

Norfolk Boreas Offshore Wind Farm Applicant's comments on Written Representations and Additional Submissions

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Glossary of Acronyms

AEol	Adverse Effect on Integrity
CoCP	Code of Construction Practice
DCO	Development Consent Order
dDCO	Draft Development Consent Order
dDML	Draft Deemed Marine License
Defra	Department for Environment, Food and Rural Affairs
DML	Deemed Marine Licenses
EPP	Evidence Plan Process
EPS	European Protected Species
ES	Environmental Statement
ETG	Expert Topic Group
FCS	Favourable Conservation Status
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables Group
FLCP	Fisheries Liaison and Co-existence Plan
HBMCE	Historic Buildings and Monuments Commission for England
HDD	Horizontal Directional Drilling
HE	Historic England
HER	Historic Environment Record
HES	Historic Environment Services
HHW	Haisborough, Hammond and Winterton
IPMP	In Principle Monitoring Plan
JNCC	Joint Nature Conservation Committee
km	Kilometre
Kv	Kilovolt
M	Metre
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MOD	Ministry of Defence
MoU	Memorandum of Understanding
MSI	Maritime Safety Information
NATS	National Air Traffic Services
NERL	NATS En Route plc.
NRA	Navigation Risk Assessment
NRHE	National Record of the Historic Environment
O&M	Operations and Maintenance
OASIS	Online Access to the Index of Archaeological Investigations
OCoCP	Outline Code of Construction Practice
OLEMS	Outline Landscape and Ecological Monitoring Strategy
ORPAD	(The Crown Estate's) Offshore Renewables Protocol for Archaeological Discoveries
OWF	Offshore Wind Farm
OWSI	Outline Written Scheme of Investigation
PTS	Permanent Threshold Shift / Permanent Auditory Injury

SAC	Special Area of Conservation
SCI	Site of Community Importance
SIP	Site Integrity Plan
SMS	Strip, Map and Sample
SNCB	Statutory National Conservation Bodies
SoCG	Statement of Common Ground
SPE	Set-Piece Excavation
TWT	The Wildlife Trust
UK	United Kingdom
UXO	Unexploded Ordnance
WDC	Whale and Dolphin Conservation
WSI	Written Scheme of Investigation

1 Comments on Written Representations

1. This document contains the Applicant's response to all Written Representations submitted by Interested Parties at Deadline 1 of the Norfolk Vanguard Examination.

1.1 NATS Safeguarding Office REP2-082

Summary of Written Representation	Applicant's Response
<p>NATS has confirmed that an agreement has been entered into between NATS (En Route) plc (NERL) and the Applicant for the agreement of suitable planning requirements and the implementation of an identified and defined mitigation solution in relation to the development that will be implemented under agreement.</p> <p>NERL is prepared to withdraw its objection subject to the imposition of agreed requirements set out in the representation.</p>	<p>The Applicant agrees with the imposition of the detailed requirements contained within the NERL representation.</p>

1.2 Maritime and Coastguard Agency (MCA) REP2-092

Summary of Written Representation	Applicant's Response
<p>The MCA's remit for offshore renewable energy development is to ensure that safety of navigation is preserved, and search and rescue capability is maintained, whilst progress is made towards government targets for renewable energy. The MCA has assessed the process by which the Applicant has undertaken the Navigation Risk Assessment (NRA) and Shipping and Navigation Chapter of the Environmental Statement, in accordance with MCA guidance contained in Marine Guidance Note MGN 543, and is content that the requirements have been followed with the following two items noted.</p>	<p>It is noted that the MCA accepts that the guidance within MGN 543 has been followed by the Applicant. The two items referenced are addressed below.</p>
<p>The MCA expects the hydrographic survey requirements to be undertaken in accordance with Marine Guidance Note 543 and its hydrographic survey guidelines, and the Applicant is currently considering how it is going to achieve these requirements.</p>	<p>The Applicant is currently reviewing its hydrographic survey data coverage with reference to MGN 543. The Applicant is confident that an agreement can be reached with the MCA once the data availability has been reviewed.</p>
<p>The MCA has also agreed a standard set of navigation safety conditions with the Marine Management Organisation and Trinity House, which we expect to be applied to all renewable projects to ensure the safety of navigation. These include specific timeframes</p>	<p>The standard navigation safety conditions were promulgated after the Development Consent Order (DCO)/ Deemed Marine Licence (DML) for Norfolk Vanguard was finalised. Given that it is likely that Norfolk Boreas and Norfolk Vanguard will both be controlled and monitored from the same marine coordination centre, it is important</p>

Summary of Written Representation	Applicant's Response
<p>for issuing local notices to mariners, timescales for notifying the UK Hydrographic Office for dissemination of MSI (Maritime Safety Information) by appropriate means for adequate geo-spatial coverage, and notification timescales for any cable exposure. These aspects are currently not yet agreed by the Applicant as per statement of common ground with MCA.</p>	<p>that both DCO/DMLs are aligned to prevent confusion which could result in errors in notifications etc. being issued. As per the Statement of Common Ground (SoCG) the current position is to await the Norfolk Vanguard Decision in order to align both DCO/DMLs.</p>
<p>As detailed in the Statement of Common Ground, the 'Layout Design and use of Development Principles' section is listed as agreed. The MCA would like to highlight that this is purely in relation to the process for achieving layout acceptance and is by no means any layout agreement.</p>	<p>Agreed – the development principles (section 25.2 of the Navigation Risk Assessment – APP 569) are intended to be a framework to support layout design post consent.</p>
<p>The MCA notes that the NRA assesses just one 'line of orientation'. The requirement as per MGN 543 is for two lines of orientation, however there is scope to consider bespoke safety justification which demonstrates why just one line of orientation may be acceptable from the safety of navigation and Search and Rescue perspective. The MCA requests that every endeavour should be made by the Applicant to accommodate two lines of orientation. Multiple lines of orientation provide alternative options for vessel passage planning as well as reduction in traffic density. The MCA knows that by far the safest way to navigate through a wind farm is when the turbines are in straight lines, with multiple lines of orientation, which gives a clear line of sight of entry and exit. The Applicant also must consider the mariners who find themselves in the vicinity of a wind farm in an emerging situation, or in adverse weather and visibility conditions.</p>	<p>The Applicant understands the requirement to submit a bespoke safety justification for any layout proposed that has less than two lines of orientation. This is noted within the development principles (section 25.2 of the Navigation Risk Assessment – APP 569).</p> <p>Section 15.7.6.1.1 of Chapter 15 (APP-228) Shipping and Navigation identifies the impact of the worst case layout (one line of orientation) on vessel types within the area. Empirical evidence gathered throughout the development of offshore wind farms and consultation feedback indicates that commercial vessels are unlikely to navigate through the array. Small craft such as recreational vessels and commercial fishing vessels (transiting) are not likely to be impacted, again based on experience from other sites, the low likelihood of them transiting and the minimum spacing of 720 metres (m). This minimum spacing is considered to provide adequate sea room to navigate safely and make adjustments to course as necessary.</p> <p>The Applicant is not aware of any documented evidence from the MCA to support the MCA's statement that by far the safest way to navigate through a wind farm is when the turbines are in straight lines, with multiple lines of orientation, which gives a clear line of sight of entry and exit. As noted above the Applicant's specialist navigation consultant has evidence to demonstrate that vessels navigate both within rows but equally on irregular courses transiting between and across different rows, and that spacing and marking are more important to managing navigational safety. It is also noted that given the likely size of the development area it is unlikely any vessel would be able to see the exit point on entering a wind farm regardless of whether the structures were in row or not. Again, for mariners in the wind farm in an 'emerging</p>

Summary of Written Representation	Applicant's Response
	situation' or adverse weather conditions, the minimum spacing of 720m, installed navigation aids and compliance with COLREGs will provide appropriate mitigation.

