-033

Summary of Submission	Applicant's Comments
<p>The Eastern Inshore Fisheries and Conservation Authority (IFCA) noted that the National Federation of Fishermen's Organisations (NFFO) set out a case at Deadline 2 (REP2-043) with regards to the use of a quantitative approach based on percentage loss of grounds to define impact magnitude. Whilst Eastern IFCA agree with the Applicant that the impacts on the inshore fisheries within the Eastern IFCA district have been characterised appropriately, using quantitative measures to inform impact assessments would be sensible.</p> <p>The Eastern IFCA notes that quantitative and qualitative assessment approaches each have their advantages and disadvantages. Eastern IFCA considers that if used in combination, supplementing current assessment techniques with quantitative approaches (such as</p>	<p>The methodology used for assessment in Chapter 14 Commercial Fisheries (APP -227) follows an impact assessment matrix approach taking account of receptor sensitivity and impact magnitude in line with standard Environmental Impact Assessment (EIA) methodologies (as outlined in ES Chapter 6 Impact Assessment Methodology, APP-219).</p> <p>The Applicant notes that the methodology used for assessment of impacts on commercial fisheries was agreed to be appropriate in the Statements of Common Ground (SoCG) with the Eastern Inshore Fisheries and Conservation Authority (IFCA) and the Marine Management Organisation (MMO), including the outcomes of the evaluation of impact magnitude and the impact significance levels identified (REP2 -045, REP2-051).</p> <p>When assessing loss of fishing grounds, in defining magnitude, consideration is given in ES Chapter 14 Commercial Fisheries to the area affected by the potential impact but also to the duration of the impact. In addition, the level of fishing activity that the offshore project area sustains is considered in the context of its relative importance to the overall grounds and the</p>

Summary of Submission	Applicant's Comments
<p>calculating percentage loss of access to grounds) could lead to a more reliable and accountable assessment.</p> <p>As well as quantifying anticipated loss of access to grounds, Eastern IFCA consider it appropriate to assess recent losses to fishing grounds resulting from offshore activity (for example from offshore energy projects and aggregate extraction activity) and regulatory requirements (for example areas closed to fishing for conservation purposes). To ensure a thorough assessment, we would suggest looking at the ten years before the planned start of construction and assessing changes in access to fishing grounds that have occurred during that time. Eastern IFCA are acutely aware of the increasing pressures on fishers and the displacement of effort that results from the proliferation of offshore activity in combination with the increasing number of spatial restrictions being introduced by fisheries managers.</p> <p>Eastern IFCA would very much like to see approaches to impacts assessment become more consistent between regulators of fishing and non-fishing activities. Introducing quantitative impact measures into assessments would be a good start to transitioning towards a more consistent approach.</p>	<p>level of activity that these grounds sustain. When evaluating impact magnitude during the construction phase, consideration is also given to the potential for fishing to be able to resume activity within the operational site.</p> <p>The Applicant notes that whilst the assessment undertaken in ES Chapter 14 is qualitative in nature, it is supported by an extensive quantitative analysis of fisheries data and information. The outcomes of this analysis are illustrated within the numerous figures presented as part of ES Chapter 14 Commercial Fisheries which are referenced throughout the impact assessment.</p> <p>The Applicant would also note that evaluating magnitude of impact using quantitative criteria based on percentage loss of grounds may misrepresent the potential magnitude of effect where this does not factor in the relative importance of the area of the project in the context of the levels and distribution of fishing activity in other areas.</p> <p>Furthermore, if percentage loss of grounds was to be used to establish the criteria for definition of impact magnitude, it would not be possible for such an approach to be applied in a standard and comparable way across different fleets. This is due to the limitations of available fisheries data and information, including the way in which data is compiled by different fisheries data centres and organisations and the format in which data is provided to third parties due to confidentiality issues. For instance, the spatial resolution of the fisheries data available to developers for analysis differs significantly depending on the fleet under consideration:</p> <ul style="list-style-type: none"> <li>• Vessel Monitoring System (VMS) data for Dutch fishing vessels is provided by IMARES in a grid in which each data cell equates to one sixteenth of an International Council for the Exploration of the Sea (ICES) rectangle, whilst VMS data of UK vessels collected by the MMO is provided using a much finer grid (200 data cells are included within each ICES rectangle).</li> <li>• For local fleets (vessels under 15 m) VMS data is not available. Fisheries data for these vessels is only accessible from the MMO at a very broad spatial scale with ICES rectangles generally representing the smallest statistical spatial unit used for the collection of fisheries data for these vessels.</li> </ul> <p>In addition to issues associated with data limitations, adopting quantitative criteria for definitions of impact magnitude would not allow for key parameters such as the ability of the various fishing methods to resume activity in the site and the duration of the potential impact to be incorporated in the assessment. Similarly, information gathered during consultation, such as</p>

Summary of Submission	Applicant's Comments
	<p>location of preferred fishing grounds or information on seasonality and operating patterns, could not be integrated in a quantitative manner.</p> <p>Given the limitations outlined above and the nature of the various factors needing consideration, it is the Applicant's view that in line with the methodology used for assessment in Chapter 14 Commercial Fisheries, a qualitative approach to the evaluation of magnitude of effect supported by quantitative analysis of available fisheries information, is the most appropriate.</p> <p>The different nature of potential loss of access/grounds to fishing associated with offshore wind farm development in comparison to that associated with other activities subject to assessment by regulators, such as the implementation of management measures in marine protected areas, should also be noted in this context. In the case of management measures such as fishing closures, access to fishing tends to be fully restricted across defined areas on a permanent basis for selected fishing methods. The greater complexity of loss of fishing grounds/access to fishing grounds associated with offshore wind farm development should be noted in this context (i.e. during construction loss of ground is temporary and localised and during the operational phase fishing is permitted within wind farm arrays with the level of fishing which may resume depending upon individual skipper's preferences and the practicalities associated with operating fishing gear within wind farm arrays).</p> <p>With regard to the cumulative assessment and whether or not the inclusion of past losses is appropriate, the Applicant would note that the characterisation of fishing activity included in the commercial fisheries baseline, in line with standard practice, took account of the most recent five years of available fisheries data and was further complemented with information gathered during consultation with fisheries stakeholders. The Applicant notes that the baseline characterisation used for assessment in Chapter 14 Commercial Fisheries was agreed to be appropriate with Eastern IFCA and the MMO in their respective SoCGs.</p> <p>The effect from projects which may have been under construction or operational, during the period of time for which data is presented in the baseline, would be reflected in the outcomes of the analysis of fisheries data and therefore in the baseline upon which the cumulative impact assessment was undertaken. As such, inclusion of potential losses associated with those projects in the cumulative assessment would represent double counting of their impact.</p>

Summary of Submission	Applicant's Comments
	Furthermore, the Applicant would like to highlight that attempts to establish and evaluate potential past losses would not be able to take account of the mitigation that may have been applied by existing projects as this would be extremely hard to quantify. In addition, information on the specific mitigation applied would be confidential in many cases (i.e. cooperation agreements).

### 1.6 Historic England's Post Hearing Submission REP4-034

- The Applicant has reviewed Historic England's submission at Deadline 4 and concurs with what is written in that document. A version of document 8.6 (Outline WSI (offshore) and document 8.12 In Principle Monitoring Plan which had been updated to address Historic England's concerns was provided to Historic England on the 31<sup>st</sup> January. Historic England have since responded to confirm agreement that the changes address their concerns.

### 1.7 The MMOs Post Hearing Submission REP4-035

- The Applicant has reviewed the Marine Management Organisation's (MMO) submission at Deadline 4. The Applicant wishes to provide an update on a number of the points made in the submission. The Applicant's responses are tabulated below.

Summary of Submission	Applicant's Comments
1.1.2 The MMO suggests a summary page in the Outline WSI could provide an overarching description of how archaeological risks and consents are dealt with through different stages of the works including pre-construction surveys.	The Applicant has included a flow chart within the Outline WSI (offshore) (document reference 8.6) which shows the different stages of work and illustrates at what stages Historic England and the MMO would be consulted. This illustrates how the archaeological risks will be mitigated. This has been agreed with Historic England.

Summary of Submission	Applicant's Comments
<p>1.2.2 The MMO believe that the MMO Coastal Office, Eastern Inshore Fisheries and Conservation Authorities, National Federation of Fishermen's Organisations and other relevant fishing communities need to be consulted [on the Fisheries liaison and coexistence plan].</p>	<p>Consultation with the fishing industry is on-going and will continue post-consent. Relevant fisheries stakeholders, including those identified by the MMO, will be consulted to help inform the final Fisheries Liaison and Co-existence Plan (FLCP).</p>

## 1.8 National Farmers Union REP4-036

Summary of Submission	Applicant's Comments
<p>Cable Duct Instillation</p> <p><i>'Further to the hearing where it was mentioned that the 'cable duct installation' topic would be covered under further written questions. The NFU and LIG would like to highlight that this is an area of concern and in a SOCG the NFU raised the question over the length of the time required for cable pulling. Vattenfall are stating it could take up to 4 years being 2 years per project for land to be out of production. A cable installation time of 2 years is more preferable to landowners. Vattenfall have explained that cable pulling must be conducted in line with onshore project substation construction, offshore cable installation and offshore substation installation to allow energisation of the transmission circuit within a timely manner. The 4 years of onshore cable pulling activity is required to align with the worst case phases of potential transmission circuit commissioning. <b>The NFU and LIG would like a further explanation on this as this has never been raised before in regard to cable pulling and timings.'</b></i></p>	<p>The Applicant addressed duct instillation in REP2-021, Q2.0.1.</p> <p>Duct installation was covered in the Applicant's response to the first written question 12.0.1, where it was stated: The construction methodology is a standard trenching approach common across the utility industry, with the benefit of duct installation (rather than direct cable installation) being that short lengths of duct can be installed at a time, rather than long lengths of cables.</p> <p>To ensure the viability of the construction method throughout the onshore cable route, the strategy includes all supporting infrastructure requirements during construction such as a running track, soil storage areas and multiple mobilisation areas distributed along the cable route. The construction method is included as embedded mitigation within the OCoCP (document 8.1, REP1-018) and secured within Requirement 20 of the dDCO. As part of the OCoCP, the Applicant has committed to producing Construction Method Statements which will further detail good practice in line with achieving the construction strategy.</p> <p>During cable pulling, the area of impacted land on the onshore cable route is notably less than during duct installation and is limited to joint bays (approximately 800m separation) and temporary access routes to the joint</p>



Summary of Submission	Applicant's Comments
	<p>bays where necessary (maximum of 12km x 6m), to a maximum of 10 weeks per joint bay.</p> <p>It may not be feasible to install all cables within a 2 year period due to the necessary cable supply requirements which may limit the physical quantity of cable available from suppliers and the number of cable jointers required within that timescale. Furthermore, it is preferable to energise a transmission circuit within a timely manner of installation to minimise the risk of any cable degradation which could occur. Such degradation of the cable could require further works to replace cable sections during commissioning. The onshore cable cannot be energised until the entire transmission link for that circuit from the National Grid, through the respective onshore project substation, onshore cable route, offshore cable route and offshore platform is in place. The up to 4 years (2 years for Norfolk Vanguard and 2 years for Norfolk Boreas) of onshore cable pulling activity is therefore required to align with these worst case phases of potential transmission circuit commissioning to reflect the potential limitations in supply chain capacity and minimise cable degradation risk.</p> <p>The preferences of the NFU/LIG regarding minimising the number of cable pull activities is however understood and reasonable endeavours will be made to minimise the number of cable pulling phases.</p>
<p><i>'Vattenfall has stated that the jointing pits will not be left open for the 4 year cable pulling phase and that a jointing pit will be set up for one per circuit and the land will be reinstated within the 10 week period, per annum. It is stated that the cable pulling and jointing process would take approximately five weeks per 800m length of cable, per circuit. <b>The NFU and LIG would like confirmation that the land between each jointing pit will be reinstated straight away after the ducts are laid.'</b></i></p>	<p>Paragraphs 422 and 423, Chapter 5 of the ES, Project Description [APP-218] proposes an onshore cable duct installation strategy to minimise impacts. Construction teams would work on a short length (approximately 150m section) and once the cable ducts have been installed, the section would be back filled and the top soil replaced before moving onto the next section. This would minimise the amount of land being worked on at any one time.</p>
<p>Landscape and Visual Effects: Substation at Necton</p>	
<p><i>'At the hearing it was discussed whether bunding should be used around the site to help reduce visual impact. The NFU knows from experience that bunding is not always the best solution. NFU and LIG have asked Vattenfall to explain <b>whether the bunding would be constructed into the slope so that the height at the lower level of the slope remains</b></i></p>	<p>The Applicant addressed bunding in REP2-021, Q9.4.3.</p> <p>In the Applicant's responses to the first written question 9.4.3, the Applicant responded to the question regarding amending the ground level and bunds as</p>

Summary of Submission	Applicant's Comments
<p><b>the highest point.</b> <i>This information was requested in the NFU SoCG on 29.11.2019 and as yet no response has been forthcoming from Vattenfall.'</i></p>	<p>follows: <i>'In terms of landscape and visual considerations, the options of lowering the ground level and large scale bunding were considered and discounted for the following reasons. In order to ensure a design is responsive to the unique characteristics and attributes of a local landscape, the best approach is generally to work with the landform, in order to minimise the magnitude of change. While the landform is gently undulating, it falls more steeply towards the south-east. In order to cut a level platform of 250m x 300m at a lower ground level would require a huge amount of earthworks and would fundamentally alter the character of the local landscape. Similarly, the introduction of large scale bunds would appear out of character in this traditional, rural landscape and at variance with the gently undulating landform.'</i></p>
<p><i>'NFU and LIG require further information on what landscaping design and principles will be put in place. In particular the owner losing land to this site would like to have an input in to the design and into the hedgerow and tree species to be planted.'</i></p>	<p><b>Landscaping</b></p> <p>As stated in the OLEMS [REP1-020] the Applicant has committed to mitigation planting of species which grow at various speeds to accelerate visual screening, while still using native species which are indigenous to the area and will improve the green network for wildlife and increase biodiversity.</p> <p>The Applicant is obliged to meet all of these commitments, which results in a reduced number of tree and hedgerow species to select from when planting which will meet all of the above criteria.</p> <p><i>"In respect of the onshore project substation....The mitigation planting would be designed to comprise a mix of faster growing 'nurse' species and slower growing 'core' species. While mitigation planting forms part of both the Scenario 1 and Scenario 2 proposals, under Scenario 1, mitigation planting associated with the Norfolk Vanguard project would already be implemented as part of this project and the mitigation planting associated with the Norfolk Boreas project would be added to this, in order to increase the overall extent of mitigation planting relative to the increase in development.</i></p> <p><i>Mitigation measures have been designed to screen the project from the most sensitive receptors. With this principal aim in mind, the planting includes areas of fast growing woodland species as this would provide, most importantly the</i></p>

Summary of Submission	Applicant's Comments
	<p><i>height required, as well as the density, to ensure effective screening. Other considerations for the design and layout of the planting, include the use of predominantly native species and those species indigenous to the area, to ensure that the planting integrates well with the local landscape character.</i></p> <p><i>Mitigation planting aims to create a landscape framework that connects with existing woodland and hedgerows to improve the wider strategic green network. This is important for the movement of animals through the area, as well as increasing biodiversity across the local landscape.</i></p> <p><i>A mix of species would be included in the woodland planting and hedgerows and the integration of grass strips and wider species rich grassland areas have been included to provide a diversity of habitats and food sources for wildlife."</i></p> <p>The Applicant has included additional information the Design Access Statement (DAS) submitted at Deadline 5 (Document reference 8.3, Version 3) on the design guide and design process for the onshore project substation which includes that as part of the process <i>'the Applicant would welcome the opportunity to share local knowledge on native species that are suited to local conditions. This would ensure that the 'palette' of species selected would present the best opportunity for successful establishment and growth.'</i></p>
<p>Accompanied Site Visit: Substation at Necton</p>	
<p><i>'The site visit to the proposed Necton substation site took place on a foggy day and therefore visibility was considerably reduced. The NFU and LIG are also aware that due to access constraints on part of the site, not all of the proposed substation could be pegged out. LIG has been made aware that the area that had been pegged out on the ground did not resemble the plans and was not pegged out to demonstrate the level of detail that we understand was requested by PINS including red line boundary, environmental mitigation area and buildings. Please see attached the plan showing the proposed Necton substation site and the outline with an M in the middle demonstrating the area that had been pegged on the ground. It was not clear what the pegs were actually highlighting. Mr Allhusen is happy to accommodate a further site visit on his land and for the parts of the substation and landscaping to be pegged out and for this hopefully to take place on a clear day.'</i></p>	<p>The Applicant intended to peg out the extents of the onshore substation compounds themselves under both Scenarios 1 and 2 as requested. Due to access constraints, only the extent of the substation compound under Scenario 1 on Mr Allhusen's land was pegged out.</p> <p>The Applicant notes the NFU and Mr Allhusen's position on a further ASI and would be happy to work with the ExA to arrange a further visit should one be requested.</p>

Summary of Submission	Applicant's Comments
<p><i>'The NFU and LIG would be grateful for more detailed plans showing the layout of the site. Plans have now been requested on numerous occasions. Further detail is required on the position of the buildings and external electrical equipment within the site compound.'</i></p>	<p>The layout of the onshore project substation will be finalised once contractors are appointed. However, the Applicant has included additional information the Design Access Statement (DAS) submitted at Deadline 5 (Document reference 8.3, Version 3) on the design guide and design process to be followed once the layout, scale and design have been developed. The updated DAS also includes an illustrative zoning plan for the onshore project substation which indicates that the convertor buildings would be located to the northern end of the site with the outdoor electrical equipment being located to the south.</p>

## 1.9 Natural England's Updated Benthic Ecology Advice REP4-038

Summary of Submission		Applicant's Comments
<b>1</b>	<b>Main Point</b>	
1.1	<p>Natural England's advice generally remains unchanged since the Relevant Representation [099] and cannot currently advise that an Adverse Effect on Integrity (AEoI) on Haisborough Hammond Winterton SAC can be ruled out. However, we would like to recognise that the Applicant is moving in a positive direction in applying mitigation and reducing the impacts on the designated site features to a more acceptable level.</p> <p>Should the Applicant be able to commit to only one cable through HHW SAC, as suggested within the HHW SIP then this is also likely to go some way to ameliorating the impacts to the site.</p>	<p>The Applicant welcomes this response from Natural England and considers that this demonstrates the Applicant's ongoing commitment to working with Natural England to reduce potential effects on the HHW SAC as far as possible. Further comments are provided in 2.13 below regarding the Applicant's ability to commit to only installing one cable within the HHW SAC.</p>
<b>DCO Document 8.11 Outline Offshore Operation and Maintenance Plan</b>		
2.1	<p><i>Page 7</i></p> <p>445 vessel movements for cleaning purposes (only) each year- it is not clear how vessel movements have been taken into account in terms of disturbance to Red Throated Diver (RTD).</p>	<p>The maximum number of maintenance trips to the windfarm is 445 a year, some of these trips may include cleaning activity. This covers all maintenance activities. The RTD assessment has included the 445 visits per year in the</p>