1.3 National Federation of Fisherman's Organisations REP2-076

Summary of Written Representation	Applicant's Response
<p>The assessment criteria with respect to sensitivity and magnitude criteria applied to assess fisheries impacts should be more quantitatively defined. To support a more quantitative assessment NFFO and VisNed suggest that magnitude criteria should be based on a percentage loss of access to grounds, including past losses in the case of the cumulative assessment (taking account of completed projects).</p>	<p>The assessment of commercial fisheries follows an impact significance matrix approach taking account of receptor sensitivity and impact magnitude. This is in line with standard Environment Impact Assessment (EIA) methodologies (as outlined in ES Chapter 6 Environmental Impact Assessment Methodology, Document reference 6.1.6, APP -219) and the methodology used for assessment of commercial fisheries for other projects, including Norfolk Vanguard.</p> <p>Fisheries receptors are identified by national fleet and fishing method, in line with available fisheries data. Consequently, the impact assessment is undertaken on that basis. As noted in ES Chapter 14 Commercial Fisheries (Document reference 6.1.14, APP- 227), due to data limitations, it is beyond the scope of the EIA to assess impacts on individual vessels. It is however recognised that the level and distribution of fishing activity and dependence on fishing grounds within the offshore project area will vary between individual vessels within the same fleets.</p> <p>The identification of sensitivity is based on parameters such as operational range, versatility (ability to deploy/target various species) and availability of grounds. In defining magnitude, consideration is given to the area affected by the potential impact and 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 level of fishing which these grounds support. Furthermore, in the case of impacts during the operational phase, consideration is given to the potential for fishing to continue within the operational site.</p> <p>The Applicant does not consider it appropriate to factor in potential past losses of fishing grounds associated with completed projects/activities within impact magnitude for the assessment of cumulative impacts, as suggested by NFFO/VisNed. The current distribution and level of fishing activity already takes account of the presence of existing projects/ activities. As such, including existing projects/activities in the cumulative assessment would represent double counting of their effect.</p>

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<p>Impact 6 - safety issues for fishing vessels lacks evidence that a standard risk-based assessment using “frequency of occurrence” and “severity of consequence” criteria has been conducted in order to draw its conclusions. NFFO and VisNed note that there is no probabilistic assessment similar to that completed for other navigation related impact risks (Chapter 15 Shipping and Navigation).</p>	<p>The potential impacts of the project with regards to navigational issues are assessed in Chapter 15 Shipping and Navigation (Document Reference 6.1.15, APP-228), including consideration of potential risks to fishing vessels (as well as other vessels) and supported by a Navigational Risk Assessment (NRA) in agreement with the Maritime and Coastguard Agency’s (MCA) requirements.</p> <p>Further to the assessment presented in Chapter 15, and recognising that vessels engaged in fishing may be subject to additional safety issues other than those strictly related to navigation (i.e. manoeuvrability issues when gear is deployed and snagging risks), an additional assessment covering these aspects was presented in ES Chapter 14 Commercial Fisheries. The assessment identifies the potential risks and highlights the measures proposed by the Applicant to minimise safety issues.</p> <p>Measures to minimise safety issues are noted in Chapter 14 Commercial Fisheries, including embedded mitigation measures (Section 14.7.1), such as the removal of floating foundations from the design envelope, cable burial, the undertaking of appropriate liaison and information sharing and the production of a Fisheries Liaison and Co-existence Plan (FLCP) post-consent in line with the Outline FLCP submitted with the application (Document reference 8.19, APP-710).</p> <p>Taking account of the proposed measures to minimise impacts, and through on-going liaison with fishermen and information distribution, and with the required compliance from fishermen, the assessment concluded that safety issues for fishing vessels would remain within acceptable limits.</p> <p>It is the Applicant’s view that the information provided within ES Chapter 14 Commercial Fisheries is robust and supports appropriately the conclusions reached in the chapter with regards to safety issues.</p>
<p>Worst case scenarios have not been defined with respect to the application of safety buffers to determine the maximum theoretical fishable space between turbines.</p>	<p>The worst case scenario described in Chapter 14 Commercial Fisheries makes reference to the potential minimum width of the corridor left clear of infrastructure (and therefore accessible for fishing) between turbines. This was calculated to be 650m taking account of the worst case minimum spacing (720m) and the use of Tetrabase foundations (radius of legs on the seabed up to 35m).</p> <p>Within this corridor it is advised that fishing vessels (and any other vessels) remain at a distance of at least 50m from the turbines (in line with minimum safe passing distances).</p> <p>This safety buffer around turbines is however advisory and based on the outputs of the shipping template</p>

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	<p>contained in MGN 543; vessels should consider this and MGN 372 when passage planning through any wind farm array.</p> <p>The application (made post consent) for statutory safety zones during operation would be limited to 500m safety zones around major maintenance works.</p>
<p>The use of Service Operation Vehicles (SOVs) and application of what appears to be a proposed 500m statutory safety zones, when they are attached to turbines, appears not to be factored into the worst-case scenario. We consider the use of such large safety zones for such purposes to be disruptive and unnecessary.</p>	<p>The worst case scenario presented in Chapter 14 Commercial Fisheries makes reference to the implementation of 500m safety zones during operation associated with major maintenance works. These are as defined in Part 1, Regulation 2 of The Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007.</p> <p>As described in the Statement of Common Ground (SoCG) with the MCA (Document Reference ExA.SoCg-11.D2.V1F, REP2-049) safety zones triggered by the use of SOVs during major maintenance are currently not supported by the MCA and a case would need to be included and considered as part of the safety zone application phase post consent, should the Applicant consider using this type of vessel.</p>
<p>To better inform the potential for fisheries access, Vattenfall should clarify under what circumstances it would regard damage to cables resulting from fishing activity to be the result of wilful intent or negligence on the part of a fishing vessel operator.</p>	<p>As stated with section 14.7.1 of Chapter 14 Commercial Fisheries (APP 227) of the Environmental Statement (ES), existing legislation does not prevent fishing from occurring within operational wind farm sites and Vattenfall is committed to facilitating co-existence with the relevant sectors of the fishing industry. With regard to cable burial Chapter 14 of the ES states that:</p> <p><i>"In respect of potential loss of fishing grounds associated with the presence of array, interconnector/project interconnector and export cables, as outlined in section 14.7.1, cables will be buried where possible to at least 1m depth and where burial is not possible (i.e. due to hard ground or at crossings) cables will be protected.</i></p> <p><i>In addition, in line with standard practice in the North Sea offshore oil and gas industry, measures would be undertaken to ensure that where cable protection is required, the protection methods used are as far as practically possible, compatible with fishing activities.</i></p> <p><i>It is therefore assumed that during the operational phase, the presence of cables, would not result in any material loss of fishing grounds and that fishing activity will be able to continue normally with the exception of any safety zones around maintenance works, where required, and discrete areas where temporary advisory safety zones may be necessary (i.e. around sections of</i></p>

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	<p><i>offshore cables which may become exposed during the operational phase)</i>".</p> <p>Ground conditions within the site are such that the Applicant expects to be able to achieve the 1m minimum burial depth for at least 90% of inter array and export cables.</p> <p>Where cable protection is required the locations will be communicated to mariners. Where sandwaves are present the Applicant is advocating that seabed levelling to the "bed reference level" occurs prior to cable installation to minimise the possibility of any cables becoming exposed and therefore the need for repeated work.</p> <p>In, addition if cables become exposed a Notice to Mariners will be issued and notification provided to The Kingfisher Information Service - Offshore Renewable & Cable Awareness project (KIS-ORCA) as per condition 4(12) of the transmission licence DMLs. This goes beyond the standard DML conditions which, in addition to the points outlined previously, further reduces the risk of accidental cable damage.</p> <p>Vattenfall does not have a policy on when claims for damage to cables would be brought and each case would be judged on its merits. In addition, Vattenfall has never sought to prosecute under the Submarine Telegraph Act 1885, and is not aware of any prosecutions having been brought by any other undertaker of an UK offshore wind farm.</p>
<p>Given a lack of evidence exists that towed gear fishing activities have returned to operational wind farms, we consider that on a precautionary basis the worst-case scenario for the cumulative impact assessment (CIA) should include an assumption that no towed gears will operate within windfarms post-construction.</p>	<p>There is currently no legislation in the UK preventing fishing from taking place within operational wind farms. There is evidence of static and towed gear fishing resuming in various operational wind farms around the UK.</p> <p>In addition, the ability of vessels to operate towed gear methods within operational sites is further supported by evidence from numerous fish monitoring surveys carried out to date within operational wind farms in the UK using commercial fishing vessels for sampling.</p> <p>In general terms the cumulative assessment notes that fishing would be able to resume with the exception of projects in countries where fishing within wind farms is prohibited (i.e. the Netherlands, Belgium). In the case of seine netting, the assumption is made that given the dimensions of the gear used, it would be highly unlikely for this method to resume in operational sites,</p>

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	regardless of whether or not fishing is permitted within wind farm arrays.
<p>NFFO/VisNed provided the Applicant with information on proposed fisheries measures associated with designated Marine Protected Areas (MPAs) during the Norfolk Vanguard examination process. However, since then further Marine Conservation Zones have been designated in English waters and therefore it is not clear whether and to what extent potential measures associated with new designations or possible proposals in other North Sea MPAs been assessed and what fishing restrictions, if any, have been assumed.</p>	<p>Potential closures to fishing within MPAs identified by NFFO/VisNed in UK, Dutch and German waters during the Norfolk Vanguard examination and provided to the Applicant were taken account of for assessment of cumulative impacts. In line with requests made by NFFO/VisNed during the Norfolk Vanguard examination, the location and extent of these potential closures was overlaid with fisheries data to help inform the assessment of cumulative impacts.</p> <p>The Applicant acknowledges that the designation of MPAs, and the potential for additional proposals for closed areas to fishing, is a continuous and evolving process. The inclusion of any additional MPAs and/or closures which may have been recently designated/proposed would add to the magnitude of effect identified in the assessment. It should be noted, however, that with regard to beam trawling (Dutch and Anglo-Dutch vessels) and Dutch seine netting, taking account of the proposed closures to fishing, the cumulative assessment identified impact magnitude as high (the highest potential magnitude score). As such, the inclusion of additional MPAs/proposed closures would not materially affect the conclusions of the cumulative assessment.</p>
<p>Existing plans and projects are not factored into the cumulative impact assessment and are assumed to form part of the baseline. We consider this will disguise impacts already being endured by impacted parts of the fleet.</p>	<p>As previously described, the current distribution and level of fishing activity already takes account of the presence of existing projects/ activities. As such, including existing projects/activities for cumulative assessment would represent double counting of their effect.</p>
<p>A range of additional measures are identified principally to minimise safety risk associated with seabed hazards including taking account of predominant fishing tows when designing inter array cabling and consulting and communicating with fishing interests over cable plans, risk information from post-lay and monitoring surveys, factoring in fishing activities into cable burial risk assessments, protection of exposed cables until remediation works are completed and advancing warning systems communicating seabed hazards to the fishing industry.</p>	<p>The Applicant considers that that the DML conditions and the provision made in the Outline FLCP (Document reference 8.19, APP-710) are appropriate to minimise potential snagging risk.</p> <p>Measures proposed by the Applicant (and secured through consent conditions) which are of relevance with regards to minimising potential for snagging risks are outlined below:</p> <ul style="list-style-type: none"> • The Scour Protection and Cable Protection Plan required under the draft DCO Schedules 9 and 10 (Part 4 Condition 14(1)(e)) of the Generation Assets DMLs, Schedules 11 and 12 (Part 4 Condition 9(1)(e)) of the Transmission DMLs and Schedule 13 of the Interconnector assets DML (Part 4 Condition 7(1)(e)) in accordance with the Outline Scour Protection and Cable Protection Plan (Document reference 8.16, APP -707), must

Summary of Written Representation	Applicant's Response
	<p>be approved by the MMO prior to construction. This document will be updated as the final design of the project develops and will include justification of the location, type, volume and area of cable protection, based on crossing agreements and pre-construction survey data to ensure only essential cable protection can be installed.</p> <ul style="list-style-type: none"> • Condition 14(1)(e) of Schedule 9 and 10, Condition 9(1)(e) of Schedule 11 and 12 and Condition 7(1)(e) of Schedule 13 require that prior to commencement of licensed activities "...details of the need, type, sources, quantity and installation methods for scour protection and cable (including fibre optic cable) protection..." must be approved by the MMO. • Production of the Cable Specification, Installation, and Monitoring Plan (to be agreed with the MMO pursuant to Condition 14(1)(g) (Schedules 9 and 10), Condition 9 (1) (g) (Schedules 11 and 12) and Condition 7(1)(f) (Schedule 13) must include: (ii) a detailed cable (including fibre optic cable) laying plan for the Order limits, incorporating a burial risk assessment to ascertain suitable burial depths and cable laying techniques, including cable landfall and cable protection measures; (iii) proposals for monitoring offshore cables including cable protection during the operational lifetime of the authorised scheme which includes a risk based approach to the management of unburied or shallow buried cable. • Dropped objects will be reported to the MMO using the Dropped Object Procedures Form outlined in Schedules 9 and 10, Part 4, Condition 12 (10), and Schedules 11 and 12, Part 4, Condition 7 (11) and Schedule 13, Part 4, Condition 5 (10). <p>Co-existence procedures noted in the Outline FLCP of relevance in the context of minimising snagging risk include:</p> <ul style="list-style-type: none"> • Regular and routine communications with the fishing industry; • Early provision of construction and cable laying plans, including location and methods for cable protection, if required; • Consideration for the use of guard vessels; • Development of a fisheries guidance document to reduce interactions with fishing activity and provide response procedures; • Cable burial monitoring;

Summary of Written Representation	Applicant's Response
	<ul style="list-style-type: none"> • Provision of procedures for the safe recovery of lost or snagged fishing gear; and • Appropriate communication with the fishing industry in the event that cables become unburied during the operational phase (i.e. through the Fisheries Liaison Officer (FLO) and appropriate channels such as the Kingfisher Information Service). This has been reflected in the draft DCO under Schedule 9 and 10, Part 4, condition 9 (12) and Schedule 11 -12, Part 4 condition 4 (12). The Applicant considers that the wording included in the draft DCO is appropriate.
<p>NFFO and VisNed encourage support with the adoption of the Fish Safe or equivalent device by fishing vessels operating in the area – see http://www.fishsafe.eu/en/fishsafe-unit.aspx.</p> <p>In addition, NFFO and VisNed encourage the use of funding arrangements like the West of Morecombe Fisheries Fund as a mechanism to support fishing industry stakeholders affected by the project and provisioning of work opportunities (e.g. guard vessels or surveys for example) available to affected fisheries stakeholders as far as practically possible.</p>	<p>The Applicant notes that the potential for a community benefit fund is outwith the DCO consenting regime and therefore wider community benefits should not be taken into account when determining the Application.</p> <p>Notwithstanding this, the Applicant has and will continue to engage in relevant wider industry initiatives as appropriate.</p> <p>Consultation with the fishing industry is on-going and will continue post-consent.</p>
<p>NFFO/VisNed to achieve consistency with draft best practice guidance of the Fisheries Liaison with Offshore Wind and Wet Renewable Group we suggest the following amendment (in red) to Schedule 9 Part 4, Section 9 (12) Notifications and inspections and Schedule 10, Part 4, Section 9 (12):</p> <p><i>(12) In case of a state of shallow burial or exposure of cables on or above the seabed, the undertaker must within five days following the receipt by the undertaker of the final survey report from the periodic burial survey, notify mariners by issuing a notice to mariners and by informing Kingfisher Information Service of the location and extent of exposure. Copies of all notices must be provided to the Marine Management Organisation (MMO and Maritime and Coastguard Agency (MCA) within five days.</i></p>	<p>The Applicant considers that the wording currently proposed in the draft DCO is appropriate and in line with the wording agreed with NFFO/VisNed during the Norfolk Vanguard Examination.</p> <p>The Applicant notes that the draft Guidance referred to by NFFO/VisNed (Fishing Liaison with Offshore Wind and Wet Renewables (FLOWW) - draft Recommendations for Fisheries-Cable Interactions, Planning and Mitigation, And Guidance on The Offshore Transmission Owners (OFTOs) Regime) is currently a working draft for consultation within the FLOWW Group and yet to be finalised and published.</p>

1.4 N2RS (No to Relay Stations) REP2-106

Summary of Written Representation	Applicant's Response
<p>N2RS in REP2-106 and accompanying Doc 1 describe how they have campaigned and made contributions during early stages of the consultation process providing their views on the benefits of an HVDC transmission system. They acknowledge and welcome the decision made by the Applicant to revise Project proposals and submit a DCO application for a Project with an HVDC transmission system.</p> <p>Although welcoming the decision and acknowledging the significant extent to which it reduces impact, REP2-106 Document 1 suggests the Project will still affect some individuals and communities, especially at landfall, where the cable corridor runs close to homes and businesses, where traffic is disruptive and where it connects to the Grid, N2RS submits that:</p> <p>a) Due regard should be given to homes and businesses which are still directly affected by the wider plans - and loss in property value and quality of life should be taken into account. It should not fall upon individuals to bear the brunt of schemes like this and those affected must be properly compensated. This would include owners of holiday businesses who will lose trade during construction and possibly suffer longer-term loss of reputation.</p> <p>b) The intrusion into the countryside should be kept to an absolute minimum and the developers should continue to liaise with local people to utilise their knowledge and experience so that homes, the quality of life of individuals, businesses and wildlife do not suffer unnecessarily.</p> <p>c) Vattenfall should continue to communicate with those who have expressed an interest in this project directly to inform them of major milestones and any aspect that will affect nearby communities – such as road closures and improvements.</p> <p>d) Once construction starts, local people should have an effective means of contacting the developer or project team especially in emergencies where for example there is evidence</p>	<p>The Applicant acknowledges and thanks N2RS for their contributions to the consultation process and to shaping the Project proposals. The contributions of N2RS, those from all other stakeholders, community members and groups are described in Doc 5.1 Consultation Report (APP-027). The executive summary, section 1.6 of APP-027 (Responses to feedback and Project decisions influenced by consultation), in particular, describes the many decisions taken by the Applicant as a result of the consultation process.</p> <p>With respect to the additional points made by N2RS, we would refer N2RS to the following specific submissions:</p> <p>a) and e): APP-243 Doc. 6.1.30 Environmental Statement - Chapter 30 Tourism and Recreation, Table 30.35, summarises the likely tourism and recreation effects associated with the proposed project during the construction and operation and maintenance phases of the proposed project under both Scenario 1 and Scenario 2. It has been concluded that following mitigation the residual potential impacts on tourism and recreation range from no impact to minor adverse.</p> <p>These impacts are driven mainly by the increased traffic density during construction and the visual impact of construction in a rural area. The construction impacts have a greater likelihood of being more significant closer to the coast because the density of tourism and recreational receptors increases with proximity to the coast. This is to be expected because the Norfolk Coast AONB is one of the main drivers of tourism in the area. However, these impacts are temporary, short term due to the sequential nature of the construction, and fully reversible once construction is complete. .</p> <p>Where minor adverse impacts have been assessed, they are localised and the Applicant will work to mitigate the determinants of the impacts by development of the final Code of Construction Practice (CoCP) ((in accordance with the Outline CoCP8.1 , REP1-018)) and final Traffic Management Plan (in accordance with the Outline Traffic Management Plan (8.8, REP1-022)) to ensure all potential impacts are managed to an acceptable level.</p> <p>During operation, there are not expected to be any impacts to tourist visitors or the tourist industry.</p>