Summary of Submission		Applicant's Comments
		worst case scenario. The relevant text within the OOOMP has been updated for Deadline 5 to make this clearer [document 8.11].
2.2	<p><i>Page 10</i></p> <p>Why in the Table (Appendix 1) is 'cable burial with surface protection' – no marine licence required included and then the next row is 'placement of cable protection in new areas' - yes marine licence required. This is confused as surely the first one is replacement of cable protection installed during installation? Please can the Applicant clarify.</p>	<p>Appendix 1 of the Norfolk Boreas OOOMP has been drafted to accord with the Norfolk Vanguard OOOMP. This is especially relevant to any licensed activity within the HHW SAC as both projects would be installing cables within the site.</p> <p>The Applicant does however acknowledge that the three rows to which Natural England refer do overlap. Accordingly, the Applicant has removed the line with the words "using surface protection" from the updated OOOMP submitted at Deadline 5 [document 8.11].</p>
2.3	<p><i>Page 11</i></p> <p>There is reference to replacement cable protection within the SAC, but Natural England would like to reiterate that this is on the understanding that it is consented in the first place. Please be advised that NE's position remains unchanged i.e. we consider the placement of cable protection in a SAC to have an AEoI and therefore we are currently unable to support this document.</p>	<p>This comment is noted by the Applicant.</p>
<b>DCO Document 8.12 In Principle Monitoring Plan Norfolk Boreas</b>		
2.4	<p><i>Section 1.1, Page 4</i></p> <p>Please note that monitoring is for residual impacts to ensure that they are not significantly affecting the environment, and that the predictions/assessment conclusions are correct. Monitoring will need to demonstrate this and any hypothesis of the HRA.</p>	<p>The Applicant agrees that monitoring should be for residual impacts and this is discussed further in section 3 of the IPMP.</p>
2.5	<p><i>Section 9, Page 5</i></p> <p>What happens if NVG is under construction and impacts upon NB pre construction surveys and vice versa in terms of NVG monitoring requirements?</p>	<p>The only part of the offshore project area where Norfolk Boreas surveys have a realistic potential to overlap with Norfolk Vanguard construction surveys would be within the offshore cable corridor and within the project interconnector search area, should the final design include a project interconnector. In order not to damage already installed cables there is a requirement for Norfolk Boreas cables to be located up to 250m from the Norfolk Vanguard cables [Plate 5.2 REP1-033]. Norfolk Boreas have</p>

Summary of Submission	Applicant's Comments
	<p>committed to undertake a survey of the area within which it is proposed that seabed works will be carried out. In the unlikely event that the survey for Norfolk Boreas would need to be undertaken at the same time as export cable installation works for Norfolk Vanguard, the surveys would focus on different geographical areas. Furthermore, It would be in the interests of Norfolk Boreas Limited to ensure that its survey timelines are developed in such a way as to maximise the use of data and experience gathered by Norfolk Vanguard as well as ensuring that the surveys would not interfere with Norfolk Vanguard's construction. The following text has been added to the updated IPMP submitted at Deadline 5 to state:</p> <p><i>Norfolk Boreas Limited will endeavour to develop its survey timelines in such a way as to maximise the use of data and experience gathered by Norfolk Vanguard.</i></p>
<p>2.6 <i>Section 35, Page 15</i></p> <p>Natural England would like clarity from the Applicant as to what they see the benefits being of undertaking an Annex I reef survey in 2020. Our understanding is that the survey results will not feed into the Boreas examination. And whilst we always welcome more survey data in this situation we envision there being two likely outcomes; a) Applicant demonstrates reef is there and NE advice doesn't change or b) Applicant demonstrates there isn't any reef currently present and NE advice doesn't change as the fisheries byelaw/management measures to ensure recovery hasn't started being implemented yet. Moreover, in relation to outcome b we advise there is a risk that 2 years' post 2020 a similar survey could have very different results. Outside of the byelaw areas the data could start to help form a core reef approach, but again more than one additional dataset would be required to fully implement that. Therefore we wish to highlight this to the Applicant in order to inform their decision making process.</p>	<p>The survey has been designed to provide the Applicant and Norfolk Vanguard with a reliable baseline to underpin the core reef approach and to allow initial cable routeing design to avoid areas of <i>S.spinulosa</i> reef . This data would then be supplemented by the Norfolk Vanguard pre-construction surveys and then the Norfolk Boreas pre-construction surveys.</p> <p>The Applicant understands that two fisheries management areas have been proposed which overlap with the cable corridor and that this may result in a change to the extent and location of <i>S.spinulosa</i> reef. The first area to be implemented is likely to be the EIFCA byelaw area which is expected to come into effect sometime in the Autumn of 2020 [REP2-069]. This would only occupy approximately 1.5% of the section of the offshore cable corridor within the SAC. Whilst <i>S.spinulosa</i> reef could increase within this protected area as a result of less fishing activity, this change will not affect the remaining 98.5% of the offshore cable corridor. Furthermore, the proposed bylaw does not stretch across the entire width of the offshore cable corridor, therefore even if the change results in recovery of Annex I <i>S.spinulosa</i> reef, across the entire byelaw area that would not occur across the entire width of the offshore cable corridor in that particular location. The Applicant's</p>

Summary of Submission		Applicant's Comments
		<p>clarification note submitted at Deadline 4 [REP4-022] demonstrates that in this scenario, sufficient space would remain within the offshore cable corridor at this location to install the Norfolk Boreas and Norfolk Vanguard export cables.</p> <p>The Applicant is also aware of a fisheries management area which has been proposed by Defra to restrict fishing activity across a much larger section of the SAC. Given the joint recommendation requirements to implement this restriction, there is however little prospect that it will be implemented in advance of the anticipated offshore construction date for Norfolk Boreas, especially given the uncertainty on how fisheries closures will be progressed following Brexit. Furthermore,, there is no guarantee that the restriction proposed by Defra will lead to recovery of Annex 1 <i>S.spinulosa</i> reef. The Vessel Monitoring System (VMS) data used in the Joint recommendation for the restriction showed that there has been very little fishing within the majority of the Norfolk Boreas offshore cable corridor and therefore the restrictions will not result in a significant change in fishing pressure.. This is applicable to both the Defra recommended restriction and the EIFCA proposed byelaw. For further discussion on this please see section 3.1.1 of the Applicant's position paper on the HHW SAC [ExA.AS-6.D5.V1]).</p> <p>There is also recent research which has found <i>S.spinulosa</i> reef in areas that experience high levels of fishing pressure; Van de Reijden (2019), published a paper on the Discovery of <i>Sabellaria spinulosa</i> reefs in an intensively fished area of the Dutch Continental Shelf, North Sea. It is however recognised that, should the fisheries management area be implemented prior to Norfolk Boreas construction, further survey work will be required to establish to what extent (if any) the <i>S.spinulosa</i> reef has recovered as a result of the fishing restrictions. This would be completed as part of the Norfolk Vanguard and Norfolk Boreas Pre-construction surveys.</p>
2.7	Table 4.2	Three surveys will inform understanding prior to commencement of any works, being the proposed <i>S.spinulosa</i> reef surveys in 2020, the Norfolk Vanguard pre construction surveys likely to be undertaken in 2023-2024 and



Summary of Submission		Applicant's Comments
	<p>The IPMP only seems to focus on construction and not on Operations and Management (O&amp;M). The requirement for Annex I reef surveys for O&amp;M activities seems to have fallen between the cracks. Monitoring of Annex 1 reefs for O&amp;M will be required in the form of Geophysical data and ground truthing using drop down video, completed 18 months – 2 years prior to the works taking place. For anything other than this justification will be required</p>	<p>the Norfolk Boreas preconstruction surveys (likely to be undertaken in 2024 - 2025). The scope of each survey would be agreed with Natural England and the MMO. The IPMP (REP1-029) commits the Applicant to undertake surveys to monitor known areas of <i>S.spinulosa</i> reef at “a frequency to be agreed with the MMO (e.g.3 years non-consecutive e.g. 1, 3 and 6 years or 1, 5 and 10 years). If evidence of recovery is available and agreed with the MMO, monitoring will cease. Surveys specifically targeting those reefs identified in the baseline survey will be undertaken as a check on their condition using the same methodology set out for pre-construction monitoring to be agreed with the MMO”. Therefore the Applicant considers that monitoring during the operation period has been considered with the possibility of three or more surveys over a period of ten or more years post construction.</p>
<p><b>DCO Document 8.16 Outline Scour Protection and Cable Protection Plan</b></p>		
2.9	<p>The update to this document consists of inclusion of statements committing to the reduction in protection and sign posting to the SIP; whilst NE welcome the reduction in protection our previous comments on the Outline Scour Protection and Cable Protection Plan remain unchanged.</p>	<p>The Applicant notes this comment and has responded to Natural England's previous comments on this document with the Applicant's Comments on Relevant Representations [AS-024]</p>
<p><b>DCO Document 8.20 Outline Norfolk Boreas Haisborough Hammond and Winterton Special Area of Conservation Site Integrity Plan</b></p>		
2.10	<p><i>Section 56, Section 4.2.1</i>            An Annex I reef survey is planned for 2020, it would be good to know how this relates to the construction time table.</p>	<p>An indicative construction programme is provided in Table 5.26 of the ES [APP-218]. Based on this the 2020 survey would take place four years prior to pre-construction activity taking place and five years prior to the main construction activity commencing.</p>
2.11	<p><i>Section 77, Page 25</i>            NE notes the Applicant refers to temporary disturbance if Annex I reef cannot be avoided. This is something that NE has advised against in our RR [099], and our advice remains unchanged.</p>	<p>The Applicant understands this advice, however as requested by Natural England, the Applicant has had to account for a scenario where the entire cable route contains <i>S.spinulosa</i> reef, at which point temporary impact would be necessary over a relatively small (in terms of the extent that <i>S.spinulosa</i> reef would have to have increased to create this situation) area.</p>

Summary of Submission		Applicant's Comments
2.13	<p><i>Section 81, Page 28</i></p> <p>NE welcomes the consideration of different electrical solutions, particularly the consideration of only one export cable to be located within HHW SAC. However, from discussions with the Applicant on 8th January 2020 it is clear that this is not committed to and previous numbers of cables remains an option. Should the option of a single cable route be proposed as mitigation then further consideration will need to be given as to whether or not this is sufficient to remove NE concerns in relation to AEoI on the site. In order to do this the impact assessments will need to be revised</p>	At this stage of the projects design process it is not possible for the Applicant to commit to a single electrical solution therefore the use of one or more export cables cannot be ruled out.
2.14	<p><i>Section 96, Page 31</i></p> <p>NE is concerned that the disposal of sediment will only be agreed in the final HHW SIP post consent. We would hope that ongoing surveys will enable this to be agreed sooner rather than later.</p>	The Applicant would also welcome the agreement of the sediment disposal strategy as early as possible.
2.15	<p><i>5.4.1</i></p> <p>NE welcomes the consideration of further mitigation measures.</p>	This comment is noted by the Applicant.
2.16	<p><i>Section 106, Page 35</i></p> <p>NE welcomes the removal of redundant cables to reduce the cable protection requirements.</p>	This comment is noted by the Applicant.
2.17	<p><i>Section 127, Page 37</i></p> <p>The proposals are not mitigation, but best practice and doesn't remove cable protection requirement.</p>	The Applicant agrees this is not additional mitigation which removes the need for cable protection. However the Applicant considers that these commitments do reduce the risk of impacts on the SAC.
2.18	<p><i>Table 6.1, Page 43</i></p> <p>The additional survey of Sabellaria reef is welcomed.</p>	This comment is noted by the Applicant.
2.19	<p><i>Appendix I, Page 48</i></p> <p>In relation to ability to micro site NE advice remains unchanged from that of our relevant representation [REP – 099].</p>	The Applicant notes this comment and has responded to Natural England's previous comments on this document within the Applicant's Comments on Relevant Representations [AS-024].
2.20	<p><i>Appendix 3 of SIP - likely Cable protection locations</i></p>	This comment is noted by the Applicant.

Summary of Submission		Applicant's Comments
	General point - all of the site is designated with no site fabric	
2.21	<i>Appendix 3 of SIP - likely Cable protection locations</i> 3.1. Natural England is less concerned about cable crossing points compared to un-impacted areas, as it is unlikely for reef to be present.	This comment is noted by the Applicant.
2.22	<i>Appendix 3 of SIP - likely Cable protection locations</i> Whilst this document gives more confidence that areas of reef will be avoided, we remain concerned that protection is still being proposed within the site.	The Applicant has now made the commitment to avoid cable protection in the areas which Natural England have identified as priority areas [RR-099].

### 1.10 Natural England's Updated Ornithology Advice (provided prior to ISH4) REP4-039

4. In advance of the Issue Specific Hearing on the 22<sup>nd</sup> of January 2020, Natural England submitted a document containing updated ornithology advice to both the Examining Authority (ExA) and the Applicant, in response to the Applicant's Offshore Ornithology Assessment Update as Submitted at Deadline 2 (REP2-035).

#### 1.10.1 Precaution in Assessments

Summary of Submission		Applicant's Comments
<b>1.1</b>	<b>Use of collision estimates calculated for consented wind farm designs in the cumulative and in-combination totals</b>	
	The Applicant refers to projects in the cumulative and in-combination assessments that have been built out to a lower capacity than that consented as a source of precaution within the assessments. As Natural England has stated previously during the Norfolk	The Applicant acknowledges Natural England's position on this matter and presented evidence in support of the legal aspect during ISH4 and in the Applicant's written summary of oral submissions (REP4-014). In addition, the Applicant's written summary of oral submissions REP4-104) provides a detailed explanation and demonstration that it is not necessary to re-run the collision model. Thus, the Applicant considers that it is a straightforward task to base wind farm impacts on as built designs, not consented ones.

	Summary of Submission	Applicant's Comments
	<p>Vanguard examination (see our Deadline 2<sup>1</sup> and 8<sup>2</sup> responses for this examination), we acknowledge that this is an important issue with regard to cumulative/in-combination collision risk modelling (CRM) predictions and assessments. However, without a legally secured reduction in the consented Rochdale envelope, and a re-run CRM with the final design parameters (noting that the predicted impacts still need to be calculated for the worst case scenario within the consent unless there is documented evidence that what has been built cannot be added to/changed etc. over the lifetime of the project consent), cumulative assessments should be based on consented parameters. We note that East Anglia 1 is currently the only project to date to meet these tests.</p>	
<b>1.2</b>	<b>Nocturnal Activity</b>	
	<p>The Applicant refers to nocturnal activity factors used in the assessments as being overestimates. As we have noted previously during the Norfolk Vanguard examination (see our Relevant and Written Representations, our Deadline 2<sup>1</sup> and Deadline 8<sup>2</sup> submissions for the Vanguard examination), we recognise that from recent evidence presented e.g. by MacArthur Green (2015) and Furness et al. (2018), nocturnal activity levels relative to daytime levels for some species may be lower than the levels that equate to the nocturnal activity factors currently used in CRM. However, this does not necessarily translate into an over assessment of nocturnal collision risk, because of the way that densities of birds derived from baseline digital aerial surveys may not reflect diurnal activity patterns as measured by tagging studies. Our position regarding nocturnal activity rates/factors position remains unchanged from that set out during the Norfolk Vanguard examination, which includes that offshore survey periods will have missed the periods of peak activity around dawn and dusk, which means it is not appropriate to apply 'empirically derived' nocturnal activity rates from tracking studies to offshore survey recorded results. Additionally, as we have previously noted during the Norfolk Vanguard examination (see</p>	<p>The Applicant acknowledges that in order for nocturnal activity to be applied robustly in the CRM it is necessary to have confidence in the representativeness of the daytime activity recorded by surveys. Furthermore, the aim for the daytime surveys should be to capture 'average' levels of activity, not peaks or troughs of activity. In the case of gannet the data presented in Furness et al. (2018) demonstrated that the period when surveys are often conducted corresponds with average activity levels and therefore this requirement is typically met.</p> <p>For older wind farm applications it is very unlikely that it will be possible to obtain records of the timing of the original surveys and it is therefore necessary to make an assumption that these data were collected in a robust manner. The Applicant is not aware that the representativeness of baseline surveys was questioned by Statutory Nature Conservation Bodies (SNCBs) in</p>

<sup>1</sup> Natural England (2019) Norfolk Vanguard Offshore Wind Farm: Comments on Offshore Ornithological Aspects of Applicant's Response to Section 51 Advice from the Planning Inspectorate. Available from: <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-002461-Natural%20England%20-%20NE%20detailed%20comments%20on%20Offshore%20Ornithology%20S51%20Advice.pdf>

<sup>2</sup> Natural England (2019) Norfolk Vanguard Offshore Wind Farm: Natural England's Comments on Norfolk Vanguard Ltd. Deadline 7 and Deadline 7.5 submissions in relation to Offshore Ornithology Related matter. Available from: <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-003121-DL8%20-%20Natural%20England%20-%20Deadline%20Submission.pdf>

Summary of Submission		Applicant's Comments
	our Deadline 2 <sup>1</sup> and 8 <sup>2</sup> responses for this examination), Natural England considers that it is not appropriate to simply adjust the CRM figures for the other OWFs included in the cumulative assessments to account for a change in nocturnal activity rate without re-running the CRM, as the modelling calculates the reduction in activity at night through the interaction of nocturnal activity and the latitude of the specific wind farm. Therefore this is a calculation specific to the windfarm in question and hence a re-run of the model is required.	<p>the past (i.e. before the reassessment of nocturnal activity was undertaken) and therefore it seems reasonable to assume the SNCBs accepted these data as the basis for assessment. The Applicant was also not aware of the argument implied by Natural England that the SNCBs justified the use of the previous (higher) nocturnal rates on the basis that they allowed for this potential unrepresentativeness in the survey data.</p> <p>The revised nocturnal activity rates (Furness et al. (2018) provide the first robust, evidence based values for collision risk modelling and therefore are a useful step towards improved realism in the modelling. Furthermore, despite Natural England's suggestion that it is not appropriate to adjust nocturnal activity for other wind farms, the method to do this simply requires the wind farm latitude which can easily be obtained from publicly available sources.</p>
<b>1.3</b>	<b>Over-emphasis on predictions using upper 95% confidence intervals</b>	
	As noted in our Deadline 9 response during the Norfolk Vanguard examination, the distribution of birds in the marine environment appears to be highly variable between days, seasons and years. It is likely that e.g. 24 days of surveys over 2 years - approximately 3.3% of the total number of 720 days - do not fully capture the full extent of variation density/abundance of seabirds that can be present within the survey areas during the 2 year period, including low as well as high counts, let alone over the 30-year period of the lifespan of the project. In that context, if uncertainty in an offshore ornithology survey dataset is to be properly addressed, it is entirely appropriate for the Applicant to present values from both lower and upper 95% confidence limits for consideration, bearing in mind that Natural England takes, and has consistently advocated, a range based approach.	The Applicant acknowledges the points raised by Natural England and has submitted a review of flight speed data for kittiwake at Deadline 5 (ExA.AS-5.D5.V1). This review has considered a wide range of studies and it therefore addresses the concerns raised by Natural England. The review recommends that the current flight speed used for kittiwake ( $13.1\text{ms}^{-1}$ ) should be reduced to $10.8\text{ms}^{-1}$ . Use of this flight speed in the collision model reduces collision predictions by 11%. This reduction would be appropriate to apply to all wind farms in the cumulative and in-combination assessment.
<b>1.4</b>	<b>Slower flight speeds for kittiwake</b>	
	The Applicant notes that recent studies have reported slower flight speeds for kittiwake (e.g. from Skov et al. 2018) compared with the value which has previously been assumed for use in CRM, and that reducing the value for flight speed entered in the collision model	The Applicant acknowledges the points raised by Natural England and has submitted a review of flight speed data for kittiwake at Deadline 5. This review has considered a wide

Summary of Submission		Applicant's Comments
	reduces the predicted number of collisions. Natural England recognises the need to review the evidence base for flight speeds. However the Offshore Renewable Joint Industry Project (ORJIP) avoidance study (reported in Skov et al. 2018) is just one data source for this parameter, whereas a robust review would need a range of locations/seasons per species. (Such an analysis should be possible via flight speed tracking data – please note that Marine Scotland have a project underway reviewing flight speed: CR/2018/13 'Improving our understanding of seabird behaviour at Sea'). In addition, the ORJIP data (Skov et al. 2018) also presents very different flight height distributions from the generic (pooled and modelled) data used. There is likely to be a relationship between flight speed and height, which in turn undermines confidence in the applicability of the flight speeds collected at Thanet by ORJIP for use at other projects.	range of studies and it therefore addresses the concerns raised by Natural England. The review recommends that the current flight speed used for kittiwake ( $13.1\text{ms}^{-1}$ ) should be reduced to $10.8\text{ms}^{-1}$ . Use of this flight speed in the collision model reduces collision predictions by 11%. This reduction would be appropriate to apply to all wind farms in the cumulative and in-combination assessment.
<b>1.5</b>	<b>Under estimated avoidance rates</b>	
	The Applicant notes that there is evidence (e.g. Bowgen & Cook 2018; Skov et al. 2018) that for some species the currently advised avoidance rates are too low. Natural England note that the SNCBs are currently reviewing the evidence on avoidance rates presented in the recently published Bowgen & Cook (2018), and its applicability to SNCB advice on CRM. This work is ongoing. Therefore Natural England's position remains that the appropriate avoidance rates to use with Band (2012) model are those set out in the SNCB guidance note JNCC et al. (2014), i.e. 98.9% for gannet and kittiwake with the 'Basic' Band model (i.e. Options 1 and 2).	The Applicant acknowledges that Natural England is considering this work (which proposed a gannet avoidance rate of 99.5%) which implies that it is possible the statutory guidance will be updated. On this basis the Applicant believes it is appropriate for this to be noted in the assessment.
<b>1.6</b>	<b>Extent of displacement</b>	
	The Applicant notes that the review of studies conducted at operational wind farms during the Vanguard Examination (MacArthur Green 2019a) concluded that an evidence-based, but still precautionary, assessment of displacement of auks by offshore wind farms might assume that their densities would be reduced inside offshore wind farms by 50% relative to densities in the surrounding area, and by 30%, on average, across a 1 km buffer zone surrounding the wind farm. The Applicant asserts that there are very few examples where displacement is greater than this, and many cases where it is much less. The Applicant	No response required.

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<p>considers that this contrasts with Natural England's advice to assess displacement rates of 30% to 70% across the wind farm and a 2km buffer.</p>	
<p>As was noted in our Deadline 3 response during the Vanguard examination, Natural England considers that the evidence for auk displacement is variable, with some studies finding a strong displacement effect of guillemots and razorbills from offshore wind farms, whereas other studies have found none. For example displacement of guillemots and razorbills have been reported in the non-breeding season in the southern North Sea of distances from 2 to 4km (Petersen et al. 2004) and Petersen &amp; Fox (2007) demonstrated the exclusion of guillemots out to at least 2km at Horns Rev development site. Mendel et al. (2014), studying the Alpha Ventus windfarm in Germany found that guillemot were in significantly lower numbers in all distance bands from the windfarm (out to 6-10km), with the highest displacement within 2km of the windfarm (razorbill were not in sufficient numbers to assess). Welcker &amp; Nehls (2016), also studying Alpha Ventus, found that auks (predominantly guillemot) were 75% lower inside compared to outside the windfarm and that the lower numbers were evident out to 2.5km of the windfarm. Welcker &amp; Nehls (2016) also conducted a literature review of studies looking at displacement and concluded that there was strong evidence across studies that auks are displaced by offshore windfarms. However, this has not been the case for other studies, e.g. guillemots at Robin Rigg wind farm in Scotland (Vallejo et al. 2017) and a study by Webb et al. (2017) found no displacement or attraction occurred at the Lincs and LID wind farms for all auks. Dierschke et al. (2016) conducted a review (for full details see table 3 in the paper) and they concluded that common guillemot and razorbill 'weakly avoided' windfarms. We note that displacement of auks may be state-specific (breeding or non-breeding) or it may be due to habitat quality and/or availability (e.g. birds will be more easily displaced from poorer quality habitat or where habitat is not limiting). Hence we again conclude that consideration of a range of displacement rates from 30%-70% across a 2km buffer remains our advice.</p>	<p>The Applicant acknowledges Natural England's position on this topic, but considers that the evidence based approach discussed (i.e. 50% displacement and 1% mortality) is more appropriate for assessment, and also notes that a recent study has provided further evidence that even under highly precautionary assumptions about displacement, population level effects from cumulative displacement in the North Sea were minimal (Kooten et al. 2019).</p>
<p>The Applicant also asserts that larger turbines that are spaced further apart will result in reduced displacement effects. Natural England considers that this idea that spacing is all and other factors such as turbine size has no bearing on displacement effects has very little supporting evidence, and unless other evidence can be brought forward, we disagree with the assertion that displacement is 'very likely' to be over-estimated with regard to this</p>	<p>The Applicant acknowledges Natural England's position on this topic. However, the Applicant considers it is important to give full consideration to turbine spacing within a wind farm, since the turbines in Norfolk Boreas (and other wind farms built with similar sized turbines) will be spaced much further apart than in</p>



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	<p>specific point. It is plausible that turbine spacing is one of several variables that could affect displacement effects on birds, but such an effect, and the strength of such an effect (including relative to other variables), is yet to be demonstrated. It also seems likely that there will be site specific and species/individual specific variability in the effect (if any), which is one of the reasons why Natural England advises that a range of displacement levels should be considered, in order to reflect such potential variability.</p>	<p>older wind farms where existing studies have been conducted, and therefore there is considerable opportunity for species to forage between turbines. While the Applicant agrees that there is currently limited evidence to estimate the potential relationship between turbine spacing and rates of displacement, there is evidence that such an effect exists (Leopold et al. 2013). The Applicant considers it important to highlight this aspect since it represents one reason why the current assessment, conducted following Natural England guidance, is likely to over-estimate displacement effects and is therefore precautionary.</p> <p>Leopold, M. F., van Bemmelen, R. S. A. and Zuur, A. (2013) Responses of local birds to the offshore wind farms PAWP and OWEZ off the Dutch mainland coast. Report C151/12, Imares, Texel.</p>
<b>1.7</b>	<b>Mortality resulting from displacement</b>	
	<p>The Applicant states that: <i>'The consequences of displacement are less well understood than rates of displacement, and Natural England therefore adopts precautionary values for assessment of up to 10% (i.e. 10% of displaced individuals suffer mortality as a direct result).'</i></p>	<p>See response above to point 1.6.</p>
	<p>As noted in our Deadline 9<sup>3</sup> response at Vanguard, it is not the case that Natural England focusses its assessments on a 10% mortality rate alone – we consider a range of potential rates. Critically though, empirical evidence regarding the energetic consequences of displacement for seabirds and wintering waterbirds using the marine environment are very limited, and the role of overwinter survival on seabird population dynamics is poorly understood. Therefore as there is very little information available about the consequences</p>	<p>The Applicant agrees that in the specific case of mortality resulting from wind farm displacement there is limited evidence, however the review submitted by the Applicant at Deadline 2 (REP2-035), included consideration of a number of studies which could be used to inform this aspect. The Applicant considers there to be good evidence that Natural</p>

<sup>3</sup> Natural England (2019) Norfolk Vanguard Offshore Wind Farm: Natural England's comments on Deadline 8 Submission – Offshore Ornithology Precaution in ornithological assessment for offshore wind farms. Available from: <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-003190-DL9%20-%20Natural%20England%20-%20Deadline%20Submission.pdf>

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<p>of displacement for individuals, there is actually no evidence to suggest that 10% is precautionary. Furthermore, we again note that the mortality rates are a crude method of capturing a range of potentially deleterious effects that could arise from displacement, including reduced fitness for migration and reduced productivity during the breeding season. These are particularly relevant when considering displacement effects within sites designated for the species affected.</p>	<p>England's mortality range (of 1-10%) is precautionary and notably Natural England has acknowledged that mortality is likely to be at the lower end of this range (RR-099).</p>

### 1.10.2 Key points on Applicant's updated offshore ornithology assessments in REP2-035

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<p>2.1 We welcome that the Applicant has given consideration of the uncertainty/variability in input parameters of the assessments through consideration of the collision and displacement predictions for Norfolk Boreas alone based on the 95% confidence intervals of the bird density or abundance data.</p>	<p>The Applicant welcomes Natural England's response on this point and assumes that this aspect of the assessment is now agreed.</p>
<p>2.2 We agree that the collision predictions from Norfolk Boreas alone are based on outputs from the Band (2012) collision risk model, and that the uncertainty/variability is considered through consideration of the 95% confidence intervals of the bird density data. As given the current issues identified with the stochastic collision risk model, this represents the best available approach and the greatest variability in predictions for Norfolk Boreas comes from variation of the bird density data.</p>	<p>The Applicant welcomes Natural England's response on this point and assumes that this aspect of the assessment is now agreed.</p>
<p>2.3 We welcome that the cumulative and in-combination collision and displacement assessments have been updated to include the missing offshore wind farms noted in our Relevant Representations [RR-099] and to correct the figures for other projects (e.g. Vanguard, Thanet Extension, Hornsea 3) as identified in RR-099.</p>	<p>The Applicant welcomes Natural England's response on this point and assumes that this aspect of the assessment is now agreed.</p>
<p>2.4 With regard to the numbers included in the cumulative/in-combination assessments for Hornsea 3, we note that Natural England highlighted throughout our written and oral submissions for Hornsea 3 that the lack of sufficient baseline information for the Hornsea 3 Zone (i.e. the array area) means that there is a considerable degree of uncertainty (and thereby level of risk) associated with these figures and these should in no way be seen as Natural</p>	<p>The Applicant acknowledges Natural England's response on this point and intends to provide updated cumulative and in-combination assessment at Deadline 6 which will include updated figures for Hornsea Project Three which are currently</p>

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	England's agreed position on the levels of impact from Hornsea 3. We acknowledge that the Hornsea 3 decision has been delayed and that BEIS has sought further information from the Hornsea 3 developer. We therefore note that there is the potential that the figures for Hornsea 3 could change during the Norfolk Boreas examination process and there may hence be a requirement to update the figures included in the cumulative/in-combination assessments for this project.	expected to be submitted to the Planning Inspectorate on the 14 <sup>th</sup> February 2020.
2.5	Due to Natural England's significant concerns regarding the incomplete baseline surveys for the Hornsea 3 project, and the associated level of uncertainty as regards the potential impacts of that project, Natural England is not in a position to advise that a significant adverse impact for cumulative impacts at EIA scale or adverse effect on integrity (AEoI) for in-combination impacts at HRA can be ruled out for any relevant species or feature of an SPA when the Hornsea 3 is included in the totals.	The Applicant acknowledges Natural England's position on this point, and notes that cumulative and in-combination totals have been presented both with and without this project, as advised by Natural England. It is intended that this approach will also be applied in the updated cumulative and in-combination assessment to be submitted at Deadline 6.
2.6	We note that there may be the potential for figures for the East Anglia One North and East Anglia Two projects to change during the examinations for these projects. However, we acknowledge that values currently included by the Norfolk Boreas Applicant for these projects represent the most appropriate at present.	The Applicant welcomes Natural England's response on this point and assumes that this aspect of the assessment is now agreed. It should also be noted that, given the expected timetable for examination of these projects, and the Applicant's commitment to submit an updated cumulative and in-combination assessment for Norfolk Boreas at Deadline 6, the Applicant does not expect that there will be any revisions which can be included in the assessment.
2.7	We also note that the figures for Hornsea 4 come from the PEIR for that project. These figures and the methodologies to produce them are hence subject to ongoing discussions through the evidence plan process and therefore have an element of uncertainty associated with them and a likelihood of being subject to change. For example, the CRM figures presented in the Hornsea 4 PEIR were undertaken using the stochastic CRM, and therefore are potentially affected by the issues currently being investigated with this model.	The Applicant acknowledges Natural England's response on this point, and notes that cumulative and in-combination totals have been presented both with and without this project, as advised by Natural England. It should also be noted that, given the expected timetable for examination of this project, and the Applicant's commitment to submit an updated cumulative and in-combination assessment for Norfolk Boreas at Deadline 6, the Applicant does not expect that there will be any revisions which can be included in the assessment.
2.8	The inevitable uncertainty around the Hornsea 4 figures along with that position set out above regarding inclusion of Hornsea 3 in the cumulative and in-combination assessments means that	The Applicant acknowledges Natural England's response on this point, and notes that cumulative and in-combination totals

Summary of Submission		Applicant's Comments
	Natural England is not in a position to advise that a significant adverse impact for cumulative impacts at EIA scale or adverse effect on integrity (AEoI) for in-combination impacts at HRA can be ruled out for any relevant species or feature of an SPA when the Hornsea 3 and Hornsea 4 projects are included in the totals.	have been presented both with and without these two projects, as advised by Natural England.
2.9	We understand that the figures included in the gannet and kittiwake cumulative and in-combination collision assessments (in Tables 7.1 and 7.2 of REP2-035) for the Dogger Bank Creyke Beck projects have been updated with numbers from collision risk modelling (CRM) undertaken as part of a non-material change application (Dogger Bank Wind Farms 2018). Natural England notes that our initial response to this non-material change application suggested that any future projects entering the consenting project envelope in their in-combination assessment, should this non-material change to the DCO be accepted. However, subsequent to this advice it became apparent from the developer that the non-material change application increased the Rochdale envelope to include larger turbines, but the rest of the envelope remained unchanged, i.e. smaller turbines aren't removed. Therefore, the worst case scenario for the Dogger Bank Creyke Beck projects still stands and we advise that these figures should be used in the cumulative/in-combination assessments.	The Applicant acknowledges Natural England's response on this point and intends to provide updated cumulative and in-combination assessment at Deadline 6 which will include revised figures for this project.
2.10	The Applicant has run EIA scale Population Viability Analysis (PVA) models for gannet, kittiwake, lesser black-backed gull (LBBG) and great black-backed gull (GBBG) for the Biologically Defined Minimum Population Scale (BDMPS) and biogeographic population scales using the Natural England commissioned Seabird PVA Tool ( <a href="https://github.com/naturalengland/Seabird_PVA_Tool">https://github.com/naturalengland/Seabird_PVA_Tool</a> ). This updates the previous PVA models for EIA scale kittiwake and GBBG undertaken at East Anglia 3 assessment (EATL 2015 & 2016) and the SOSS national gannet PVA (WWT 2012), so that the models are run over 30 years, the stochastic simulations are run as matched pairs and present outputs for the Natural England recommended metrics of the counterfactual of population growth rate and the counterfactual of population size to quantify the relative changes in a population in response to anthropogenic impacts. Further specific comments regarding the PVAs run using the Natural England tool are set out in Section 2.1 below.	The Applicant welcomes Natural England's response on this point and assumes that this aspect of the assessment is now agreed. Natural England's comment that the current PVA models represent the best currently available evidence for assessment remains valid.
2.12	As noted in the 2017 SNCB interim advice on displacement (SNCBs 2017), the number of birds at risk of reduced individual fitness (i.e. mortality and productivity losses) as a result of displacement is based on the numbers of birds present within a development area and buffer	The Applicant welcomes Natural England's response on this point, including that this introduces precaution into what the Applicant considers to be an already highly precautionary

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<p>both on the water and in flight. Assessment of the number of birds at risk of mortality as a result of collisions (e.g. with wind turbines) is based on the number of birds present within a development area that are in flight only. The mortality impacts estimated from CRM are assumed to be in addition to any mortality caused by displacement impacts. Productivity impacts due to displacement would be a further addition (but this is not currently quantitatively accounted for under existing methods/advice). Therefore, at present, the SNCBs regard the two impacts (collision and displacement) as additive and advise that they should be summed. In summing the predicted mortalities that arise via these two mechanisms, there is a risk of some degree of double counting as a bird that collides with a turbine cannot be displaced and vice versa. Thus, it is acknowledged that this simplistic approach will therefore incorporate a degree of precaution. The level of precaution is difficult to gauge, but will be highest when the number of birds recorded flying at turbine height (and therefore the predicted number of collisions) is greatest (SNCBs 2017). We therefore welcome that the Applicant has in REP2-035 undertaken this assessment for gannet for EIA for Norfolk Boreas alone and cumulatively with other plans and projects and also for gannets from the FFC SPA both alone and in-combination.</p>	<p>assessment, and assumes that this aspect of the assessment is now agreed.</p>
<p>2.13 We welcome that the Applicant has in the assessment of kittiwake collisions to the FFC SPA from Norfolk Boreas alone considered a range of breeding season apportionment rates up to 100% in Table 3.7 of REP2-035, as advised by Natural England. This includes the Applicant's preferred breeding season apportionment rate of 26.1%. We also welcome that the Applicant has provided the requested information on kittiwake age classes recorded in the baseline digital aerial site-specific surveys undertaken of the Norfolk Boreas site in Appendix 1 of REP2-035. We note the issues highlighted by the Applicant with ageing of kittiwakes from digital aerial survey data and hence acknowledge the issues around confidence in this data.</p>	<p>The Applicant welcomes Natural England's response on this point and assumes that this aspect of the assessment is now agreed.</p>
<p>2.14 We welcome that the Applicant has included in REP2-035 an assessment of impacts on the assemblage qualifying feature of the FFC SPA.</p>	<p>The Applicant welcomes Natural England's response on this point and assumes that this aspect of the assessment is now agreed.</p>
<p>2.15 We welcome that the Applicant has undertaken a cumulative red-throated diver operational displacement assessment using the 'like for like' approach using the SeaMast data (Bradbury et al. 2014), as was undertaken at Thanet Extension and also used at Norfolk Vanguard during the examination.</p>	<p>The Applicant welcomes Natural England's response on this point and assumes that this aspect of the assessment is now agreed.</p>