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<p>of harm to wildlife, flooding or other unexpected events.</p> <p>e) Vattenfall's project team should recognise the importance of tourism and ensure wherever possible that works will not impact on the area during peak tourism periods. The impact on tourism businesses during construction and loss of reputation should be compensated. Finally, the rights of local people to enjoy their surroundings out of peak hours should also be respected.</p>	<p>b) APP-217 6.1.4 Environmental Statement - Chapter 4 Site Selection and Assessment of Alternatives, APP-218 6.1.5 Environmental Statement - Chapter 5 Project Description, APP-235 6.1.22 Environmental Statement - Chapter 22 Onshore Ecology and APP-236 6.1.23 Environmental Statement - Chapter 23 Onshore Ornithology all describe the embedded mitigation relevant to these topics which ensure any intrusion into the countryside is avoided, minimised and mitigated.</p> <p>c) and d) The Applicant is committed to providing Local Community Liaison, detailed in Section 2.4 of the Outline Code of Construction Practice (OCoCP) (REP1-018) and secured in draft Development Consent Order (dDCO) Requirement 20. The role will ensure effective and open communication with local residents and businesses that may be affected during construction works.</p>
<p>REP2-106 Document 2: "Concerns raised on the deliverability of HVDC and the Applicant's response" expresses fears that the Applicant may be forced to recapitulate while also highlights assurances given by the Applicant with respect to its Norfolk Vanguard application.</p>	<p>Noted.</p> <p>The Applicant would also refer N2Rs and the ExA to Doc 5.1 Consultation Report (APP-027), Table 25.1 Summary of responses to section 47 and regard had by the Applicant, and can also report that constructive engagement with the supply chain continues, with potential contractors working to design solutions that meet the parameters described in the DCO.</p> <p>Furthermore, while N2RS refer to Orsted's Hornsea Project Three, and their reference with respect to SPR's East Anglia One project, we would also draw the ExA's attention to the results of the recent CfD auction round, and note that successful projects include the Doggerbank Creyke Beck A P1, Doggerbank Creyke Beck B P1, Doggerbank Teeside A P1 all of which will deploy HVDC transmission technology. This indicates advances in and innovation of HVDC technology, which means that the sector and the supply chain are confident it will help deliver the next generation of offshore wind farm projects.</p>
<p>REP2-106 Document 3 "The NSIP Process – A Herculean Task for Communities" describes the efforts many community members make to engage effectively with the NSIP process and respond with knowledgeable and considered feedback. However, N2RS 's submission asks the ExA to "contrast this to the teams fielded by the various</p>	<p>The Applicant acknowledges the great efforts many local stakeholders, including residents and community groups go to, to present informed, evidence-based contributions to the EIA consenting process, and to the NSIP examination process. Their contributions are important and are influential, as described in Doc 5.1 Consultation Report (APP-027), and the executive summary, section 1.6 Responses to</p>

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<p>developers. We are no match for the fully funded lawyers, engineers, environmental consultants and communications experts who do this for a living, and it is no wonder that ordinary people feel disenfranchised, disheartened and unable to compete and in the end campaign fatigue tends to set in.”</p>	<p>feedback and Project decisions influenced by consultation, in particular, describes the many decisions taken by the Applicant as a result of the consultation process.</p> <p>The Applicant makes many efforts during the NSIP process to make information likely to be of interest to the general public and non-statutory consultees as accessible as possible. For example, during the Statutory Consultation, the Applicant published APP-172 5.1.22.13 Consultation Report Appendix 22.13 - Consultation Summary Document and exhibition boards were prepared, as well as other visual aids to facilitate people’s familiarisation with the project. Informally, the Applicant also attempted to help residents, including N2RS with navigating the Examination Documents. the Applicant acknowledges the volume of the information and documents required as part of the DCO process. The Applicant, however, is mindful that while these documents are open to all, there are organisations whose statutory responsibility includes scrutiny and responses to such documents, on behalf of civic society.</p> <p>Furthermore, Vattenfall maintain an open and collaborative attitude and considers that the contributions of all consultees, throughout the entire NSIP process, are valuable and have helped ensure it develops projects that are both in the national interest, addressing and delivering on the needs of the UK (as set out in APP215 6.1.2 Environmental Statement - Chapter 2 Need for the Project), as well as locally appropriate.</p> <p>The Applicant would like again to thank N2RS and other interested parties, who voluntarily participate in the NSIP process, for the role they play in shaping the Applicant’s proposals.</p>

1.5 Historic England REP2-072

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<p>2.7 In reference to cable installation methods (section 5.4.13) it is estimated that seabed depth of 3m will be required (paragraphs 213 and 224). However, it was noted that there was no specific attention (or any other documentation cross referencing) to demonstrate how these programmes will be fully informed by archaeological assessment practices or other mechanisms to be employed should any</p>	<p>The Applicant notes this advice. This is, however, addressed through the embedded mitigation set out in Chapter 17 of the ES (section 17.7.2) [APP-230] and in the Outline WSI (Offshore) (section 7.1) [APP697] which sets out the Applicant's commitment to avoidance as the primary means of mitigation (to be informed by further archaeological assessment post-consent) or further investigation and additional mitigation where avoidance is not possible. In addition, during the</p>

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<p>consented project encounter previously unknown archaeological materials.</p>	<p>construction phase, The Crown Estate's Offshore Renewables Protocol for Archaeological Discoveries (ORPAD) will be implemented to account for any further unexpected discoveries which should come to light during the course of construction. The archaeological assessment practices which will fully inform the design of cable layouts, and any additional mitigation requirements prior to or during cable installation, are set out in the Outline WSI (Offshore).</p>
<p>2.9. Pre construction survey design should be undertaken in conjunction with the retained Archaeologist and Archaeological curator to ensure accordance with the WSI.</p> <p>The In Principle Monitoring Plan (IPMP) will require revision to facilitate such coordinated action.</p>	<p>The Outline WSI (Offshore) (section 9.4, paragraphs 78 to 83) [APP697] recommends that, prior to the acquisition of further survey data during the pre-construction phase, a data review is undertaken by a suitability qualified and experienced archaeological contractor in order to qualify the continued suitability of the existing data and assessment to the project. This is in order to identify any data gaps and any additional requirements (including specific objectives) which may inform the acquisition of further geophysical data. It is also stated that Historic England will be consulted on the scope of all further geophysical survey. In addition, if required, a method statement will be issued by Norfolk Boreas Limited in advance of any further geophysical survey campaigns that incorporate archaeological objectives, as advised by the retained archaeologist and/or archaeological contractor.</p> <p>The IPMP [REP2-029] states that:</p> <p><i>The principal mechanism for delivery of monitoring is through agreement on the offshore Written Scheme of Investigation (WSI) and the pre-commencement survey scheme secured under Requirement 14(2) (Schedule 9-10), 9(2) (Schedule 11-12), and 7(2) (Schedule 13) of the DCO, which reads as follows:</i></p> <p><i>(2) Pre-commencement surveys and archaeological investigations and pre-commencement material operations which involve intrusive seabed works must only take place in accordance with a specific written scheme of investigation which is itself in accordance with the details set out in the outline offshore written scheme of investigation (offshore), and which has been submitted to and approved by the MMO.</i></p>
<p>4.2 Historic England note that there are ongoing studies such as the seabed mobility study and this study should also support archaeological characterisation and the likelihood of presently unknown materials of archaeological interest becoming exposed within the proposed</p>	<p>The final report of the seabed mobility study was provided at Deadline 1 (REP1-040). The scope of this study did not cover materials of archaeological interest. However as stated in the Written Summary of the Applicant's Oral Case at Issue Specific Hearing 2 - Environmental Matters (RE1-042), the results of the study further support the evidence provided within the Environmental Statement (ES). The preliminary findings</p>