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2.16	We consider that the LSE screening should be a coarse filter and as the offshore cable route passes through the Greater Wash SPA, this would indicate a potential impact pathway for species sensitive to disturbance/displacement from the presence of vessels and hence an LSE concluded for the common scoter qualifying feature. We therefore welcome that the Applicant has included an assessment of impacts to the common scoter feature of this SPA in REP2-035.	The Applicant welcomes Natural England's response on this point and assumes that this aspect of the assessment is now agreed.
2.17	<p>Whilst Natural England is still in the process of undertaking a full review of the updated assessments provided by the Applicant in REP2-035 and will provide our full advice on this at Deadline 4, we note that the cumulative and in-combination collision and displacement totals presented in REP2-035 for all relevant species and designated sites have increased from those presented in our Deadline 8<sup>4</sup> and 9<sup>5</sup> responses during the Norfolk Vanguard examination. This is the case for both the totals for all projects excluding Hornsea 3 and Hornsea 4, and those including Hornsea 3 and Hornsea 4. Therefore, whilst we haven't yet completed our review, it is considered highly likely that the same conclusions as those made by Natural England during the Norfolk Vanguard examination will still hold for Norfolk Boreas, namely:</p> <ul style="list-style-type: none"> <li>i. A significant adverse impact (moderate or above) cannot be ruled out for cumulative operational collisions for gannet, kittiwake and great black-backed gull, or cumulative operational displacement for guillemot, razorbill and red-throated diver at the EIA scale.</li> <li>ii. An adverse effect on integrity (AEoI) cannot be ruled out for in-combination operational collisions for kittiwake at the Flamborough and Filey Coast SPA, irrespective of whether the Hornsea 3 and Hornsea 4 projects are excluded from the total, or for lesser black-backed gulls at the Alde-Ore Estuary SPA.</li> <li>iii. We also note our comments above on the uncertainty regarding the figures for the Hornsea 3 and Hornsea 4 projects and therefore in addition we will be unable to rule out an AEoI for in-combination operational collisions for gannet at the Flamborough</li> </ul>	The Applicant acknowledges Natural England's position on these aspects and notes that Natural England has agreed that there will be no significant effects or adverse effects on integrity due to the Norfolk Boreas project alone. The impacts which Natural England has highlighted for concern all relate to cumulative and in-combination effects and have been reached using methods which the Applicant considers to be highly precautionary (see responses to points 1.1 to 1.7 above). The Applicant considers that if a more proportionate approach to precaution is used, it can be concluded that there will be no significant cumulative impacts or in-combination adverse effects on the integrity of designated sites, as presented in the Applicant's submissions.

<sup>4</sup> Natural England (2019) Norfolk Vanguard Offshore Wind Farm: Natural England's Comments on Norfolk Vanguard Ltd. Deadline 7 and Deadline 7.5 submissions in relation to Offshore Ornithology Related matters. Available from: <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-003121-DL8%20-%20Natural%20England%20-%20Deadline%20Submission.pdf>

<sup>5</sup> Natural England (2019) Norfolk Vanguard Offshore Wind Farm: Natural England's Comments on Deadline 8 Submission – Offshore Ornithology Auk Displacement Assessment Update for Deadline 8. Available from: <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-003190-DL9%20-%20Natural%20England%20-%20Deadline%20Submission.pdf>

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	<p>and Filey Coast SPA or for in-combination operational displacement for guillemot and razorbill at the Flamborough and Filey Coast SPA when the Hornsea 3 and Hornsea 4 projects are included in the in-combination totals.</p> <p>iv. However, we will provide a final conclusions/advice on all of these once we have completed our review of the updated assessments in REP2-035, which will be provided at Deadline 4.</p>	
2.18	<p>Natural England, therefore again recommends that the Boreas Applicant (and all relevant future projects located in the North Sea) considers raising turbine draught height, as has been done by other projects (e.g. Hornsea 2, East Anglia 3 and Norfolk Vanguard), in order to minimise their contribution to the cumulative/in-combination collision totals by as much as is possible. We would also advise that Norfolk Boreas considers a range of possible options of draught heights be presented, to demonstrate due consideration of alternative mitigation options.</p>	<p>The Applicant has given detailed consideration to potential mitigation options and has committed to both an increase in draught height of at least 8m (from 22m to 30m) for wind turbines of to 14.7MW and above and of at least 13 m (from 22 m to 35m) for wind turbines of up to 14.6MW and the removal of the two smallest turbine options (10MW and 11MW) from the design envelope. These mitigation measures combined attain modelled collision reductions of up to 74%. It should be noted that the removal of the two smallest turbine options alone is approximately equivalent to the reduction achieved by an increase in draught height of 5m for the 10MW scenario. Therefore, the combined result of these changes is equivalent to a draught height increase of 13m for wind turbines of 14.7MW and above and of 18m for wind turbines of up to 14.6MW.</p>



### 1.10.3 Specific comments on PVAs run using Natural England commissioned Seabird PVA

	Summary of Submission	Applicant's Comments
3.1	<p>As noted by the Applicant in Appendix 3 of REP2-035, Natural England did note to the Applicant that the Natural England Seabird PVA tool was available for use and advised consideration of it in any updates/re-running of PVA models undertaken as part of the Norfolk Boreas assessment. We also advised that, as was being done with the stochastic CRM, that any issues should be flagged on the GIT hub for the tool. We subsequently informed the Applicant that further changes were being made to the model and we advised waiting on running the models to make sure that the change is finalised before outputs for Boreas are generated. However, these models have been run before the updates to the tool have been completed. This is expected in mid-January 2020.</p>	<p>The Applicant acknowledges the advice from Natural England on this matter, however due to the limited time available for the project submission at Deadline 2 and the need to address Natural England's comments as far as possible, it was considered more appropriate to use the PVA tool in its current form than attempt to undertake alternative modelling. Natural England has now advised the Applicant that the updated PVA tool will be further delayed. However, their internal reviews have found that the model outputs are not affected by these updates and therefore the results presented in REP2-035 are robust and suitable for assessment.</p>
3.2	<p>Whilst the Applicant has confirmed that the simulated impact was applied to all ages in proportion to their presence in the population, the counterfactual metrics presented in Tables 3.2, 3.6, 3.11 and 3.18 in REP2-035 relate to breeding pairs only (i.e. adults in the population). We note that the tool can be set so that it outputs all age classes separately, but the metrics are then also reported against each age class separately. This is just an output reporting issue with the tables in the tool, which is one of the aspects being addressed in the updates currently being undertaken. Therefore, whilst we welcome that the Applicant has run these PVA models using the PVA tool, we have advised the Applicant in discussions since submission of our Relevant Representations [RR-099] that this additional work on the tool is due to be completed in mid-January 2020 and hence we recommend that the models are re-run when the updated version of the tool is available, and that the assessments present the metrics calculated across the whole population. The new version of the tool will have this as a new option that can be selected as an output type.</p>	<p>See previous response. In addition, the Applicant considers that the outputs are very unlikely to be materially affected by this revision.</p>
3.3	<p>We note that whilst the input parameters for these PVAs have been provided in Appendix 3 of REP2-035, there does not appear to be anything included on the outputs from the models in terms of the growth rates predicted by the models for the un-impacted scenarios. These are needed in order to assess whether the models are suggesting a reasonably sensible trajectory for the populations with no offshore wind farm impacts. Therefore, we advise that the</p>	<p>See previous response. These outputs will be included in the updated assessment to be provided at Deadline 6. These will be based on the existing model outputs since the PVA revisions have not been made available in time for these deadlines. .</p>

Summary of Submission		Applicant's Comments
	Applicant includes this information if the models are re-run, as advised by Natural England, following completion of the updates currently being undertaken on the PVA tool.	
3.4	<p>We also note from Appendix 3 of REP2-035 that:</p> <ul style="list-style-type: none"> <li>i. The kittiwake BDMPS and biogeographic density independent models and the guillemot FFC SPA density independent and density dependent models have been run for only 500 simulations; and,</li> <li>ii. The lesser black-backed gull BDMPS model and the great black-backed gull BDMPS and biogeographic independent and density dependent models have been run for 1,000 simulations.</li> </ul>	<p>The Applicant has discussed this aspect with Natural England during previous meetings and explained that this limit on the number of simulations resulted from failures to successfully run larger numbers of simulations. The Applicant's considerable experience in population modelling indicates that 1,000 simulations is a robust number to use, and that in many cases the outputs from 500 simulations are also robust. The Applicant intends to undertake some model comparisons (using the original version of the PVA tool) to demonstrate this result which will be submitted at a future deadline.</p>
3.5	<p>We note that the Seabird PVA Tool report (Searle et al. 2019) states that 'it is not recommended to use small values of sim.n (number of simulations) because PVAs based on small numbers of simulations are likely to be unreliable (using a value of less than 1,000 will generate a warning message in the tool, but in practice the minimum number of simulations may need to be substantially higher than this in order to achieve reliable results). Natural England considers that a larger number of simulations than 500 would be needed to generate reliable results for the kittiwake and guillemot models. With regard to models run for 1,000 simulations we recommend that the Applicant presents evidence to demonstrate that using 1,000 simulations in the models produces reliable results.</p>	<p>See previous response.</p>
3.6	<p>However, these models nevertheless currently represent the best available evidence on which to base an assessment, though this should not be taken as a Natural England endorsement or 'acceptance' of the model. Natural England will therefore consider the outputs from these models as they currently stand in our full response to REP2-035, which will be submitted at Deadline 4.</p>	<p>The Applicant welcomes Natural England's response on this point. Further responses to specific comments on the model outputs are provided in Table 1.11 below.</p>

#### 1.10.4 Approach to interpretation of predicted impacts

Summary of Submission		Applicant's Comments
4.1	<p>Where predicted impacts equate to 1% or below of baseline mortality for a population (e.g. colony population) then this level of impact could be considered non-significant. However, while 1% baseline mortality can be considered to be insignificant in the context of the population, we are not saying that this level of additional mortality should not be added to an assessment of in-combination impacts. Where predicted impacts equate to greater than 1% of baseline mortality of the relevant population (e.g. colony population), then we advise this is given further consideration, e.g. through population modelling, to determine the significance of the mortality for the population in question.</p>	<p>The Applicant welcomes Natural England's response on this point, which corresponds to the approach taken in the assessment, and assumes that this aspect of the assessment is now agreed.</p>
4.2	<p>We advise that population modelling is undertaken using stochastic Leslie matrix models. Where possible, demographic rates from the focal population should be used but where these are not available, we recommend using the best available estimates from other populations. Unless there is clear evidence of the form and strength of density dependence operating on the focal population, we recommend presenting outputs from density independent models. When using stochastic models it is necessary to use a 'matched-runs' approach (Green et al. 2016), where a metric is derived for each matched pair of baseline and impacted simulations. Matching simulations under impact scenarios with simulations under the baseline scenarios, allows the uncertainty associated with the impact of each scenario to be accurately represented, rather than uncertainties such as the variability in the demographic parameters that have been sampled. Cook &amp; Robinson (2016) recommend using both the counterfactual of population growth rate and the counterfactual of population size metrics. Natural England therefore recommends that assessments should focus on the counterfactual of population growth rate and the counterfactual of population size metrics to quantify the relative changes in a population in response to anthropogenic impacts, as these are the two metrics that have been shown to be the least sensitive metrics to mis-specification of the population trend and demographic rates used in the PVA model.</p>	<p>The Applicant welcomes Natural England's response on this point, which corresponds to the approach taken in the assessment, and assumes that this aspect of the assessment is now agreed.</p> <p>The Applicant considers that density dependent PVA are more appropriate since they generate more realistic predictions. When considering the outputs from a density dependent simulation the Applicant considers that the more appropriate metric for impact assessment is the counterfactual of population size, since this measure will vary between the baseline and impacted populations in line with the magnitude of impact, while the counterfactual of population growth (for a density dependent simulation) will provide limited information since long-term growth is constrained to one in both the baseline and impacted simulations (i.e. the models will produce approximately parallel population projections, with a gap between them determined by the size of the impact).</p> <p>In contrast, when considering Natural England's preferred density independent models, the population size is unregulated and a simulated population will therefore ultimately grow to infinity or decline to zero (i.e. if the model is run for sufficient</p>

Summary of Submission		Applicant's Comments
		<p>time there is no other outcome the model can produce). Density independent counterfactuals of population size therefore compare two projections which bear little resemblance to the way seabird populations, or indeed any natural populations, change. Furthermore, the counterfactual of population size is strongly influenced by the period over which it is calculated, getting increasingly large as the simulated period extends. In contrast, the counterfactual of population growth rate for a density independent simulation is not sensitive to the period over which it is estimated and provides a measure of the average annual effect of the modelled impact which applies at any temporal scale, from one year to the full period of the modelled impact.</p> <p>Since Natural England has advised the Applicant to focus on the density independent PVA outputs, the Applicant (for the reasons outlined above) has given primary consideration to the more reliable counterfactual of population growth.</p>
4.3	<p>As quantitative thresholds applied to metrics are arbitrary Natural England advises that a range of site, and project, specific factors need to be considered when making integrity judgements. Population metrics need to be considered with reference to the site trend, population status and SPA conservation objective for HRA, or to the relevant reference population trend and conservation status of the species for EIA. As it is not known what the growth rate of a specific feature of a colony will be over the next 30 years, this uncertainty should be considered when judging the significance of predicted impacts against the conservation objectives for the feature.</p>	<p>The Applicant welcomes Natural England's response on this point, which corresponds to the approach taken in the assessment, and assumes that this aspect of the assessment is now agreed.</p>
4.4	<p>In interpreting the metrics from a PVA, the counterfactual of growth rate and counterfactual of population size metrics at the end of the impact (e.g. after 30 years) should be considered against a realistic assessment of the current and potential future population trend. Where a specific feature of a designated site has a conservation objective to restore the population size to a given level (as is the case for kittiwakes at the Flamborough and Filey Coast SPA and lesser black-backed gulls at the Alde-Ore Estuary SPA), reductions in population growth rates and</p>	<p>The Applicant acknowledges Natural England's response on this point and notes that both counterfactual measures have been presented.</p> <p>The Applicant also considers that the requirement to increase the kittiwake population at the Flamborough and Filey Coast SPA to a figures in excess of 80,000 pairs is based on unreliable</p>

Summary of Submission		Applicant's Comments
	population size as a result of additional anthropogenic impacts may be counter to such conservation objectives. Whereas if a specific feature has a conservation objective to maintain the population size at or above a given level, as is the case for gannets, guillemots and razorbills at the Flamborough and Filey Coast SPA, then consideration will need to be given to a range of plausible growth rates for the colony and whether the PVA metrics suggest that the population will be maintained at or be able to grow above the current or designated population size over the lifetime of the predicted additional impact.	population estimates for which there is very little evidence. Furthermore, all other evidence points to the much simpler explanation that individuals were counted but recorded as pairs. Coulson (2017) presents detailed consideration of this population and strongly rebuts the evidence for the high counts.
4.5	This approach will be taken by Natural England in our comments/advice on the Applicant's updated offshore ornithological assessment in REP2-035 in our full response which will be submitted at Deadline 4.	The Applicant welcomes Natural England's response on this point and will continue to engage with Natural England to resolve any remaining aspects within the Applicant's control. Further comments on Natural England's submission at Deadline 4 (REP4-040) are provided in Table 1.11 below.

### 1.11 Natural England Updated Ornithology Advice REP4-040

Summary of Submission		Applicant's Comments
<b>The Applicant has not reproduced the complete REP4-040 submission in this response but instead has provided the headings and key points for those aspects to which a response was considered appropriate.</b>		
General		
Precaution in assessments	<p>Natural England provided a response on the Applicant's concerns regarding the over-precaution in the ornithology assessment in REP4-039 which included the same information as presented in REP4-040. The Applicant has responded to these comments in Table 1.1.1 .</p> <p>In addition to the comments in REP4-039 addressed above, in REP4-040 Natural England suggests that because the collision estimates obtained using Option 1 of the Band collision risk model (CRM) are higher than those obtained using Option 2 this supports the degree of precaution Natural England applies in ornithology assessment. However, the Applicant does not consider it appropriate to consider the Option 1 estimates in this manner due to the concerns raised by the aerial survey contractor about the reliability of their own methods. Furthermore, for these reasons it was agreed with Natural England during the Evidence Plan Process that the Applicant's</p>	

Summary of Submission	Applicant's Comments
	<p>assessment would be based on Option 2 (Project document ref: PB5640-004-025). Therefore, the Applicant considers Natural England's reference to the Option 1 estimates is inappropriate and that these should not be used as supporting evidence for the high levels of precaution proposed by Natural England.</p>
<p>Cumulative / in-combination assessments</p>	<p>The Applicant welcomes that Natural England has confirmed that, with the following exceptions, the cumulative assessment has been conducted as requested in RR-099. The Applicant notes Natural England's position with regard to the inclusion of projects which have not yet been determined and for which Natural England has outstanding concerns regarding the figures presented (Hornsea Project Three and Hornsea Project Four). For these reasons the Applicant has provided cumulative and in-combination assessments with and without these projects.</p> <p>Natural England has also requested that the Applicant reverts to the consented collision mortality estimates for the Dogger Bank Creyke Beck wind farm, in place of those submitted in that project's non-material change application. The updated cumulative and in-combination collision assessment to be submitted at Deadline 6 will include this revision.</p>
<p>Population Viability Analysis (PVA)</p>	<p>The Applicant welcomes the fact that Natural England has given consideration to the PVA results as presented at Deadline 2 (REP2-035), and also acknowledges Natural England's request that the PVA results be updated following a planned update to the Natural England PVA tool. Natural England informed the Applicant that the updates to this tool have been further delayed and these will not be available within the project's timeframe for examination. However, Natural England has also advised the Applicant that their own internal comparison of the original and updated PVA outputs has confirmed that the results are not materially altered and therefore the outputs in REP2-035 are robust for assessment.</p>
<p>EIA</p>	
<p>EIA Impacts of Norfolk Boreas – overall</p>	<p>The Applicant welcomes Natural England's agreement that the project alone will have no significant adverse impacts on any species (with the exception of red-throated diver for which Natural England has been unable to rule out a significant adverse effect. This is discussed in more detail under the project alone displacement, below).</p> <p>Nonetheless, the Applicant has continued to explore options for reducing impacts through design mitigations, with a commitment to an increase in draught height (to a minimum of 30m from Mean High Water Springs (MHWS) for wind turbines of 14.7MW and above and to a minimum of 35m</p>

Summary of Submission	Applicant's Comments
	<p>from MHWS for wind turbines of up to 14.6MW) and removal of turbine models of less than 11.55MW from the design envelope. The updated collision assessment for these changes has been submitted at Deadline 5 (ExA.AS-8.D5.V2). These mitigations reduce collision estimates by up to 74% compared with the values in the original application (APP-226).</p>
<p>EIA impacts of Norfolk Boreas alone – collision risk</p>	<p>The Applicant welcomes Natural England's agreement with the Applicant that the project alone will have no significant adverse impacts on any species due to collisions, and notes that further reductions in predicted collision risk have been submitted at Deadline 5 (ExA.AS-8.D5.V2).</p>
<p>EIA impacts of Norfolk Boreas alone – displacement risk</p>	<p>The Applicant welcomes Natural England's agreement with the Applicant that the project alone will have no significant adverse impacts on gannet, guillemot and razorbill due to displacement. However, Natural England considers that a significant impact cannot be ruled out for red-throated diver. The Applicant disagrees with Natural England's conclusion as it has been reached through a combination of assumptions in the assessment which the Applicant has provided following Natural England advice, but which are considered over-precautionary, as discussed in detail in REP2-035 (paragraphs 132 to 136) and the strict application of Natural England's preferred displacement and mortality rates. The Applicant considers that Natural England has not given due consideration to other factors which combine to indicate that for this assessment the application of a 10% mortality rate is highly precautionary and not appropriate.</p> <p>In summary, the annual (non-breeding) displacement total is the sum of the seasonal totals for autumn, winter and spring, of which the spring contribution is over 77%. The spring density estimate used in the assessment was strongly influenced by a late March survey (see REP2-035 for details) which is in the middle of the peak period of migration. During this period a large number of this species passes through the region and currently individuals are likely to be present for relatively short periods. Consequently the application of a 10% mortality rate to birds likely to be present for no more than two to three weeks at most (and even that duration is likely to be an over-estimate) is highly precautionary. At 10% mortality the predicted spring mortality due to displacement is 80, while at the Applicant's evidence based (precautionary) rate of 1% it is 8. The threshold for a 1% increase in the background mortality of the smaller Biologically Defined Minimum Population Scale (BDMPS) is 30 individuals. Therefore even if the mortality rate was as high as 3.75% this would still not result in a detectable effect on this BDMPS population while for the larger biogeographic population a mortality of less than 61 individuals (obtained with a 7.8% mortality rate) would be undetectable. Thus, even with still precautionary assumptions on</p>



Summary of Submission	Applicant's Comments
	<p>displacement mortality (of up to 3.75 and 7.8% for the BDMPS and biogeographic populations respectively) the effect would be undetectable against background variations.</p> <p>Thus, the Applicant does not agree with Natural England's conclusion and considers that a significant impact due to displacement from the project alone can be ruled out.</p>
<p>EIA impacts of Norfolk Boreas alone – displacement and collision risk combined (gannet)</p>	<p>The Applicant welcomes Natural England's agreement with the Applicant that the project alone will have no significant adverse impact on gannets due to collisions and displacement combined (and that this combined assessment introduces precaution into what the Applicant considers to already be a highly precautionary assessment). The Applicant also notes that further reductions in the predicted collision risk component of this potential impact have been submitted at Deadline 5 (ExA.AS-8.D5.V2).</p>
<p>EIA Impacts of Norfolk Boreas cumulatively - overall</p>	<p>The Applicant welcomes that Natural England has agreed that cumulative impacts can be ruled out for displacement of gannets and collisions of lesser black-backed gull, herring gull and little gull (when the uncertainty regarding impact levels for Hornsea Project Three and Hornsea Project Four are omitted). However, the Applicant does not agree with Natural England's conclusions for the remaining impacts, as detailed in the rows below.</p> <p>In addition, Natural England has highlighted that little gull collision figures for East Anglia ONE North and East Anglia TWO need to be included. These will be added to the little gull cumulative assessment to be submitted at Deadline 6.</p>
<p>EIA impacts of Norfolk Boreas cumulatively – collision risk</p>	<p><b>Gannet</b></p> <p>The Applicant considers that the approach Natural England has taken in reaching a conclusion that a significant cumulative impact cannot be ruled out due to collisions is overly precautionary. The PVA prediction (REP2-035) was that the population growth rate could be reduced by up to 0.8%. To provide a measure of what this level of reduction could mean for the population the Applicant has compared it to the recent growth rate of the population (2-3%), on the basis that this is the most robust current indication of the status of the population to use. On this basis the Applicant concluded that the cumulative impact would not have a significant impact on the population. Natural England disagrees with this conclusion on the basis that the population may not continue to grow at this rate. While this is undeniable, it remains the case that the best predictor of the future (and indeed the basis of all models designed to predict the future such as PVA) is the past, and more specifically the recent past. Thus the Applicant considers that Natural England is applying</p>

Summary of Submission	Applicant's Comments
	<p>an approach to the interpretation of the PVA outputs which can never be countered (i.e. that the future is unknowable and could be worse than the model prediction) and fails to take account of the fact that the most reliable predictor of the future is the recent past.</p> <p><b>Kittiwake</b></p> <p>The Applicant considers that the approach Natural England has taken in reaching a conclusion that a significant cumulative impact cannot be ruled out due to collisions is overly precautionary and also fails to acknowledge the counterfactual aspect of the analysis. The PVA prediction (REP2-035) was that the population growth rate could be reduced by up to 0.6%. Natural England has considered this against the approximate 40% decline in European kittiwake populations over the last 39 years and reached a conclusion that this magnitude of decline in growth rate is therefore significant. However, the observed kittiwake population declines are not due to wind farm collision mortality. The annual decline (to achieve a 40% reduction over 39 years) is approximately 2.3% per year, which is almost four times the maximum predicted decline for the smaller biologically defined minimum population scale (BDMPS) and over 20 times that for the biogeographic population scale (growth rate reduction of 0.11%), and the latter is arguably the more appropriate comparison at the European scale. Thus, while it is not disagreed that kittiwake populations are in decline, the potential maximum contribution to this is relatively small and in this context the Applicant was able to conclude the cumulative impact of wind farm collisions was not significant. Furthermore, while in the case of gannet Natural England disputed a suggestion the population may continue to grow at the recent rate, the same could equally be argued of kittiwake, that the recent trend may not be maintained and population growth cannot be ruled out.</p> <p><b>Great black-backed gull</b></p> <p>The Applicant presented predictions that the cumulative great black-backed gull collisions could result in population growth rate reductions of up to 1.4% for the BDMPS population or 0.55% for the biogeographic population. Against a backdrop of relative stability in this population (REP2-035) the Applicant considered these reductions would be so small they would have an undetectable effect on the population and therefore no significant impact would result. While Natural England has stated that the predicted effects have the potential to give rise to significant effects, the Applicant considers that very little evidence has been presented in support of this position in REP4-040 and therefore the Applicant considers that no significant effect remains a robust conclusion.</p>
EIA impacts of Norfolk Boreas cumulatively – displacement risk	<b>Red-throated diver</b>

Summary of Submission	Applicant's Comments
	<p>The Applicant welcomes Natural England's agreement that Norfolk Boreas' contribution to the cumulative displacement of red-throated diver is small at 0.1%, although the Applicant would suggest that in fact the project's contribution is extremely small. Furthermore, the Applicant disagrees with Natural England's conclusion (of a significant impact) for the following reasons. The like-for-like assessment of this impact (REP2-035) has demonstrated that 84% of the total impact is due to operational wind farms. During the period these wind farms have been installed, surveys of the region for this species have reported that the population has trebled in size from around 6,000 individuals to over 18,000. The Applicant considers that these highlight there is a large degree of over-precaution in Natural England's approach to this assessment, since impacts of the magnitude suggested (100% displacement and 10% mortality) would appear to be incompatible with a population which has grown considerably in spite of such effects apparently occurring. Thus the Applicant considers that there will be no significant cumulative displacement impact for red-throated diver.</p> <p><b>Guillemot and Razorbill</b></p> <p>The Applicant welcomes Natural England's agreement that most wind farms in the cumulative assessment are located in regions of lower importance to auks and that as a consequence mortality of displaced birds will be at the lower end of the 1%-10% range that is advised. The Applicant considers that Natural England's position is therefore not that different from its own. Furthermore, the Applicant has presented evidence in support of the rates used in the assessment (50% displaced and 1% mortality) which also explained why these retain precaution (REP2-035). Consequently the Applicant does not agree with Natural England that there will be a significant cumulative displacement effect for these species, since the evidence based assessment indicates much lower impact magnitudes.</p>
EIA impacts of Norfolk Boreas cumulatively – displacement and collision risk combined (gannet)	The same arguments made above in relation to gannet cumulative collision risk apply to this aspect of the assessment since displacement makes a very small contribution to the total.
HRA	
HRA Impacts of Norfolk Boreas – overall	The Applicant welcomes Natural England's agreement with the Applicant that the project alone will have no adverse effects on the integrity (AEoI) of any Special Protection Area (SPA) populations (noting that includes the Applicant's commitment to mitigation with respect to red-throated diver

Summary of Submission	Applicant's Comments
	<p>disturbance during cable installation and resulting from vessels involved in the project's operation and maintenance).</p> <p>Nonetheless, the Applicant has continued to explore options for reducing impacts through design mitigations, with an increase in draught height of at least 8m (from 22 m to 30m above MHWS for wind turbines of 14.7MW and above and of at least 13m for wind turbines of up to 14.6MW) and removal of turbine models of less than 11.55MW from the design envelope. The updated collision assessment for these changes has been submitted at Deadline 5 (ExA.AS-8.D5.V2).</p> <p>In addition the Applicant welcomes Natural England's agreement that the project, in-combination with other plans and projects (when Hornsea Project Three and Hornsea Project Four are excluded), will not result in any AEol for SPA populations, with the exception of kittiwake from the Flamborough and Filey Coast SPA and lesser black-backed gull from the Alde-Ore Estuary SPA. These are discussed in more detail below.</p> <p>With respect to Natural England's conclusions where AEol can be ruled out without Hornsea Project Three and Hornsea Project Four, but cannot be ruled out with these wind farms included (gannet, razorbill, guillemot and assemblage from Flamborough and Filey Coast SPA and little gull from the Greater Wash SPA), the Applicant notes that Natural England state these relate to their 'significant concerns' regarding the data used in the assessment of Hornsea Project Three and the preliminary nature of the figures for Hornsea Project Four. Thus, Natural England's conclusions appear to relate to the uncertainty that is introduced when these projects are included rather than to the actual in-combination impact magnitudes as presented. It was for this reason that the Applicant has presented in-combination impacts with and without the Hornsea wind farms and as advised by Natural England.</p>
<p>Flamborough and Filey Coast SPA – Kittiwake</p>	<p>The Applicant disagrees with the basis for Natural England's conclusions on the potential that in-combination collisions would have an AEol because this fails to take into account the reduced mortality for built wind farms compared with the consented designs and the Applicant also considers that the conservation objective for this population has been derived from erroneous data (as discussed in REP2-035). Thus, while Natural England considers that that target is a population of 80,000 pairs, there is robust evidence that the population has never been that large and that this is almost certainly unachievable. When this is taken into account, and the revised target is to maintain the population around its current size (i.e. between 40,000 and 50,000 pairs)</p>

Summary of Submission	Applicant's Comments
	it can be seen that the Applicant's PVA predictions would permit such an outcome, even including the sources of precaution inherent in the assessment.
Alde-Ore Estuary SPA – Lesser black-backed gull	The Applicant disagrees with Natural England's basis for concluding that the in-combination mortality of lesser black-backed gulls will result in an AEoI because this fails to take into account the reduced mortality for built wind farms compared with the consented designs and that the status of the gull population has been much more strongly influenced by changes in local farming practice and predation at the colony. Against this population context, the Applicant considers that the estimated (and precautionary) in-combination mortality will not result in an AEoI. In addition, the Applicant's contribution to the in-combination total has been further reduced by 64% following the project design revisions (with a revised worst case turbine of 14.7MW and minimum draught height of 30m from Mean High Water Springs). As a consequence the predicted collision mortality apportioned to the SPA population from Norfolk Boreas is now between 1.5 (Applicant's apportioning rate) and 2.1 (Natural England's apportioning rate), reduced from 4.3 and 6 respectively as estimated for the original project design. The revised collision estimates represent less than 4% of the total in-combination estimate.
Greater Wash SPA and Outer Thames Estuary SPA – Red-throated diver	<p>The Applicant welcomes Natural England's agreement that AEoI can be ruled out for red-throated diver displacement at the Greater Wash SPA and Outer Thames Estuary SPA as a result of the mitigation that the Applicant has agreed to put in place (restrictions on both cable installation and the movement of vessels involved in operation and maintenance through the Greater Wash SPA), as secured in the DCO:</p> <ul style="list-style-type: none"> <li>• Generation DMLs beneath the Project Environmental Monitoring Plan (PEMP) - Condition 14(1)(d)(vi) of Schedule 9 and 10 which reads as follows: <i>(vi) procedures to be adopted within vessels transit corridors to minimise disturbance to red-throated diver during operation and maintenance activities.</i></li> <li>• Transmission DMLs at Condition 19 of Schedule 11 and 12, as follows: <i>Restriction on cable installation construction works</i> <i>19. During the months of January to March inclusive, construction activities consisting of cable installation for Work No. 4A and Work No. 4B must only take place with one main cable laying vessel.</i></li> </ul>
Greater Wash SPA – Common scoter	The Applicant welcomes Natural England's agreement that AEoI can be ruled out for common scoter from the Greater Wash SPA.

## 1.12 Natural England’s Position Statement Regarding the Proposed Site Integrity Plan for the Haisborough Hammond and Winterton Special Area of Conservation REP4-041

5. The Applicant has reviewed Natural England’s Position Statement, and in order to set out the respective positions of the Applicant, the MMO and Natural England in relation to all issues associated with the possible effects of the project on the HHW SAC, the Applicant has produced its own Haisborough Hammond and Winterton Special Area of Conservation Position Paper which is being submitted at Deadline 5 [ExA.AS-6.D5.V1].

## 1.13 Natural England’s Risk and Issues Log REP4-042

Summary of Submission	Applicant’s Comments
Offshore Ornithology	
Issue numbers 1 to 6 (inclusive) and 8	The Applicant welcomes Natural England’s agreement on the methods used and that these issues are now coded green.
Issue number 9: Population modelling (EIA and HRA)	The Applicant notes Natural England’s comments on this issue do not appear to take into account the updated PVA presented in the Deadline 2 update (REP2-035), and also do not correspond to the comments in Natural England’s submission at Deadline 4 [REP4-040] in which Natural England note that the PVA represents the best models currently available.
Issue number 10, point 3: Natural England, therefore, recommends that the Applicant (and all relevant future projects located in the North Sea) considers raising turbine draught height, as has been done by other projects (e.g. Hornsea 2, East Anglia 3 and Vanguard). This is in order to minimise their contribution to the cumulative/in-combination collision totals by as much as is possible.	The Applicant has undertaken detailed investigations into mitigation options and an updated assessment reflecting these has been submitted at Deadline 5, including an increase in draught height and removal of the smallest turbines from the design envelope.
Benthic Ecology and Marine mammals	
Rows 12 to 21 (Benthic and Marine Mammals) have not been updated since the first submission of the Risk and Issues log at Deadline 1 [REP1-056]	The Applicant does not believe this to be a true reflection of the current position. The Applicant has been working with Natural England to undertake further study

Summary of Submission	Applicant's Comments
	<p>and propose additional mitigation for many of the issues contained within the log and this is reflected in Natural England's submission at Deadline 4 which states that; <i>....we would like to recognise that the Applicant is moving in a positive direction in applying mitigation and reducing the impacts on the designated site features to a more acceptable level.</i></p> <p>This has not been reflected in the Risk and Issues log provided at Deadline 4 [REP4-042]. Therefore, the Applicant's comments on Risk and Issues log which were provided in section 2.1 of the Applicant's Comments on written Representations and additional submissions submitted at Deadline 3 [REP3-007] are still relevant.</p> <p>The Applicant considers that many of the issues in relation to benthic ecology and marine mammals should be updated to reflect recent discussions.</p>
Onshore Ecology	
This was not updated for Deadline 4	The Applicant have discussed this with Natural England and understand that Natural England were waiting on the Applicants submissions at deadline 4 before updating the onshore ecology sections. This will be updated for deadline 5.

### 1.14 Natural England's Written Summary of Oral Representations at ISH4 REP4-043

Summary of Submission	Applicant's Comments
Issue Specific Hearing 4 on offshore effects including the draft Development Consent Order	
ii) Natural England clarified that Point 4 is in relation to monitoring of marine mammals. For which Natural England requests that monitoring of marine mammals as proposed within the In Principle Monitoring Plan (IPMP) is secured by a DCO condition. We noted that other important factors, such as ornithology, had their monitoring specifically secured through condition.	This is addressed in the Applicant's Responses to the Examining Authority's Further Written Questions [ExA.FWQR.D5.V1] response written question 2.2.0.5.
Item 6 Natural England set out their position with regard to the use of a SIP for the HHW SAC	The Applicant has responded to all of these points in The Applicant's position paper, 'The Haisborough Hammond and



Summary of Submission	Applicant's Comments
	Winterton Special Area of Conservation Position Paper [ExA.AS-6.D5.V1] which has been submitted at Deadline 5'.
Natural England confirmed that the proposed disposal location is acceptable to Natural England and welcomed retention within the SAC sandbank system. The condition for Norfolk Vanguard required that particles should be 95% similar. However, as written, the condition partially compromises MMO regarding enforcement; but we're working on this and will discuss with MMO and the Applicant to hopefully have it resolved by Deadline 5 (February 26, 2020).	This was discussed with Natural England and the MMO on the 17 <sup>th</sup> February, however it was not possible to reach agreement at that meeting and further meetings between the Applicant, Natural England and the MMO will be required to resolve this issue.
Natural England confirmed that the presence of AEZs and A2 features which will potentially require micro-siting will compound benthic concerns in relation to the ability to micro siting the cables and therefore increase the chances of AEoI.	The Applicant's Clarification Note - Optimising cable routeing through the HHW SAC [REP4-022] demonstrates that micrositing can be achieved to avoid AEZs and areas to be managed as <i>S.spinulosa</i> reef.