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development areas or known sites becoming buried.	were already integrated within the ES and the final report only serves to confirm those initial findings. Therefore the conclusions made in Chapter 8 Marine Geology, Oceanography and Physical Processes (APP-221) remain relevant, as do those which use the findings of Chapter 8 to underpin assessment. This includes Chapter 17 offshore archaeology and cultural heritage (APP-230). The findings reported in the Report do not change the results of the impact assessment and only increase certainty in the baseline.
5.3, 5.12, 8.2 and 13.5 Historic England consider that it would be appropriate to have further discussion as part of the consultation to prepare any post-consent archaeological WSI (Offshore). Such discussion should include suitability of survey data acquired to date to provide baseline characterisation and the appropriate survey resolution in relation to the relevant guidance [Marine Geophysics Data Acquisition, Processing and Interpretation Guidance Notes. English Heritage 2013] for further survey campaigns. Sufficient detail is an important component of any subsequent Method Statements to address specific survey objectives (as alluded to in paragraph 60 of chapter 17, APP-230).	<p>In addition to the detail provided above on the development of further survey requirements for archaeological assessment post-consent, paragraph 5 of the Written Scheme of Investigation (offshore) (document reference 8.6, APP-697) states:</p> <p><i>An updated, final Offshore WSI will be developed in consultation with Historic England, post-consent to be agreed at least four months prior to the commencement of any survey programmes to ensure the effective inclusion of archaeological objectives in such surveys. This final Offshore WSI will be reviewed and updated as necessary prior to construction in order to inform a construction phase document based on the final design of the project.</i></p> <p>The Applicant considers that this would ensure that all survey data would be collected to a standard acceptable to Historic England.</p>
9.1 Historic England encourage the Applicant to complete the deposit of any agreed Technical Report with the National Record of the Historic Environment (NRHE) and relevant local HER (where applicable), this is made in reference to, amongst others, Appendix: 17.4: Marine Archaeology Technical Report of the ES (APP-577)	<p>Condition 14(1)(h) (vi) of schedules 9 and 10 of the DCO (also included in Schedules 11, 12 and 13) includes:</p> <p><i>a requirement for the undertaker to ensure that a copy of any agreed archaeological report is deposited with the National Record of the Historic Environment, by submitting a Historic England OASIS (Online Access to the Index of archaeological investigations) form with a digital copy of the report within six months of completion of construction of the authorised scheme, and to notify the MMO that the OASIS form has been submitted to the National Record of the Historic Environment within two weeks of submission;</i></p> <p>Appendix 17.4: Marine Archaeology Technical Report of the ES (APP-577) is also a document that forms part of the Norfolk Vanguard application and therefore it is likely that this will be submitted by Norfolk Vanguard Limited should that project get consent. If that project does not get consent the report will be submitted by Norfolk Boreas Limited when discharging the condition.</p>
Historic England note that Schedules 9, 10, 11 and 12; Deemed Licences under the 2009 Act –	The Applicant acknowledges that the formatting of this address within Schedule 9-13 of the dDCO is incorrect

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<p>Generation Assets and Transmission Assets. Part 1 (Interpretation) – amend as follows:</p> <p>Article 4 – the address for returns and correspondence for HBMCE is:</p> <p>Historic England Cannon Bridge House 25 Dowgate Hill London EC4R 2YA</p>	<p>and the Applicant will update this accordingly within the next version of the dDCO.</p>
<p>11.2 Historic England concur with the provisions stipulated for how an archaeological WSI should be produced in consultation with the HBMCE as the statutory historic body. Furthermore, it is apparent to us that given the proposed methodology for the use of HDD to take the electricity export cables from below Mean Low Water Springs that there will not be any foreshore intrusive works conducted. However, we appreciate that the spatial extent of the archaeological WSI should match that of Marine Licensing control and therefore the above referenced Schedules should state "...the offshore Order limits seaward of Mean High Water Springs..."</p>	<p>As stated in the Applicant's Responses to the Examining Authority's Written Questions [REP2-021] response to question 1.0.1 and 5.3.8, the Applicant proposed that the dDML Condition 14(1)(h) (Schedule 9-10), Condition 9(1)(h) (Schedule 11-12), and Condition 7(1)(h) (Schedule 13) be amended to refer to the offshore Order limits seaward of mean HIGH water, and this will be updated in the next version of the dDCO.</p>
<p>2.5 states: At the proposed landfall location cable ducts, under Scenario 1, would be installed during construction of Norfolk Vanguard and under Scenario 2 ducts would be installed as part of Norfolk Boreas.</p>	<p>This is not correct. Under Scenario 1 all fully <u>onshore ducts</u> would be installed by Norfolk Vanguard, however the landfall ducts (which pass under the intertidal area) will be installed by Norfolk Boreas. The Applicant have retained an option for these to be installed at the same time as the Norfolk Vanguard Landfall ducts (to reduce the cumulative impacts), however they would be installed under the Norfolk Boreas consent.</p>
<p>Comments on the Outline Written scheme of investigation (onshore) [APP-696]</p>	
<p>12.4 Historic England note that it is not clear from the information provided (in section 6.2 of the outline written Scheme of investigation (onshore)) if this means that the under the strip map and sample methodology, planning and excavation will take place immediately after the site has been stripped. If the site is to remain open for a short time before the excavation takes place then a time limit should be agreed with Norfolk County Council Historic Environment Services; the exposure of sites to the elements can result in the damage and/or loss of materials and deposits through weathering and bioturbation. The stripping and evaluation of the sites therefore need to be carefully timetabled to</p>	<p>The Applicant notes this advice. This level of information will be included within the detailed onshore mitigation agreed within the WSI(s), both pre-construction and construction related, to be produced post-consent, prior to construction commencing, in consultation and agreement with Norfolk County Council (Historic Environment Service)(HES)), Historic England - and National Trust (where works are relevant to the Blickling Estate's land ownership). The Archaeological written scheme of investigation is secured through Requirement 23 of the draft DCO [REP1-016] which states that the WSI must be completed:</p> <p><i>"in consultation with Norfolk County Council and Historic England... and approved by the relevant planning authority".</i></p>

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<p>ensure that archaeology is not negatively impacted.</p>	<p>Consultation with National Trust is secured within the outline WSI [APP-696] under paragraph 65 which states:</p> <p><i>"The National Trust's archaeologist will also be consulted where works are relevant to the Blickling Estate's land ownership."</i></p>
<p>12.5 It is noted in Section 6.3 (Archaeological Monitoring/Watching Brief) that a contingency is to be included in the works programme to allow investigation and recording of archaeological remains that may be identified, disturbed or destroyed. It is noted that as some of the evaluation work will not take place until after the project has been consented that there are risks that previously unknown archaeological remains may be identified (paragraph 106). The work schedules will therefore need to allow for the flexibility to investigate any sites discovered appropriately.</p>	<p>This has been raised and discussed during the Evidence Plan Process (EPP) and the Applicant is fully aware of the need to allow such flexibility within the work schedules.</p> <p>The 'initial informative stages of mitigation' as per the Outline WSI (Onshore) APP-696] would be completed first within the post-consent stages, followed by subsequent additional mitigation measures where required. Sufficient time will be built into the programme, and where unexpected remains are uncovered, contingency measures will be applied and followed. This level of information would be included within the detailed onshore mitigation related WSI(s), both pre-construction and construction related, to be produced post-consent, prior to construction commencing, in consultation and agreement with Norfolk County Council HES, Historic England and the National Trust (where works are relevant to the Blickling Estate's land ownership). The commitment to this consultation is secured through the outline WSI and DCO (see Applicant's response to 12.4 above for references).</p>
<p>12.6 Section 6.4 discusses the possibility that some sites may be preserved in situ where necessary and appropriate, but this will be considered on a case by case basis. We would recommend that the Historic England document Preservation of Archaeological Remains (2016) is consulted to help guide the decision making process about whether a site should and could be preserved in situ, and the sort of information required when making these decisions.</p>	<p>The Applicant notes this advice. Further specific review of, and reference to, this Historic England guidance document will be made when drafting the detailed onshore mitigation related WSI(s), both pre-construction and construction related, to be produced post-consent, prior to construction commencing, in consultation and agreement with Norfolk County Council HES, Historic England and the National Trust (where works are relevant to the Blickling Estate's land ownership). The commitment to this consultation is secured through the outline WSI and DCO (see above for references)</p>
<p>12.8 Section 11 presents the mitigation works that will be carried out as part of the archaeological monitoring/watching brief investigations. The majority of the presented strategy appears to be sensible and appropriate, but we offer the following comments to clarify aspects of the approach. We would recommend that some flexibility should be afforded to the sampling of features such as postholes. It is stated in Section 11.5 (paragraph 21) that</p>	<p>The Applicant notes this advice. Section 11 is intended to provide example (model) clauses only, at this stage, for the purposes of the Outline Written Scheme of Investigation (OWSI), specific to the type of additional archaeological mitigation work (and the associated specifications, with specific reference to Set-Piece Excavation (SPE), Strip, Map and Sample (SMS) and Archaeological Monitoring / Watching Brief) likely to be required following the initial informative stages of mitigation post-consent. The recommendations above</p>