## 1.15 Necton Substation Action Group REP4-044 – REP4-046, and REP4-048, REP4-049

### 1.15.1 Necton Substation Action Group REP4-044

Summary of Submission	Applicant's Comments
REP4-044 have stated the software used does not recognise trees and hedges, so they were omitted, when in fact the truth appears to be that it was showing them as changes in land height and as ridgelines. It is on these non-existent ridgelines that the applicant plans to plant trees, when in fact they could well be 'invisible' or non-recognised hedges, not ridges, which of course they cannot plant on top of	The Applicant has provided a response in Q2.9.1.2 and Q2.9.1.3 to the Examining Authority's further Written Questions at Deadline 5 in document ExA.FWQR.D5.V1.

### 1.15.2 Necton Substation Action Group REP4-045

Summary of Submission	Applicant's Comments
REP4-045 state that they are concerned that there is a <i>'wider issue of 'Light Pollution' over the whole area'</i> .	The Applicant has provided a response in Q2.9.01 to the Examining Authority's further Written Questions at Deadline 5 in document ExA.FWQR.D5.V1.

### 1.15.3 Necton Substation Action Group REP4-046

Summary of Submission	Applicant's Comments
REP4-046 raise the issue of the 1996 air crash.	This is addressed in Written Summary of the Applicant's Oral Case at Issue Specific Hearing 3 - Onshore effects including the draft Development Consent Order [REP4-013]. Please refer to Agenda Item 5i.

### 1.15.4 Necton Substation Action Group REP4-048

Summary of Submission	Applicant's Comments
REP4-048 state that <i>'there has been a lot of contention about jobs it is claimed with be created for the village locality by Boreas and the Vanguard project. How many jobs does the applicant think they will actually offer Necton and how does that compare with job losses on two farms?'</i>	<p>The Applicant assessed the potential job creation for both the operational and construction phases of the proposed development within Sections 31.7.5.1, 31.7.6.1 and 31.8.1.1 of Chapter 31 of the ES, Socio-Economics [APP-244].</p> <p>As the average commuting time in the UK is 45 minutes, the assessments conducted took into account these potential commuting distances, and therefore the Applicant cannot directly state how many people from Necton will be employed.</p> <p>The Applicant is currently working on detailed design and procurement strategies, so further information regarding job</p>

Summary of Submission	Applicant's Comments
	creation will be provided at a later date. Note, these will inevitable be projections.

### 1.15.5 Necton Substation Action Group REP4-049

Summary of Submission	Applicant's Comments
NSAG would like to know if <i>'the applicant considered the possibility of using subterranean substations? We understand companies like Siemens do them.'</i>	The Applicant has provided a response in Q2.9.6.4 to the Examining Authority's further Written Questions at Deadline 5 in document ExA.FWQR.D5.V1.

### 1.16 Chamber of Shipping REP4-051

Summary of Submission	Applicant's Comments
<p>The UK Chamber of shipping thanks the Planning Inspectorate for the opportunity to provide input into the consultation into the Norfolk Boreas application and to respond to the question posed in the Examination Questions. The UK Chamber of Shipping recognises that there is an effect on maritime radar caused by navigating close to Offshore Wind Turbines. This information was a conclusion of a study carried out on an early and windfarm in 2004 and 2005 and the Chamber wishes to highlight that there have been no additional trials carried out since then. The Chamber would encourage additional trials to be carried out to determine the effects of windfarms on the operation and reliability of radar units to ensure the safety of navigation of vessels operating in, or near, these constructions. The UK Chamber of Shipping is at the service of the Planning Inspectorate with respect to this consultation and looks forward to assisting in the future. Please do not hesitate to contact us if we can provide any further information.</p>	<p>The Chamber of Shipping has agreed a Statement of Common Ground with the Applicant (REP2-042) within which there are no 'matters not agreed'. Given this, it is the Applicant understands that the Chamber of Shipping's response is regarding a generic concern to the ExA's question and not a specific project response to the radar effect associated with wind turbine generators proposed to be located within the Norfolk Boreas site.</p> <p>The Navigational Risk Assessment (NRA) (APP-569) notes that there are well understood effects on marine radar when navigating in close proximity to wind turbine generators but that these effects are mitigated by several embedded measures that mean the impact is assessed to be either Broadly Acceptable or not significant under EIA terms.</p> <p>The Applicant also recognises that Maritime Coastguard Agency (MCA) led trials related to marine radar effects have not been undertaken within United Kingdom waters since 2007, but there</p>

Summary of Submission	Applicant's Comments
	<p>have been project specific trials undertaken in 2012 (for example) which have been used as part of the assessment contained within section 22.8 of the NRA (APP-569). Furthermore, numerous wind farms have become operational since the MCA trials, and no consultation responses have highlighted any concerns from Mariners operating within those sites associated with radar interference.</p>

### 1.17 Colin King REP4-052

Summary of Submission	Applicant's Comments
Electrical Infrastructure and Residential Properties	
<p>REP4-052 raised concerns around the prescribed required distance for electrical infrastructure from residential areas. REP4-052 requested that examples of similar sized substations should be provided by the Applicant for reference, and asked what could be done to mitigate the noise produced by the proposed HVDC substation.</p>	<p>The Applicant addressed the concerns around the distance of electrical infrastructure from residential properties in REP3-007, Table 1.7.</p> <p>The Applicant has assessed the worst case operational noise of the proposed HVDC substation for both Scenario 1 and Scenario 2 within Chapter 25 of the ES, Noise and Vibration. Within Chapter 25 the Applicant presents the data for both the unmitigated and the mitigated scenarios so clear comparisons can be drawn as to the effectiveness of the mitigation. See Tables 25.40 – 25.44 of Chapter 25.</p>
Scenarios	
<p>REP4-052 raises concern over the implications that Scenario 1 and Scenario 2 have on the assessments carried out within the Environmental Statement (ES). A question was also raised around the movement of the Norfolk Boreas Substation in Scenario 2 – if Norfolk Vanguard does not go ahead. REP4-052 asked if a Scenario 3 needs to be drafted to account for a situation where Norfolk Vanguard goes ahead, and Norfolk Boreas does not.</p>	<p>The Applicant provided a full explanation of Scenario 1 and Scenario 2 in relation to the ES (see Chapter 5 Project Description APP-218) and a full Environmental Impact Assessment of both scenarios has been undertaken.</p>

Summary of Submission	Applicant's Comments
	<p>The proposed substation location for both Scenario 1 and Scenario 2 are discussed in Section 4.13, Chapter 4 of the ES, Site Selection. Figures 6.2.5.5 and 6.2.5.6 provide visual representations of the substations for Scenario 1 and Scenario 2. A Scenario 3 is not applicable to this application process as only the options for Norfolk Boreas are considered.</p>
Photomontages at Lodge Lane North	
<p>REP4-052 states that the photomontages at Lodge Lane North are flawed as they believe that although the Applicant is correct in the plotted landfall of 5m, however the Applicant misses the 3m land rise beyond lodge farm. Because of this 3m rise, REP4-052 believe that the most critical screening effect is negated. REP4-052 also states that the Applicant have 'ignored the effect of the distance between the viewpoint and the mitigating trees.'</p>	<p>The Applicant explained photomontages at Lodge Lane North in REP3-007, Table 1.7. The Applicant also discussed the landfall around the substation within Issue Specific Hearing 3, and therefore within the Written Summary of the Applicant's Oral Case at Issue Specific Hearing 3 (Onshore) [REP4-013], Agenda Item 4b.</p> <p>The Applicant considered and addressed the potential for bunding in REP2-021, Question 9.4.3.</p>

### 1.18 Patricia Lockwood REP4-053

Summary of Submission	Applicant's Comments
<p>REP4-053 deemed the methodology used within the human health chapter '<i>questionable</i>', and more specifically, the method for examining the factors characterising population sensitivity was challenged.</p>	<p>As stated in Chapter 23 of the ES, Human Health [APP-040], the methodology used was in line with best practice guidance from Public Health England (PHE). The guidance from PHE also uses emerging best practice published by the Institute of Environmental Management and Assessment (IEMA), in line with the 'Health in Environmental Impact Assessment: A Primer for Proportionate Approach' (Cave et al., 2017a).</p>
<p>REP4-053 raised concerns around temporary air quality reductions during construction, stating that '<i>breathing in fine particulate matter is irreversible, however small or infrequent.</i>'</p>	<p>The Applicant has assessed the potential air quality impacts which could arise during construction in Chapter 26 of the ES, Air Quality [APP-239]. More specifically, a qualitative assessment of</p>

Summary of Submission	Applicant's Comments
	<p>construction phase dust and PM<sub>10</sub> emissions was carried out in accordance with the latest Institute of Air Quality Management guidance. This approved methodology was used to conclude that the human health impacts would be low. Further detail can be found in APP-239.</p> <p>Nevertheless, the Applicant has committed to a range of control measures with respect to air quality, these are detailed in Section 10 of the OCoCP [REP1-018] and secured in the dDCO [REP4-003], Requirement 20.</p>

### 1.19 Jenny Smedly REP4-056

Summary of Submission	Applicant's Comments
<p>REP4-056 expresses concern around the cumulative effect of the National Grid extension, and the substations for Dudgeon, Vanguard and Boreas increasing the likelihood of a hazardous incident at the site. REP4-056 states that <i>'the Applicant does not appear to have provided an adequate assessment of the potential impacts arising from nor mitigation measures to prevent accidental, engineering (equipment / system failure) or terrorism related incidents from taking place'</i>. Further to this, REP4-056 requests that the Applicant shows the worst case scenario of a fire or terrorist attack. REP4-056 goes onto provide a list of examples of fires at substations.</p>	<p>The Applicant has provided a response in Q2.13.5.3 to the Examining Authority's further Written Questions at Deadline 5 in document ExA.FWQR.D5.V1.</p>

## 1.20 RSPB's comments on the Offshore Ornithology Assessment Update [Additional Submission - Further comments on the Offshore Ornithology Assessment Update - Accepted at the discretion of the Examining Authority, 21/01/2020]

	Summary of RSPB's Comments	Applicant's Response
1.1	This note is a further response to the Offshore Ornithology Assessment Update submitted by the Applicant at Deadline 2 (Document Reference: REP2-035).	No response required.
1.2	In the introduction and frequently throughout the Offshore Ornithology Assessment Update the Applicant has argued why they consider that the Natural England and RSPB recommended approach to assessment of offshore wind farm developments is overly precautionary. Many of the arguments presented to support that position are unjustified and in this note the RSPB will demonstrate why the approach taken is not overly precautionary. The RSPB considers its approach and that of Natural England is a measured and reasonable response to the considerable uncertainty inherent in the assessment procedure. While the RSPB welcomes the Offshore Ornithology Assessment Update, there is nothing presented within it that would cause a change in our position with regard to adverse effects, as laid out in previous written submissions.	The Applicant agrees that there is a requirement to consider uncertainty for the reasons outlined by the RSPB. However it is both the degree to which this is incorporated (and inevitably focus tends to be on the upper end of distributions without as much consideration given to the lower end) and also the fact that individual (and unrelated) sources of precaution are combined, as routinely occurs through the analysis and modelling stages involved in reaching conclusions of impact significance, that is the Applicant's primary concern.
1.3	Whilst the RSPB is unable to attend Issue Specific Hearing 4 on the 22nd January 2020, we note that the Applicant has indicated that the RSPB has misinterpreted the results of their PVA and that this is scheduled as an agenda item. The RSPB sets out our reasoning why we have not misinterpreted the PVA results in sections 4 and 5 below. We hope this will help inform the item to be considered on this issue at the Hearing.	The Applicant provided a response to this question at the Issue Specific Hearing on the 22 <sup>nd</sup> January and this is summarised in the Applicant's written summary (REP4-014).
1.4	The precautionary principle The precautionary principle exists for situations where scientific data does not exist or is incomplete and therefore it is not possible to complete a full evaluation of the possible risks a plan, project or activity may cause to the environment, including possible danger to humans, animal or plant health, or to the environment in general. The European Commission's	The Applicant notes that the precautionary principle as quoted here does not appear to support the combination of precaution as advocated by the RSPB and Natural England. Specifically, the Applicant considers that while the justification for applying individual elements of precaution in the assessment are typically reasonable in isolation, for example the inclusion of confidence intervals around seabird density estimates in acknowledgement of the uncertainty and variation present in such estimates, the addition of these precautionary aspects at multiple



Summary of RSPB's Comments	Applicant's Response
<p>Precautionary Principle guidance states that it should apply when a phenomenon, product or process may have a dangerous effect, identified by a scientific and objective evaluation, if this evaluation does not allow the risk to be determined with sufficient certainty. As such the degree of precaution applied to an evaluation, or assessment, can be seen to be directly proportional to the extent of scientific uncertainty inherent in that assessment. As the guidance goes on to recommend, "The implementation of an approach based on the precautionary principle should start with a scientific evaluation, as complete as possible, and where possible, identifying at each stage the degree of scientific uncertainty."</p>	<p>stages within the overall assessment leads to highly precautionary overall estimates of impacts and conclusions thereon. For example, for an assessment of impacts on a Special Protection Area (SPA) population the impact itself is estimated with precaution (e.g. the use of precautionary collision modelling parameter values), the proportion of the impact assigned to the SPA is estimated on the basis of precautionary assumptions (e.g. the longest recorded foraging ranges) and the longest duration of breeding season which includes months when large numbers of birds are on migration to or from colonies further to the North, and finally the consequences for the SPA population are estimated using density independent population viability models (PVA) which almost always generate more precautionary outputs. Thus, the final conclusions are derived from a combination of independent precautionary steps with the end result being over-estimated impact magnitudes.</p>
<p><b>Uncertainty</b></p> <p>As there can be "almost as many definitions of uncertainty as there are treatments of the subject", following Masden et al. (2015), the RSPB defines it as a lack of knowledge, or incomplete information about a particular subject. Masden et al., identified a hierarchy of uncertainty in offshore wind farm assessment. This included not only the uncertainty arising from scientific knowledge, as argued by the Applicant, but uncertainty arising more strategically from the process of assessment itself, such as uncertainty within language and decision-making. Included within this process, uncertainty can be considered as anything that increases the difficulty in reaching firm and robust conclusions, such as revisions in modelling approaches, late submissions, overly complicated language and unsupported arguments put forward as evidence. As such, the approach taken by the Applicant to date, and as evidenced below, is one of increasing uncertainty rather than reducing it. As the degree of precaution is proportional to the degree of uncertainty, such an approach increases the need for precaution in the assessment.</p>	<p>Significant additional work has been undertaken by the Applicant in the spirit of continued cooperation and positive engagement with the objective of increasing common ground with key stakeholders (including the RSPB) rather than to increase uncertainty and much of the additional assessment and modelling presented by the Applicant has been at the request of Natural England.</p> <p>The Applicant is not aware of any late submissions that have been made for this project, either before the application was submitted or during the examination and the Applicant has presented detailed reviews of evidence in support of the assessment methods used (e.g. for displacement rates, REP2-035) and therefore the Applicant is not aware of which aspects of the assessment the RSPB considers to be unsupported.</p> <p>The Applicant agrees that ornithology assessments for offshore wind farms have become increasingly complicated and therefore the Applicant has strived to present a straightforward and readily understandable assessment of what are highly technical aspects. The assessment has been undertaken following advice and requests for information from both Natural England and the RSPB and the Applicant would welcome the opportunity to undertake further discussions with the RPSB, including discussions on appropriate language, if that would be of</p>

Summary of RSPB's Comments	Applicant's Response
	assistance (however the Applicant notes that all requests made to date for meetings with the RSPB have been unsuccessful).

### 1.20.1 Collision Risk Assessment

Summary of RSPB's Comments	Applicant's Response
<p>2.1 Consented and built out capacity</p> <p>2.1 The Applicant refers to projects in the in-combination assessment that have been built out to a lower capacity than that consented as a source of precaution within the assessments. As discussed in our earlier written submissions, this is an acceptable point for windfarms where the Development Consent Order (DCO) has been amended and therefore there is legal certainty regarding the reduction. However, where windfarms still have their original DCOs and therefore the ability to construct more wind turbines, it is not appropriate to do anything less than consider the full extent of those DCOs when considering in-combination/cumulative effects.</p>	<p>The Applicant acknowledges the RSPB's position on this matter and has presented arguments in support of the legal aspect during ISH4 and in the Applicant's written summary of oral submissions (REP4-014). In addition, the Applicant's written summary of oral submissions (REP4-104) provides a detailed explanation and demonstration that it is not necessary to re-run the collision model. Thus, the Applicant considers that it is a straightforward task to base wind farm impacts on as built designs, not consented ones.</p>
<p>2.2 The Applicant cites an unpublished report commissioned by the Crown Estate (Appendix 2 of The Applicant's comments on Written Representations and Additional Submissions; doc REP3-007). This report, which was not designed for use in assessment, was flawed for several reasons and took an approach counter to the principles of sustainable development. Rather than seeking to achieve maximum capacity for least environmental effect, the report implied that the calculated 'headroom' for each species is simply expendable. Furthermore, no new knowledge and understanding was accommodated within the report, for example, there was no clarity on the accuracy of the underlying baseline data sets, uncertainties within the modelling and expression of confidence intervals</p>	<p>Since the mortality estimates for older wind farms discussed in the named report are those used in current wind farm cumulative and in-combination assessments it is unclear to the Applicant why these are not suitable for consideration with regards the consented vs. built arguments discussed in this report. Furthermore, the fact that adoption of revised collision estimates for existing and consented wind farms reduces the cumulative mortality to levels at which previous wind farms have been granted consent indicates that this level has been assessed and determined to be within acceptable limits. This is considered to be informative and useful guidance for decision makers, irrespective of measures by developers to mitigate their own predicted impacts as far as possible, as demonstrated by Norfolk Boreas: the Applicant has now committed to a minimum draught height of 35 m from Mean High Water Springs (MHWS) for WTG up to 14.6 MW and 30 m</p>

Summary of RSPB's Comments	Applicant's Response
<p>for the outputs of those models. In the absence of this context, the report cannot be relied upon to be used to inform assessment.</p>	<p>from MHWS for WTG above 14.7MW and furthermore has removed the smallest turbines from the design envelope (10MW and 11MW). Together these design revisions (increase in draught height and turbine model) substantially reduce collision risks, with reductions of 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 (these are for the 14.7MW turbine at 30m draught height which is the new project worst case option for collision risk),ExA.AS-8.D5.V2.</p> <p>The report to which the RSPB refers to presented a robust and repeatable method for updating older wind farm predictions so that they correspond to built designs rather than consented or assessed ones. This is equivalent to the process which Norfolk Boreas has undertaken in the design review noted above (ExA.AS-8.D5.V2), but has the advantage that it can be used with the more limited range of data often available for older wind farms. The outputs are completely reliable and the Applicant does not consider there to be any reason why collision estimates calculated in this manner are any less reliable for impact assessment than those currently used in project cumulative and in-combination assessments.</p>
<p>2.3 Nocturnal activity</p> <p>We do not agree with the changes in nocturnal activity rates proposed. While for gannet, we welcome the latest published evidence review (Furness et al. 2018 ), for the other species there is no such peer reviewed evidence. There are several issues with this.</p>	<p>Capturing peaks of activity is no more desirable in survey data than troughs, as both are unrepresentative of the average level of activity, and the goal of baseline surveying should be to obtain representative data. In this regard it is notable that the gannet activity presented in Furness et al. (2018) revealed that the period of the day when aerial surveys for wind farms are typically undertaken (i.e. between 8am and 3pm) typically captures the middle of the range of activity observed in this species. While a similar analysis of activity levels has not been conducted for other species (to the Applicant's knowledge) it is very likely that similar patterns will be observed. Therefore the RSPB's concern on this point is not considered to be contrary to using the revised nocturnal rates identified.</p>
<p>2.4 Mortalities are potentially underestimated because in doing so there is no account for the potential interaction between survey timing and diurnal behavioural patterns. Peaks in foraging activity at first and last light (see for example, Fig. 3 in Furness et al. 2018) will not be accounted for in the assessment if these did not coincide with surveys (the timings of which are currently unknown, but likely to be in the middle of the day), and the survey may have been carried out at a time of much lower activity. Thereby the application of the revised nocturnal activity rates either recommended by Furness et al. (2018) or the rates suggested by the</p>	

Summary of RSPB's Comments		Applicant's Response
	Applicant could result in underestimates of collision risk. We request that details of the timings of survey are presented.	
2.5	It is not clear how the revised rates, other than those for gannet, account for the distinction between the definition of daylight as used in the Band model and with the official concept of 'twilight' and 'night'. This is an issue, as the Band (2012) model considers the nocturnal period as between sunset to sunrise and so treats flight activity that occurs at twilight as being within the nocturnal flight period. This period is of importance as evidence from tagging shows that a number of seabirds actively forage at twilight.	The Applicant acknowledges there is more work required to improve the understanding of nocturnal activity in species other than gannet. However the fact remains that all the evidence to date indicates that the current assumption that gulls are half as active at night as they are during the day is an over-estimate, and this point has been accepted by Natural England.
2.6	The Applicant's proposed reductions in collisions from nocturnal activity do not take into account spatial or temporal variability in nocturnal activity. This variation in seabird behaviour has been shown by a number of studies (e.g. Dias et al., 2012 , Parades et al., 2014 , Kokubun et al., 2015 , Dias et al., 2016 ). This variation can be related to underlying habitat and prey choice and stages of the lunar cycle, potentially due to different light levels that affect the ability to effectively forage. As such, cloud cover could also cause variability in nocturnal activity. Furthermore, there is likely to be significant individual and colony scale variability not included in the Applicant's limited reviews. Such variability highlights the importance of presenting a range of nocturnal activity factors, in order to capture the uncertainty inherent in the estimate and ensure a proportionately precautionary assessment. The Applicant's preferred approach of presenting a single value, derived from a limited sample of studies and non-peer reviewed in all cases except gannet, does not sufficiently account for variability and therefore is not suitably precautionary. This may lead to a serious underestimation of uncertainty.	The Applicant followed Natural England's advice on the selection of nocturnal activity rates used in the original assessment and therefore considers that this has been presented robustly (i.e. upper and lower values). It should also be noted that in the updated assessment at Deadline 2 (REP2-035) the Applicant only presented collision estimates using the upper values advised by Natural England and therefore the RSPB's criticism on this point appears to be misplaced.
2.7	Over emphasis on 95% confidence intervals Following Masden et al. (2015) Natural England requested that an indication of uncertainty is given around estimates of abundance – a	The Applicant raised the point about using 95% confidence intervals for two reasons: it forms part of the overall approach to combining separate sources of precaution which can then lead to over-estimates of impact, and emphasis tends

Summary of RSPB's Comments		Applicant's Response
	request that the RSPB strongly supports. This means that although there may be insufficient scientific knowledge for an estimate to be made with full confidence, as uncertainty is inherent in all scientific research, presenting an indication of the extent of this uncertainty provides a measure of confidence that greatly assists any decision making. This point is made by Millner-Gullard & Shea (2017 ) as follows: "In order to manage uncertainty it must first be acknowledged and identified".	to fall on the upper confidence interval predictions without the balance of the lower prediction. While this may be justified from a worst case impact assessment perspective, it is not statistically justified, since all values within the 95% range are considered potentially possible, with the mean values those most likely (and hence the focus on the mean in impact assessment and elsewhere in statistics).  The Applicant also considers that the approach taken by Natural England with respect to how upper confidence intervals are used to inform assessment conclusions is slightly different from that suggested by the RSPB. For occasions when both the mean impact magnitude and that of the upper 95% confidence interval is below a specified threshold of concern, Natural England's conclusion is of no significant adverse effect. However, when the upper 95% value exceeds the threshold then Natural England note that a conclusion of no significant impact can only be made with reduced confidence. The Applicant considers that this indicates that the conclusion has been affected, contrary to the RSPB's view on this matter.
2.8	However, the Applicant argues that the 95% confidence intervals requested by Natural England to give the indication of uncertainty, are an "over emphasis". This misinterprets the advice given by Natural England, which is that the means are used in the overall assessment, but confidence intervals also need to be presented to allow consideration of the variability (and therefore the uncertainty) in the underlying annual population estimates. This ensures confidence in any conclusions can be expressed, but does not affect the actual conclusions, which should of course be based on the means (or other measure of central tendency). This is an entirely appropriate method and not in any way over precautionary. Not to express this uncertainty, as the Applicant seems to advocate, would not be consistent with European Commission Guidance on the Precautionary Principle. By not identifying and highlighting uncertainty, the need for precaution could therefore increase.	
2.9	<b>Kittiwake flight speeds</b>  2.9 The Applicant highlights the difference in flight speed of kittiwake that is typically used in assessment and which was recorded during the study carried out by Skov et al. (2018) . The RSPB welcomes the use of parameters with an evidence base in collision risk assessment, however,	The Applicant acknowledges the points raised by the RSPB and has submitted a review of flight speed data for kittiwake at Deadline 5 (ExA.AS-5.D5.V1). This review has considered a wide range of studies and it therefore addresses the concern raised by the RSPB that evidence should be drawn from a range of studies. The review recommends that the current flight speed used for kittiwake

Summary of RSPB's Comments		Applicant's Response
	there are several reasons why the flights speeds presented in Skov et al. should not be used in isolation, which we outline below.	(13.1m/s) should be reduced to 10.8m/s. Use of this flight speed in the collision model reduces collision predictions by 11%. This reduction would be appropriate to apply to all wind farms in the cumulative and in-combination assessment.
2.10	The speed given is from a single study, the ORJIP Bird Collision Avoidance study, that was carried out at a single wind farm offshore from Kent and distant from kittiwake breeding colonies. As such, the behaviours recorded will largely have not been from breeding birds. Indeed, Bowgen and Cook (2018) in their analysis of Skov et al. caution that the flight speeds “come from a single site during the non-breeding season. Given the influence of site-specific data on the estimated collision rates, such data may not be directly transferable to other sites or, to the breeding season.”	
2.11	There is considerable variability in the flight speeds of seabirds, and this can be related to, for example, behavioural state, prey type and abundance, and the presence of fishing vessels (Votier et al., 2010 ), (the latter is of interest in this context, as aspects of the Skov et al. study were compromised by the presence of fishing vessels (Bowgen & Cook, 2018)), and can vary between years and between colonies (Petex et al., 2012 ). There are also different measures of flight speed presented in Skov et al., true flight speed and straight-line speed, and there remains no consensus as to which is the most appropriate to use with the Band model.	
2.12	Given the extent of this potential variability, it is not precautionary to base assessment on a speed parameter derived from a single site where not all behavioural states will have been recorded. This may be compromised by the presence of vessels and may not have the environmental conditions relative to the site being assessed. In this case it is best to have site specific parameters, or, in the absence of these, a range of values.	
2.13	Avoidance rates 2.13 The Applicant cites Bowgen and Cook (2018) as evidence of higher Avoidance Rates than those currently used. The work this report is	

Summary of RSPB's Comments	Applicant's Response
<p>drawn from has acknowledged limitations that prevent conclusions being drawn from it. These include the fact that fishing vessels were present on the periphery of the wind farm during the study, thereby biasing the results, and that due to the wind farm being of some distance from breeding colonies, that gannets and kittiwakes seen were non-breeders, or were recorded out with the breeding season. It is also of note that the Bowgen and Cook (2018) report's calculated avoidance rate for kittiwake is actually lower than that previously recommended by the BTO (the report's authors) indicating that avoidance rates can go up as well as down and so are not always the most precautionary.</p>	<p>wind farm, and the presence of fishing vessels in their vicinity is not untypical, it could be argued that the data are therefore representative of the situation to be expected at other wind farms. Thus, this is not necessarily a flaw to the study as suggested but could equally be a reflection of a common situation.</p> <p>Bowgen and Cook (2018) presented avoidance rates for the basic Band model and the extended Band model. While the avoidance rates for the latter (extended) model are slightly lower for kittiwake, the Applicant has used the basic model (as advised by Natural England and the RSPB) and these avoidance rates have increased (to 99%), as noted by the Applicant. However it is important to stress that the Applicant's assessment continued to use the rate currently advised by Natural England (of 98.9%).</p>
<p>2.14 The Avoidance Rate is cited by the Applicant from Bowgen and Cook as an "Empirical" Avoidance Rate, that is one derived from behavioural observation. This is not correct. An Empirical Avoidance Rate differs from those Avoidance Rates conventionally used in the Band model which are correction factors used to account not only for avoidance behaviour, but also model and parameter uncertainty, error and variability. As such, Empirical Avoidance Rates are not directly comparable with conventional Avoidance Rates and Bowgen &amp; Cook (2018) were careful to make the distinction between the two.</p>	<p>The Applicant notes the RSPB's point on empirical avoidance rates and agrees this description was used in error. However this does not detract from the use of these avoidance rates for collision modelling.</p> <p>The Bowgen and Cook (2018) report was noted as this found evidence that gannet avoidance may be higher than previously thought, and this is important to acknowledge. It should also be noted that the Applicant has not used this higher rate in the assessment, but does consider there to be merit in presenting evidence as it becomes available and of which the cited report forms an important part.</p>
<p>2.15 In their comments on Written Representations and Additional Submissions (doc REP3-007), the Applicant highlights the difference in preferred or recommended breeding season avoidance rate for gannet between the RSPB and Natural England and the other Statutory Nature Conservation Bodies. Whilst the RSPB accepts the Statutory Nature Conservation Bodies' recommended amendment to the gannet avoidance rate (AR) from 98% to 98.9% for non-breeding birds, we do not agree that this figure should be applied to the breeding season due to the lack of available evidence relating to breeding birds. During the breeding season there are significant time and energy constraints imposed on foraging birds by the requirement to return to the nest to incubate eggs or brood and provide food for chicks. As such, the response of foraging and commuting birds to the presence of a windfarm is likely to be different</p>	<p>With respect to the use of different avoidance rates for breeding and nonbreeding gannets, the RSPB has stated this repeatedly, but to date has presented no justification beyond that repeated here and it is assumed that this is why the UK Statutory Nature Conservation Agencies, including Natural England, have not followed this suggestion and remain content that 98.9% is appropriate all year round.</p>



Summary of RSPB's Comments		Applicant's Response
	during the breeding season. Consequently, the avoidance rate, which incorporates such reactive behaviour, is also likely to be different.	
2.16	As acknowledged in the BTO Review the Statutory Nature Conservation Body advice is drawn from , , the majority of the evidence used to assess avoidance behaviour of gannet is from non-breeding birds (the BTO review makes this clear, saying: "it should be noted that this figure is based on data that are most representative of the non-breeding season"). Breeding birds, under the constraints outlined above, will behave differently and potentially be subject to greater impacts from developments . As such, we recommend a more precautionary AR of 98% for the breeding season to account for this uncertainty regarding breeding bird behaviour around windfarms.	
2.17	This difference between the RSPB and Natural England is the only difference in our positions on Collision Risk Assessment. There is agreement that due to the uncertainty and variability in model parameters, such as gannet breeding season Avoidance Rate, that a range of values be used. Natural England have confirmed this position in their response to Q8.10.3 of the Examining Authority's Written Questions (doc REP2-080).	

### 1.20.2 Displacement Assessment

Summary of RSPB's Comments		Applicant's Response
3.1	There have been few robust studies of seabird displacement, the results differ, and we do not know the consequences for mortality or population trajectories. Because of the consequent uncertainty, it is appropriate to consider a range of putative displacement and mortality rates.	The Applicant agrees there is uncertainty on this aspect and notes that the assessments have presented a range of values as requested by Natural England and the RSPB.



Summary of RSPB's Comments		Applicant's Response
3.2	<p><b>Extent of Displacement</b></p> <p>Citing their own review (MacArthur Green 2019 ), the Applicant claims that their preferred displacement rates are precautionary, for guillemot and razorbill claiming few studies show greater than 50% displacement. Unfortunately, the review did not include Vanerman et al. (2019 ) which reports on 6 years of post-construction study at Thornton Bank wind farm. This study reports displacement rates of 60 and 63% for guillemot and 75-80% for razorbill. In this context, the higher values in the range recommended by Natural England should be viewed as realistic, rather than over-precautionary.</p>	<p>The Applicant notes that the review referred to by the RSPB (MacArthur Green 2019, included with REP2-035) considered a wide range of studies and did not place undue emphasis on any single one in drawing conclusions. Furthermore, the Applicant's review included consideration of earlier studies of displacement conducted at the Thornton Bank wind farm (e.g. Vanerman et al. 2016) and these studies reported very similar levels of apparent displacement to those in Vanerman et al. (2019). Therefore, the Applicant considers that, since the review included findings which were very similar to those in Vanerman et al. 2019, alongside those reported for other wind farms, the conclusions were derived in a balanced manner, and the precautionary, estimate of displacement for these species of 50% is robust and consistent with the evidence.</p>
3.3	<p>The Applicant argues that displacement rates are based on evidence from studies carried out at older wind farms and that these had smaller, more closely spaced turbines. However, the argument is then made, without evidence, that displacement will be reduced with modern turbine design, where the turbines are spaced further apart and are considerably larger. Notwithstanding the lack of evidence for this assertion, it intuitively seems very unlikely that larger turbines will cause less displacement. It would be far more likely that greater displacement would arise. Again, the use of these speculative and counter-intuitive arguments has the effect of increasing the uncertainty within the assessment process.</p>	<p>The Applicant acknowledges that there is limited evidence that birds will be displaced differently depending on turbine spacing (although this was reported by Leopold et al. 2012). However, this is considered to be a reasonable and logical argument since, for birds to be displaced, it must be assumed they are responding to the presence of structures in the environment and that this response would be related to distance (i.e. it will decline with increasing distance, and there will be a distance at which birds are no longer affected). Nonetheless, it is agreed that this aspect requires further study, and it was only made in the assessment as a consideration and was not used for estimating impact magnitude. The Applicant does not agree with the RSPB that raising points for consideration in the assessment increases uncertainty, but rather provides useful context within which decisions can be made with consideration given to relevant information.</p> <p>Leopold, M.F., van Bemmelen, R.S.A. &amp; Zuur, A.F. (2012) Responses of Local Birds to the Offshore Wind Farms PAWP and OWEZ off the Dutch mainland coast. Imares.</p>
3.4	<p><b>Mortality arising from Displacement</b></p> <p>Despite acknowledging that mortality rates arising from displacement are less well known, in support of their preferred lower mortality percentage, the Applicant cites a review carried out previously by their consultants</p>	<p>The review to which the RSPB refers did not rely solely on considerations of nonbreeding seabird weights in support of estimated mortality rates, and in fact considered a wide range of evidence (such as tag studies, estimates of foraging behaviour and the effects of existing sources of disturbance such as shipping) in</p>

Summary of RSPB's Comments	Applicant's Response
<p>(MacArthur Green, 2019). In this review it is claimed that as some seabirds attain higher weights during the non-breeding season, that they have little difficulty finding food at this time. However, the review does not include other conflicting evidence that some seabirds may have an “energetic bottleneck” in the winter (Fort et al., 2009 ). The higher weight in some non-breeding seabird reported by the Applicant is also likely to be because birds are not subject to the stresses and constraints of breeding. As such the non-breeding period can be seen as a recovery and preparatory period and it is wrong to suggest that higher weights during this period mean that the birds can be subjected to greater disturbance without consequence. Such consequences could apply by reducing condition prior to breeding and thereby decreasing breeding success.</p>	<p>reaching a conclusion that mortality of displaced birds in the southern North Sea in winter is likely to be at the lower end of the range of 1% to 10%. This conclusion has been supported by Natural England, who stated that ‘we do not expect mortality rates to be at the top of the range’ (REP4-040).</p>
<p>3.5 The Applicant also suggests that as current estimates of red-throated diver mortality include that occurring as a consequence of shipping activity, that additional mortality arising from displacement from wind farms is likely to be small. This ignores the recent evidence from Mendel et al. (2019) that the extent of displacement caused by the presence of wind farms is far greater than that arising from shipping traffic. The Applicant's argument appears to be that because the birds are already disturbed by shipping traffic that further disturbance will not matter. However, it is not known whether red-throated divers in the southern North Sea are close to a tipping point in terms of disturbance and whether any more could significantly exacerbate the mortality and lead to catastrophic impacts. The use of mortality figures that are lower than the current recommendations therefore risks under-estimating the significance of the impact on this and other species.</p>	<p>The Applicant's review of red-throated diver displacement did give consideration to the potential for disturbance due to shipping as noted by the RSPB, but this was not in the context that the RSPB suggests (that shipping disturbance already happens so adding to this with offshore wind farms won't matter). Rather, the review considered aspects such as the fact that shipping disturbance has been present for a considerable period of time and that during the last 15 years the southern North Sea population appears to have grown considerably (noted below), from which it is considered reasonable to conclude that the existing levels of disturbance due to shipping appear not to have had a significant adverse effect on the population.</p> <p>In addition, the review of red-throated diver displacement evidence did include consideration of Mendel et al. (2019) and this was placed in the context of other studies when reaching a conclusion which was not based on a single study. One more recent study that was not included in the review of red-throated diver displacement was the aerial surveys of the Outer Thames Estuary SPA conducted for Natural England which reported a population of over 18,000 (Irwin et al. 2019), which is an increase since the last survey (in 2014) of 14,000 (Goodship et al.</p>

Summary of RSPB's Comments		Applicant's Response
		2015) and since the surveys on which the SPA designation was based (from 2005) which reported a population in the region of 6,000. This situation does not appear to correspond to suggestions that this species is highly susceptible to disturbance and experiences elevated levels of mortality as a consequence. The population appears instead to have grown considerably during a period of ongoing shipping traffic and wind farm construction and operation (and notably the wind farms which have been built are ones located in areas of much higher diver abundance than Norfolk Boreas). Furthermore, the survey data in Irwin et al. (2019) do not indicate the presence of large buffers of avoidance around the existing wind farms. Thus, the results from the German study (Mendel et al. 2019) should be placed in the context of other studies which have found rather smaller apparent impacts, as has been done by the Applicant.