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<p>postholes will be half-section (50%), but if the posthole is relatively small then it may be more appropriate to excavate 100% of the feature. We would also recommend that the option to collect spatially distinct samples from any structures is included, as this may allow the way that the structures were used and organised to be investigated (Section 11.5, paragraph 24). Finally, we would also recommend that discrete samples are collected from any graves (Section 11.5, paragraph 26 & Section 11.9, paragraph 59), following the approaches discussed within section 3 of the Historic England document The Role of the Human Osteologist in Archaeological Fieldwork Projects (2018).</p>	<p>would be incorporated into the survey-specific WSI for trial trenching (where appropriate), and the detailed onshore mitigation related WSI(s), both pre-construction and construction related, to be produced post-consent, prior to construction commencing, in consultation and agreement with Norfolk County Council HES, Historic England and the National Trust (where works are relevant to the Blickling Estate's land ownership). The commitment to this consultation is secured through the outline WSI and DCO (see Applicant's response to 12.4 above for references).</p>
<p>12.9 It is stated in paragraph 48 that all retained artefacts will be washed; if the artefacts preserve evidence of organic residues then we would recommend that the advice provided in the Historic England document Organic Residue Analysis and Archaeology (2017), is referred to, and in particular the information regarding sampling (Historic England 2017, see section 5.2.2.3).</p>	<p>The Applicant notes this advice. This level of information would be included within the detailed onshore mitigation related WSI(s), both pre-construction and construction related, to be produced post-consent, prior to construction commencing, in consultation and agreement with Norfolk County Council HES, Historic England and the National Trust (where works are relevant to the Blickling Estate's land ownership). The commitment to this consultation is secured through the outline WSI and DCO (see Applicant's response to 12.4 above for references).</p>
<p>12.10 It is stated in paragraph 58 that all environmental samples will be processed as appropriate. We would recommend that his work is carried out in a timely manner to ensure that the remains are stabilised and to reduce the risk of their degradation.</p>	
<p>Comments on the Outline Written scheme of investigation (Offshore) [APP-697]</p>	
<p>13.4 It is necessary for any archaeological WSI produced post consent to include an amended version of this section to explain the specific matters stated within any final DCO and the actions to be taken, through application of the WSI, to deliver those conditions.</p>	<p>The Applicant notes the advice provided. The final WSI will be drafted in consultation with Historic England and will include all of the relevant points raised within Historic England's Written Representation.</p>
<p>13.5 attention will be necessary in any post-consent WSI to ensure reporting objectives are clearly understood by all parties with particular reference to any sites discovered which could be considered to be heritage assets.</p>	
<p>13.5 Section 9.5 (Marine geoarchaeological investigations) requires particular attention to support its effective implementation in reference to the identification of relevant published research frameworks to inform any subsequent programmes of analysis.</p>	

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<p>13.6 Section 9.7 (archaeological watching brief), mentions clearance operations and that a watching brief might be necessary. Chapter 5 (section 5.4.13) is clear regarding the requirement for pre-lay grapnel runs and pre-sweeping and therefore this section of the outline archaeological WSI will require attention post consent (should permission be obtained) to be informed by a risk assessment exercise to determine whether or not on board supervision will be required (as relevant to array area, electricity export cable corridor and interconnects search area) with the detail of how any on board watching brief might be delivered through an accompanying Method Statement.</p>	
<p>Chapter 7 (monitoring) discusses the possibility of revision of the final Offshore WSI. The text used here must be clear that the provisions for the production of a WSI post-consent (should permission be obtained) should be aligned with the detail of any DCO (including deemed Marine Licences) secured for this proposed project. In particular that any final Offshore WSI is produced in consultation with HBMCE, but is formally agreed with the MMO to discharge a specific consent requirement. However, it is possible that analysis and assessment programmes generated by the delivery of the final and agreed Offshore WSI through accompanying Method Statements will produce new information. It is therefore an important matter that such information is captured accordingly, which we consider to be the role of any archaeological Technical Reports generated by completed phases of works or other agreed programmes of analysis.</p>	<p>The Applicant notes this advice and the Applicant is in agreement with Historic England. Provision for the reporting and publication of new information produced from archaeological works undertaken post-consent are detailed in the Outline WSI (Offshore) with specific reference to Section 9.1 (Archaeological Recording, Reporting, Data Management and Archiving).</p>
<p>Table 4.6 (In principle monitoring proposed – Offshore archaeology and cultural heritage) explains that the Norfolk Boreas Ltd. will produce an updated archaeological WSI (Offshore) at least four months prior to the intended start of construction. However, it is important to draw attention to the provision made within the draft dMLs (Condition 14(2) for Schedules 9 and 10; Condition 9(2) for Schedules 11 and 12; and Condition 7(2) for Schedule 13 regarding production of a WSI to inform pre-commencement surveys. We therefore offer a cross reference to this requirement with the detail provided in Table 4.1 (vis. changes in seabed topography etc.), whereby the: “Scope</p>	<p>The IPMP was updated and submitted at Deadline 1 (REP1-029) to remove any reference to four months. The IPMP now states that: <i>“The final WSI will be submitted to the MMO for written approval in accordance with the timescales required by the DMLs”.</i></p> <p>As stated and agreed within the statement of common ground with Historic England (REP2-038). The dDMLs (REP1-008) state that each programme, statement, plan, protocol or scheme required to be approved under condition 14, (or 9 or 7 in schedules 11, 12 and 13) must be submitted for approval at least four months prior to the intended commencement of licensed activities, except where otherwise stated or unless otherwise agreed in writing by the MMO.</p>

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<p>for surveys and programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least four months prior to the commencement of any survey works". This also applies to updating the IPMP.</p>	<p>This is elaborated on in in the text of paragraph 5 of the outline WSI (offshore) (APP-697) which states that: <i>"an updated, final Offshore WSI will be developed in consultation with Historic England, post-consent to be agreed at least four months prior to the commencement of any survey programmes to ensure the effective inclusion of archaeological objectives in such surveys."</i> Furthermore, a firm commitment is made in the Outline WSI (offshore) that prior to the commencement of any site investigation campaign a method statement will be issued by Norfolk Boreas Limited setting out the specific details of the campaign once geoarchaeological requirements and locations have been established in order to inform consultation with Historic England. Similarly, in paragraph 83 it is stated that a method statement will be issued by Norfolk Boreas Limited in advance of any further geophysical survey campaigns that incorporate archaeological objectives, as advised by the retained archaeologist and/or archaeological contractor. Therefore, the Applicant does not consider that any update to the IPMP is required.</p>

1.6 Cadent Gas Limited REP2-103

Summary of Written Representation	Applicant's Response
<p>Cadent has intermediate and high pressure gas pipelines and associated below or above ground apparatus located within the order limits which are affected by works proposed.</p> <p>Cadent does not object in principle to the development proposed but instead objects to the authorised works being carried out in close proximity to its apparatus unless and until suitable provisions and related agreements have been secured to its satisfaction.</p>	<p>The Applicant acknowledges the written representation submitted on behalf of Cadent Gas Limited (Cadent). The Applicant acknowledges Cadent's objection to the authorised works, and that this is to be maintained until suitable protective provisions and any related agreements have been secured.</p>
<p>Cadent is discussing a form of protective provisions with the Applicant based on those agreed in relation to the Norfolk Vanguard DCO and hopes to reach agreement shortly.</p>	<p>The Applicant is committed to continue to work with Cadent towards an agreed set of protective provisions. The Applicant concurs that the agreed form of Norfolk Vanguard protective provisions are a suitable precedent.</p>
<p>Cadent reserves the right to make further representations in the unlikely event that negotiations are not concluded.</p>	<p>Noted. The Applicant is confident that agreement will be reached before the close of the Examination.</p>

1.7 Diana Lockwood REP2-101

Summary of Written Representation	Applicant's Response
<p>REP2-101 expresses concern over the implications of the cumulative effect of the National Grid substation and 2 extensions plus Dudgeon, Vanguard, and Boreas all in the same site, with regard to the probability and magnitude of a hazardous incident occurring on the National Grid and onshore project substation sites as a whole. REP2-101 expresses the opinion that 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.</p>	<p>The detailed design of the onshore project substation and National Grid substation extension will take full account of industry standard design approaches with respect to the necessary siting and separation of equipment to constrain the impact of any fault of an asset, to not have a further impact on other assets.</p> <p>This may include the use of industry standard blast wall designs around equipment such as transformers to further contain any asset failure risks.</p> <p>Both the onshore project substation and National Grid substation extension will be secured through perimeter fencing and other security measures to prevent unauthorised access. No terrorism attack has ever occurred to a substation on UK soil and, on this basis, it is reasonable to say that the risk of terrorism is low. Beyond this, the design and operation of substations are regulated and controlled to the highest health and safety standards; and operators are required to develop emergency response plans and crisis management procedures as part of that regulatory process.</p>
<p>REP2-101 suggests that a matrix be presented to determine the safe distance separating infrastructure comprising converter halls and the National Grid substation infrastructure from homes, and other sensitive receptors, and that for comparison, safe distances separating “normal” (AC only NG) substations should be located from homes should also be listed, in order to provide local people with some reassurance that they are not at risk.</p>	<p>There is no prescribed required distance for electrical infrastructure from residential areas. In urban areas, high voltage electrical substations can be sited adjacent or amongst residential areas. The substation perimeter fence provides the necessary exclusion zone from the electrical infrastructure for safe operation.</p> <p>Both the National Grid extension and onshore project substation are greater than 700m away from the nearest dwellings, further minimising risks to local residents.</p>
<p>REP2-101 expresses concern about potential impacts on water quality, stating: the substation site is clay subsoil over a chalk aquifer, which is used for water abstraction. As the cumulative scale increases, the probable risk of contamination must also increase, during construction and operation.</p>	<p>The Applicant is committed to a range of control measures with respect to contaminated land and groundwater, detailed in Section 6 of the OCoCP [REP1-018] and secured in dDCO (AS-019) Requirement 20.</p>
<p>REP2101 notes there are archaeological features documented in the surrounding area, and expresses the wish that where there is a possibility that soil may be disturbed below the plough depth, and cites trenching in proximity to Ivy Todd stream as an example of where this could occur, the area should be monitored for artefacts, and any recorded.</p>	<p>The Applicant is committed to a range of archaeology protection and control measures, detailed in the Archaeological Written Scheme of Investigation [APP-696] and secured in dDCO (AS-019) Requirement 23. The Applicant has conducted non-intrusive geophysical surveys and proposes to conduct pre-commencement archaeological</p>