### 1.20.3 Population Viability Analysis

Summary of RSPB's Comments		Applicant's Response
4.1	The RSPB welcomes the Applicant's presentation of Population Viability Assessment (PVA) using the Natural England PVA tool in their Offshore Ornithology Assessment Update. This represents the most transparent, reliable and repeatable method for doing so. However, there are several arguments that the Applicant presents alongside the results and in their comments that the RSPB disagrees with. These are dealt with below.	The Applicant provided a response to the Examining Authority question on this topic (the interpretation of the counterfactual of population size) at the Issue Specific Hearing on the 22 <sup>nd</sup> January and this was included in the Applicant's written summary (REP4-014). It is also of note that Natural England responded to this question and confirmed that their interpretation of this metric was the same as the Applicant's.
4.2	The RSPB also hopes the following will be helpful in highlighting why the RSPB has not misinterpreted the PVA results, which we understand will be considered at Issue Specific Hearing 4 on the 22nd January 2020.	
4.3	Density Dependence We do not accept the arguments for the use of PVA outputs incorporating compensatory density dependence, although acknowledge that both density dependent and independent formulations are presented. The	The Applicant agrees with the RSPB that simply assuming density dependence is compensatory is inappropriate however, this is not how the Applicant has approached this aspect. In each case the Applicant has considered the status of

Summary of RSPB's Comments		Applicant's Response
	reasons for this are outlined in Green et al. (2016) and the reviews by Cook and Robinson (2015) and Horswill and Robinson (2015). It is not that density dependence does not exist, but rather that we do not have the means to accurately quantify the strength and form of it in a biologically meaningful way in order to incorporate it into PVA.	the population in question and considered the appropriate form of density dependence to apply.  The Applicant acknowledges that the relevant population's status may change in the future, however this argument is no less applicable to the use of density independent models as advocated by the RSPB, which assume unregulated growth. Indeed on this point the Applicant considers that this is an argument in favour of density dependent modelling since all else being equal the population would be expected to remain around a similar size to its current one, rather than being subject to potentially unlimited growth as permitted in models which omit density dependence.
4.4	Whilst we accept that density dependence is likely to exist in seabird populations, precise species and colony specific knowledge of its size and shape are needed to correctly parameterise the population models. This is important to acknowledge because density dependence is not always compensatory, but can also be depensatory, slowing the rate of population growth at lower population densities. In other words, a population decline arising from an offshore wind farm could have larger consequences on the population than are predicted by the compensatory density dependent or even density independent models.	
4.5	Horswill and Robinson (2015) identified depensation occurring in three gull species (black-legged kittiwake, black-headed gull and herring gull). As such, it would be very wrong to simply assume that density independent outputs are highly precautionary, rather that density independent outputs are the most sensible to use for assessment. The Applicant claims depensatory density dependence will only occur on small populations. Given the length of time the wind farm will be operational, and the potential decline in populations, particularly kittiwake, there is no way of knowing if in the future these populations could be subject to depensatory density dependence.	
4.6	The Applicant's preference for density dependent modelling is counter to all advice, including the Applicant's own consultants who made clear in a report to Defra, "the most robust approach is to avoid the temptation to include density dependence, since it is often based on the premise that 'it must be operating therefore it must be included', even if the mechanism is unknown" (Furness et al., 2013). The argument against the use of density dependent population models is not that density dependence	The Applicant agrees that evidence for the strength and mechanism of operation of density dependence in seabird populations is limited. However, the Applicant does not agree that the appropriate response is to ignore the effects of density dependence in modelling seabird populations since the modelling approach specifically lends itself to exploratory and comparative analysis that can help to improve understanding of seabird population dynamics. Furthermore, the alternative, which is that seabird populations are not subject to any regulation (i.e.

Summary of RSPB's Comments	Applicant's Response
<p>does not exist in seabird populations, rather that it should only be incorporated when its strength and form are known for a specific species and colony (Cook and Robinson, 2015). The Applicant's approach of modelling density dependence almost entirely based on a single meta-analysis (Cury et al., 2011 ), is against this advice. Indeed, Cook and Robinson (2015) also point out that "focussing on a single study, even one as comprehensive as Cury et al. (2011), therefore risks potentially overlooking important responses."</p>	<p>density independent) is considered to be much less likely. It is for this reason that models both with and without density dependent regulation have been presented. Indeed, in other guidance produced by the Applicant's consultants (who have considerable experience in seabird populations and population modelling) it was stated that <i>'whether or not to include density dependence in a model needs careful consideration. The decision is likely to be based on both the data available and on the potential impact. One approach can be to develop both forms of model.'</i>* Furthermore, the report referenced by the RSPB was one in which the aim was not to produce models for impact assessment but rather to undertake comparative analysis across species and therefore the requirements of the population modelling were different from those used for impact assessment and the quote reproduced by the RSPB does not provide this context.</p> <p>* SOSS-04 Gannet Population Viability Analysis. Developing guidelines on the use of Population Viability Analysis for investigating bird impacts due to offshore wind farms.</p>
<p>4.7 Counterfactual of Population Size</p> <p>There are a range of output metrics possible from PVA, and for some time there was no consensus on which was the most appropriate for use in the assessment of offshore wind farms. In the absence of such guidance, inappropriate methods for the assessment of population-scale effects were often used. As an outcome of the casework undergone in response to Hornsea Project One and the Forth and Tay developments, the RSPB more clearly defined the most suitable methods for undertaking PVA (Green, 2014 and Green et al., 2016 ) advising that counterfactual metrics, in particular the Counterfactual of Population Size (CPS), was the most appropriate method to use. This was due to it being relatively insensitive to the assumptions made about the magnitude, variability and trends of demographic rates in the model from which it is calculated. This is because the same uncertainties apply to both the impacted and unimpacted scenarios. In response to this advice from the RSPB, both the</p>	<p>The Applicant is in complete agreement that the most appropriate metrics for consideration of PVAs for impact assessment is the relative difference between impacted and non-impacted simulations. While the RSPB has characterised in these sections that there was debate about the most appropriate outputs for seabird population models for impact assessment, the Applicant's consultants have advised the use of relative measures (i.e. comparison of outputs from simulations run both with and without the impact) for impact assessment for several years before the reviews cited by the RSPB*.</p> <p>* SOSS-04 Gannet Population Viability Analysis. Developing guidelines on the use of Population Viability Analysis for investigating bird impacts due to offshore wind farms.</p>

Summary of RSPB's Comments		Applicant's Response
	Joint Nature Conservation Committee (JNCC) and Marine Scotland Science (MSS) commissioned independent reviews of this advice.	
4.8	The JNCC review was carried out by the BTO and resulted in two reports and one paper (Cook and Robinson, 2015 , Cook and Robinson, 2016 , Cook and Robinson, 2017 ). All three were in entire agreement with the RSPB advocated counterfactual approach. Cook and Robinson (2015) also introduced a further metric, the Counterfactual of Population Growth Rate, recommending that both this and CPR be presented together, as they are the most useful metrics.	
4.9	The review commissioned by MSS was undertaken by the Centre for Ecology and Hydrology (Jitlal et al., 2017 ) and agreed that the counterfactual metrics (described as ratio metrics) performed best among all the metrics considered with respect to sensitivity to mis-specification in input parameters, and both showed low sensitivity to demographic input mis-specification.	
4.10	Following this, both Scottish Natural Heritage and Natural England have recommended that the counterfactual metrics are presented as the preferred outputs in PVA used in offshore wind farm environmental assessment. The RSPB agrees and welcomes the consensus that has developed following our original recommendation to use counterfactual metrics.	
4.11	It is therefore surprising that the Applicant in their comments on Written Representations and Additional Submissions; doc REP3-007) suggest the RSPB has misinterpreted the results of a metric which was included in statutory guidance as a direct result of RSPB advice. The Applicant's reasons for this accusation are purely semantic and are an unconstructive distraction in the discussion around the assessment of impact.	<p>In the RSPB's Written Representation (REP2-096) it is stated at paragraph 4.3.24: <i>'However, for the in-combination assessment, the Applicant's own calculations indicate that there will be a decrease in the SPA kittiwake population of around 16% in the lifetime of the project.'</i></p> <p>The Applicant considers that this statement (and others like this in the REP2-096) could give the impression that the impact will decrease the current population size. In fact what the CPS shows (in this example) is that the kittiwake population will be 16% smaller after 30 years with the impact than without. This is not the</p>

Summary of RSPB's Comments		Applicant's Response
		same thing as a decrease in size. Natural England has confirmed this is also their interpretation (REP4-043).
4.12	To be clear, the CPS, as first defined by the RSPB in Green (2014) and subsequently Green et al. (2016), is the ratio of the expected population size with the wind farm to that without it, as derived from Population Viability Models. To calculate it, a PVA is run predicting the size of the population in question in the absence of a wind farm and this is compared with the size of the population predicted if the additional mortality arising from the wind farm is included. The population sizes are compared after the life of the wind farm, typically 25 or 30 years. As there is additional mortality included in the model run including the wind farm, there is typically a decrease in the predicted population size compared with the predicted population size in the absence of the wind farm. The metric does not make any prediction as to whether the population with the wind farm is greater or less than the starting population, it is only a comparison between the with and without scenarios. This is one of the key strengths of the approach; it does not attempt to make predictions of future population trajectory, as this is usually impossible as there is no robust predictive method that can account for potential changes in population demographics due to unforeseen or unpredictable events, for example changes in discard policy or severe weather incidents.	The Applicant is in agreement with this description of how the CPS is derived and what it represents. However, the point the Applicant made with respect to REP2-096 was that the phrasing used by the RSPB did not reflect this definition and there was a potential for these statements to be misinterpreted. As the RSPB has noted elsewhere in their response, it is important that the language used is clear and does not add to uncertainty.
4.13	In the RSPB's written submissions to the Boreas DCO examination, we describe the CPS output metrics as a percentage decrease in the population size. The Applicant has taken this to mean in comparison with the starting population. As described above, this is not the case, it is in comparison with the predicted population size in the absence of the wind farm, as is implicit in the title of the metric and clear in all the references cited above.	The Applicant agrees that the RSPB described the CPS outputs in their written representation (REP2-096) in the terms noted above (as a percentage decrease in size) and this is the key point which the Applicant would like to clarify. The CPS is not (as the RSPB note in the current response) a measure of population decline but a comparison between two future population predictions, which may have both increased, decreased, or one may have increased and the other decreased. The CPS simply provides an indication of the relative difference between the two populations, at a specific point in the future, as a result of the modelled impact. It was for these reasons that the Applicant considered the RSPB's description of the CPS as indicating a population decline to be a misinterpretation.



Summary of RSPB's Comments		Applicant's Response
		<p>The Applicant welcomes the clarification by the RSPB in the current response that this was not their intention, however the Applicant does not consider this to be a semantic point and is in fact one that required the clarification provided in this response (that the 'decreases in population size' described by the RSPB in REP2-096 are not in fact declines but relative differences of future predicted population sizes).</p>
4.14	<p><b>Utility of Counterfactual Metrics</b></p> <p>In their Offshore Ornithology Assessment Update, the Applicant claims that the counterfactuals of population growth rate are more informative and credible for assessment purposes than counterfactuals of population size. This is in direct contradiction to the results of the reviews of PVA metrics described above.</p>	<p>The Applicant would like to clarify that the counterfactuals of population growth are considered more appropriate for consideration of density independent model outputs, since, as noted above, without density dependent regulation simulated populations can attain very large sizes and thus the CPS is sensitive to the period of simulation (i.e. it increases with time and the rate of increase also increases as the two populations, impacted and non-impacted, diverge by an increasing margin with extending simulation period). In contrast, the relative difference in population growth rate is not sensitive to the period of simulation. In addition, the reduction in growth rate can be compared with the recent trend in growth rate which gives a useful measure against which to compare predictions (i.e. if the recent trend has been growth at 5% per year and the predicted reduction in growth is 1% this would indicate growth will continue at 4%).</p> <p>Conversely, if density dependent simulations are conducted then the CPS is considered more reliable, since the two populations will stabilise around relative sizes and the output is no longer sensitive to the period of simulation. Furthermore, the growth rate will stabilise around 1 (i.e. no growth) for both the impacted and non-impacted simulations and therefore this metric becomes uninformative.</p>
4.15	<p>Cook and Robinson (2015) recommend referencing both metrics: the counterfactual of growth rates to quantify the consequence of impacts at a population level and the counterfactual of population sizes to present these impacts in an easily understandable context. Jitlal et al. (2017)</p>	<p>The Applicant has provided both counterfactual measures, as advised by the RSPB and Natural England, and for the reasons outlined above have focussed on the growth rate with respect to the density independent simulations.</p>



Summary of RSPB's Comments		Applicant's Response
	<p>suggest that both metrics showed low sensitivity to demographic input mis-specification. Neither review identified the issue suggested by the Applicant that the counterfactual of population growth rate was insensitive to the absolute value for the baseline rate of growth or direction whereas the counterfactual of population size is. The Applicant presents no evidence to support this assertion.</p>	
4.16	<p>Conversely, the analysis carried out by Jitlal et al. (2017) found both metrics showed no discernible difference in sensitivity between decreasing and increasing populations. We therefore do not agree with the Applicant's preference for the counterfactual of population growth rate. The RSPB welcomes the presentation of both metrics, following guidance and the literature cited above.</p>	<p>As noted above, the key consideration is on density dependence, not whether or not the population increases or decreases.</p>
4.17	<p>In order to reach their conclusions, the Applicant sets the Counterfactual of Growth Rate output metric against the recent SPA colony growth rate. This is a misapplication of this metric.</p>	<p>The Applicant does not consider there to be any methodological reason why it is inappropriate to compare a predicted measure of future growth against the most recent trend. It is also worth noting that the relative population growth rate is not measured at the end of the simulation, but rather over the period of simulation, since this is a robust means to estimate this parameter and ensures that conclusions reflect the overall trend and not short term fluctuations. It is acknowledged that any prediction is subject to uncertainty, however this does not mean that the Applicant's approach is inherently inappropriate.</p>
4.18	<p>A key justification of the use of counterfactual metrics (both population size and growth rate) is that they are not influenced by the uncertainty around future populations (Green et al., 2016). We have no robust predictive method that can account for potential changes in population demographic due to unforeseen or unpredictable events, for example, changes in discard policy or severe weather incidents. As the counterfactual approach is relatively insensitive to the assumptions made about the magnitude, variability and trends of demographic rates in the model from which it is calculated because the same uncertainties apply to both the impacted and unimpacted scenarios, this is not a problem for the counterfactual approach. However, to compare the predicted change in</p>	

Summary of RSPB's Comments		Applicant's Response
	population growth rate in 30 years' time against the current population growth rate does not account for the high probability that the future population growth rate will likely be considerably different from this and that, if it were possible, it would be this growth rate that should be compared to the predicted change in population growth rate.	
4.19	As it is impossible to determine what that growth rate will be, we do not accept this as an adequate method for reaching conclusions of the significance of an effect.	The Applicant acknowledges that determining the future growth rate with accuracy is not possible, however the best guide to the future situation is the recent past and therefore the Applicant considers the approach taken (to compare the predicted reduction in growth rate due to the impact against recent observed rates of population growth) to be an appropriate basis for impact assessment.

#### 1.20.4 Conclusions regarding Adverse Effects

6. In this section the RSPB presents the impact assessment figures from the Applicant's assessment submitted at Deadline 2 (REP2-035). The Applicant is in agreement with the values used but, as noted above, not with the descriptions used by the RSPB that the CPS values represent population declines rather than differences in future population sizes, nor with the conclusions which the Applicant considers to be the result of the overall combination of precaution introduced at each stage in the assessment process.
7. The Applicant's conclusions of the assessments which have been discussed by the RSPB in this section were presented in full in REP2-035. Specifically the Applicant does not consider that there will be any significant adverse effects on EIA populations nor Adverse Effects on Integrity (AEoI) of SPA populations due to the project alone, and Natural England has agreed with these conclusions, both at the ISH of the 22<sup>nd</sup> January 2020 and in REP4-040 (with the exception of red-throated diver displacement, for which Natural England have stated they are unable to rule out a significant effect). Notably this includes impacts on gannet and lesser black-backed gull for which the RSPB considers that an AEoI cannot be ruled out for the project alone; the Applicant is keen to discuss these matters with the RSPB and is attempting to organise a call with the RSPB's representatives). Furthermore, the Applicant does not consider there will be any AEoI for the project in-combination with other plans and projects or cumulatively. Contrary to the RSPB's position, the Applicant

considers that these conclusions are based on a robust application of available evidence and remain precautionary. Furthermore, as noted above (and in ExA.AS-8.D5.V1), following a detailed design review the Applicant has committed to measures which will very substantially reduce collision risks (by up to 74%).

## 1.21 References

Van der Reijden, Karin & Koop, Leo & O'Flynn, Sarah & García, Silvia & Bos, Oscar & Sluis, Christiaan & Maaholm, Jasper & Herman, Peter & Simons, Dick & Olf, Han & Ysebaert, Tom & Snellen, Mirjam & Govers, Laura & Rijnsdorp, Adriaan & Aguilar, Ricardo. (2018). Discovery of *Sabellaria spinulosa* reefs in an intensively fished area of the Dutch Continental Shelf, North Sea. *Journal of Sea Research*. 144. 10.1016/j.seares.2018.11.008.