Summary of Written Representation	Applicant's Response
	<p>investigations (trial trenching), prior to construction, to mitigate the risks to archaeology so far as possible.</p>
<p>REP2-101 suggests that while it is clear the NV ES discusses how to avoid, reduce and mitigate for “worst case scenario” potential impacts. The NB ES refers to Scenario 1 and Scenario 2.</p>	<p>Throughout the Environmental Statement, the worst case impacts of both Scenario 1 and Scenario 2 are presented. Chapter 6 Environmental Impact Assessment Methodology [APP-219] clarifies that the two different scenarios could give rise to different potential impacts, magnitude of impact and/or different effects on receptors. Therefore an assessment of potential impacts has been undertaken against each of Scenario 1 and Scenario 2.</p> <p>Throughout stakeholder consultation, both scenarios have been presented including the worst case impacts. This is exemplified in the consultation summary document [APP-172] which provides full details on both Scenario 1 and Scenario 2.</p>
<p>REP2-101 states the photo montages of view point 3 Lodge Lane North are flawed. Fig. 29.25b shows the problem. The baseline photograph shows the actual topography. The 3D model view shows the land's horizon, right to left, rising, and then falling forming a earth mound, concealing most of the converter halls. The actual baseline photograph shows the land gently falling away from the lane (right to left), with no mound. This is correct, as I am familiar with this view. Also the land does not fall away behind Lodge Farm, it is almost level, so in reality the view would show the halls almost in their entirety. (this affects scenario 1&2). The photo montage views of the national grid substation extension fail to show the actual impact of the pylons carrying the cables that drop at an angle down to the substation. The pylon that connects Dudgeon now, does not show the impact of the connecting cables, as in reality they are quite dominant, I live with the view. Fig. 29.29c and Fig. 29.29d shows a photo montage of viewpoint 7 scenario1, with and without 15 years of mitigating planting. this effect seems impossible. 29.29c shows this view is looking at the east end of the Boreas halls. Fig. 29.9 shows the planting only 20-50m away from the project at this point. 29.29c shows the halls in view, and 29.29d show them totally concealed, as this is level ground, and all thing considered, the only conclusion is, the trees must be 65 feet high. These views I live with, and feel I must comment. I worry about the possibility that other imagery of other views are not accurate. If the mentioned faults can be confirmed, could</p>	<p>In Figure 29.25b the model shows the ridgeline as modelled from OS 5m DTM, which is the landform data commonly used in the production of visualisations, with Scottish Natural Heritage (SNH) standards for visualisations recommending its use. Whether this rise in landform to the fore of the onshore project substation actually occurs or not is not possible to determine from the baseline photograph as the mature woodland associated with Lodge Farm screens this portion of the view. While it is agreed that the landform from Lodge Farm to the onshore project substation does level off, there is still a subtle rise as shown on OS maps. Moreover, the more critical point in terms of the screening effect of the intervening landform relates to the extent to which the landform falls away to the south, between Lodge Farm and the viewpoint. With a drop of approximately 5m this sets the viewer lower than the rising landform even taking into account their assumed 1.5m height (following best practice standards), giving an overall 3.5m difference in levels. This drop would account for the landform appearing to rise more notably relative to the viewpoint and causing the ridgeline to partially screen the onshore project substation.</p> <p>In the preparation of the visualisations which show the electricity transmission line at the National Grid substation extension, the pylons and transmission lines that have been modelled in have used the existing pylons and transmission lines to identify an appropriate match for the colour and intensity of the render.</p>

Summary of Written Representation	Applicant's Response
<p>there be a change to more earth banking with planting to actually achieve the mitigated views in the photo montages.</p>	<p>Figure 29.29c and 29.29d, which presents a photomontage of Viewpoint 7 under Scenario 1, includes mitigation planting at a height of approximately 5 to 7 metres in height. OS maps for this area show the elevation of the viewpoint to be 61m AOD. It shows the elevation of the area where the mitigation planting would be implemented to be 68m to 72m AOD extending east from Lodge Lane to join the existing field boundary. This means that the base height of the mitigation planting would be 7 to 11m higher than the base height of the viewpoint and taking into account the height of the viewer (assumed to be 1.5m following SNH's visualisation standards) the difference would still be 5.5m to 9.5m. This rise in landform, combined with the effect of perspective whereby the substation would be recessed a further 36m to 159m away from the mitigation planting, accounts for the visual effect of the mitigation planting appearing commensurate in height with the onshore project substation.</p>

1.8 Corpusty and Saxthorpe Parish Council REP2-068

Summary of Written Representation	Applicant's Response
<p>REP2-068 expresses concerns relating to the potential public health effects of the Norfolk Boreas construction process on people and communities living along the route of the B1149 and the B1145.</p>	<p>Environmental Statement (ES) Chapter 27 Human Health (APP-240, 6.1.27) in combination with ES Chapter 24 Traffic and Transport (APP-237 6.1.24) and ES Chapter 26 Air Quality (APP-239, 6.1.26) deal with the topics raised by Rep2-068.</p> <p>The air quality assessment methodology is detailed in section 26.4 of Chapter 26. This was undertaken using the latest Institute of Air Quality Management (IAQM) guidance. Further guidance is provided by the IAQM and EPUK (IAQM and EPUK, 2017) on determining the magnitude and significance of a project's impact on local air quality. This guidance was developed specifically for use in planning and assessing air quality impacts associated with mixed-use and residential developments.</p> <p>The results of the construction phase road traffic emissions assessment indicate that annual mean concentrations of NO², PM10 and PM2.5 are predicted to be below the respective Air Quality Objectives in the year of peak construction (2024) under Scenario 2 (the worst case scenario) at all receptors, both 'without' and 'with' the project in place (Section 26.7.4.2 Construction Vehicle Exhaust Emissions, Chapter 26 Air Quality). The change in NO² concentrations was 4% or less at all receptors; which corresponded to a 'negligible' impact due to low total NO² concentrations, in accordance with IAQM and EPUK guidance (IAQM and EPUK, 2017).</p>

Summary of Written Representation	Applicant's Response
	<p>Section 27.6.3.2 of Chapter 27 includes the information from the air quality assessment conducted in Chapter 26, to inform the human health assessment.</p> <p>The air quality effects on human health assessment concluded that the significance of effect would be no greater than minor adverse. All effects would be short-term, temporary and would cease on completion of the works. Therefore, there would be no residual long-term health outcome. Appendix 27.1 includes a scientific literature review and supporting information for the human health assessment (APP-665).</p>
<p>REP2-068 also seeks to draw to the ExA attention some important technical issues associated with project costing methods deployed uncritically in the project documentation, and in particular health costs to individuals.</p>	<p>REP2-068 highlights the health costs of polluted air, and of increased journey times to reach A&E and other medical services. The Applicant, however, considers that these comments are made in a general context, rather than in respect of detailed evidence relating specifically to the Applicant's Project. There are also significant benefits to UK and global populations from the Norfolk Boreas project through the deployment of low-carbon energy in a timely manner and the reduction of carbon dioxide into the atmosphere, as well as the potential reduction of health effects associated with the global climate crises. There are also significant socio-economic opportunities to be derived from the Offshore Wind Sector Deal (as referred to in ES Chapter 2 Need for the Project (APP-215 6.1.2) and ES Chapter 31 Socio-economics (APP-244 6.1.31)).</p>
<p>REP2-068 suggests there are disadvantages for citizens and communities wishing to engage in the NSIP process, suggesting "specialist and technical documentation presented by intending developers can sometimes seem designed to baffle rather than inform".</p>	<p>The Applicant makes many efforts during the NSIP process to make information likely to be of interest to the general public and non-statutory consultees as accessible as possible. For example, during the Statutory Consultation, the Applicant published APP-172 5.1.22.13 Consultation Report Appendix 22.13 - Consultation Summary Document and exhibition boards were prepared, as well as other visual aids to facilitate people's familiarisation with the project.</p> <p>However, the level of detail required on a very wide range of relevant topics in order to comply with EIA for these complex, nationally significant infrastructure projects, prohibits universal and comprehensive involvement on every topic by any single individual. While the complete suite of documents are open to all, there are organisations whose statutory responsibility includes scrutiny and to provide responses to such documents relating to their particular area of expertise and responsibility, on behalf of civic society.</p> <p>REP2-068 does though effectively illustrate the success of the process, in that it enables experts from among civic society, statutory consultees and other interested parties to contribute where they are able to, and to bring a very wide range of perspectives to bear on these projects of national importance, which seek to deliver on national policy, while also being sensitive to local interest and needs.</p> <p>The Applicant thanks Corpusty and Saxthorpe PC for their contribution, it is among the many representations made throughout the process that help the Applicant develop a project that is both in the national interest,</p>

Summary of Written Representation	Applicant's Response
	addressing and delivering on the needs of the UK (as set out in APP215 6.1.2 Environmental Statement - Chapter 2 Need for the Project), as well as locally appropriate.

1.9 The Wildlife Trusts REP2-098

Summary of Written Representation	Applicant's Response
<p>Impacts on the Southern North Sea SCI [The Applicant note that this is now SAC]</p> <p>Firstly, the SIP lacks detail and therefore in its current form it is not adequate. More detail should be provided on the effectiveness of the proposed mitigation as outlined in the SIP. This should include referenced examples of how the implementation of mitigation will reduce underwater noise disturbance impacts within the Southern North Sea SAC. Noise modelling should also be undertaken to demonstrate the degree of noise reduction which could be achieved through mitigation.</p>	<p>The Southern North Sea In-Principle Site Integrity Plan (SIP) (APP-708) includes a range of mitigation options, such as noise reduction. The In Principle SIP provides a framework for agreeing appropriate mitigation measures and this will be updated with additional details prior to construction, taking into account the final build scenario and best available scientific understanding and guidance at the time. The dDCO (Schedules 9 and 10 Part 4 Condition 14(m) and Schedules 11 and 12 Part 4 Condition 9(l)) states:</p> <p><i>In the event that piled foundations are proposed to be used, the licensed activities, or any phase of those activities must not commence until a Site Integrity plan which accords with the principles set out in the in principle Norfolk Boreas Southern North Sea Special Area of Conservation Site Integrity Plan has been submitted to the MMO and the MMO is satisfied that the plan, provides such mitigation as is necessary to avoid adversely affecting the integrity (within the meaning of the 2017 Regulations) of a relevant site, to the extent that harbour porpoise are a protected feature of that site.</i></p> <p>This provides the commitment that construction cannot commence until the MMO agrees there would be no Adverse Effect on Integrity (AEoI), and therefore allows the Information to Support HRA report to conclude that there would be no AEoI.</p> <p>The SIP has not yet been finalised. Once further information is available on the timeframes of piling and UXO activities, for both Norfolk Boreas and other projects, within the Southern North Sea Special Area of Conservation (SAC) (where this information is available with the required timeframes), the SIP will be finalised. This process is expected to take place in the preconstruction phase of the Project. Developing the SIP during the pre-construction phase will allow for a detailed review and assessment of the most effective mitigation measures, and to take into account the latest scientific evidence to reduce underwater noise impacts. This information will be included within the final SIP. The Applicant will consult with The Wild Life Trusts (TWT) during this process.</p> <p>The level of information provided in the In Principle SIP and the dDCO conditions (Schedules 9 and 10 Part 4 Condition 14(m) and Schedules 11 and 12 Part 4 Condition 9(l)) are consistent with</p>

Summary of Written Representation	Applicant's Response
	<p>the as made East Anglia THREE DCO and that proposed and agreed with the MMO and Natural England for the Norfolk Vanguard dDCO.</p> <p>It should also be noted that the draft Review of Consents (RoC) for the SNS SAC (BEIS 2018) currently endorses the use of Marine Mammal Mitigation Plan (MMMP)s and SIPs, concluding that <i>“the consents under review will not have adverse effects on the integrity of the Southern North Sea SAC either alone or in-combination with other plans or projects. The conclusions are supported by having agreed mitigation measures in place within each projects’ MMMP. Further, a preconstruction Marine Licence condition requiring a Site Integrity Plan (SIP) will ensure that the parameters used in order to undertake this assessment will not be exceeded.”</i></p>
<p>We cannot conclude no adverse effect on the Southern North Sea SAC due to the lack of regulatory mechanism to manage in-combination underwater noise impacts. Defra and the Southern North Sea Regulators Working Group are taking positive steps to develop effective management for in-combination underwater noise impacts and TWT will continue to work closely with all stakeholders on this. However, as management mechanisms are currently not in place, we suggest the Planning Inspectorate and the Secretary of State considers what controls need to be put in place to ensure no adverse effect on the Southern North Sea SAC at this current time.</p>	<p>The responsibility to define the regulatory mechanism to manage in-combination effects in the Southern North Sea SAC lies with the regulator (MMO). At this time, the best method of managing underwater noise effects in the Southern North Sea SAC is with the development of the SIP (document 8.17, APP-708). The SIP for the Project will be further developed in the pre-construction phase, taking into account the latest scientific evidence and Statutory Nature Conservation Body (SNCB) and regulatory advice.</p>
<p>UXO clearance</p> <p>TWT holds the position that to ensure site integrity for the Southern North Sea SAC and Favourable Conservation Status (FCS) of European Protected Species (EPS), UXO clearance should be secured within the draft DCO alongside any mitigation required. East Anglia One North and East Anglia Two have secured a mitigation for UXO clearance within the draft DCO. This has now set a precedent and best practice must be followed.</p>	<p>Impacts associated with the clearance of Unexploded Ordnance (UXO) have been considered in order to provide a conservative assessment. However, UXO clearance is not included within the DCO application. A separate Marine Licence application will be completed pre-construction following the UXO surveys and once the nature and extent of UXO clearance is known. A Marine Mammal Mitigation Protocol for the UXO clearance works will be submitted with the Marine Licence application.</p> <p>The Applicant does not consider that a precedent has been set by East Anglia One North and TWO, only that these projects have taken a different approach.</p> <p>East Anglia One North and Two are in the advantaged position of having a much greater understanding of the extent of UXO clearance that may be required due to the fact that East Anglia ONE, which is located in their vicinity has already undertaken UXO clearance in this area.</p> <p>The Applicant considers that a separate Marine Licence application, based on the UXO clearance requirements is the</p>

Summary of Written Representation	Applicant's Response
	<p>most suitable approach for the Norfolk Boreas project and has also been the approach for several other projects including Norfolk Vanguard, East Anglia THREE and the Doggerbank Creyke Beck projects.</p>
<p>The impact assessment for Norfolk Boreas has shown a major adverse effect for PTS in harbour porpoise from UXO clearance (ES, Table 12.24). This assessment is supported by peer-reviewed evidence. In addition, table 8.11 in the Information to Support the Habitats Regulations Assessment shows that PTS impacts could be up to 14.4km and currently there is little evidence to support the effectiveness of mitigation at this distance. Therefore, the developer will need to provide proven mitigation during the implementation of this activity to ensure no adverse effects from injury impacts.</p>	<p>Appropriate mitigation of underwater noise effects associated with UXO clearance will be determined as part of the licensing of these works (not included in the current DCO application). This will be undertaken once the nature and extent of clearance works are known, following the UXO survey. Developing the MMMP for UXO clearance as a separate Marine Licence application will allow for a detailed review and assessment of the most effective mitigation measures, and to take into account the latest scientific evidence to reduce underwater noise impacts. For example, techniques such as low order deflagration.</p>
<p>As no draft MMMP for UXO clearance has been produced as part of the dDCO, we cannot agree with certainty that there would be no adverse effect from PTS impacts from this activity.</p>	<p>A UXO MMMP would be a condition of the UXO clearance Marine Licence. This is also the approach that has been taken by East Anglia THREE and Norfolk Vanguard. As outlined above, developing the MMMP for UXO clearance as a separate Marine Licence application will allow for a detailed review and assessment of the most effective mitigation measures, and to take into account the latest scientific evidence to reduce underwater noise impacts.</p>
<p>The SIP makes reference to UXO clearance, yet the SIP deemed Marine Licence condition within the draft DCO only makes reference to piling. To secure mitigation for in-combination disturbance effects to ensure no adverse effect on the site, mitigation in relation to UXO clearance must be referenced in the DCO.</p> <p>TWT also refer to Article 6 Habitats Directive Guidance which establishes the obligation to detail the effectiveness of mitigation measures.</p>	<p>As outlined above, a separate Marine Licence application will be completed pre-construction following the UXO surveys and once the nature and extent of UXO clearance is known. At this stage the requirements for any UXO clearance within the SIP can then be determined, taking into account the latest scientific evidence for the most appropriate and effective mitigation, as well as the latest SNCB and regulatory advice.</p>
<p>Underwater noise monitoring</p> <p>TWT have concerns that the commitment to monitor the first four piles will not provide information on noise levels per day or during the lifetime of the construction programme</p>	<p>The IPMP [REP1-029] provides the framework to agree monitoring requirements with the MMO prior to construction. The Applicant would expect the MMO to consult with relevant consultees as required.</p> <p>Section 4.5.2 of the IPMP acknowledges that there may be little purpose or advantage in site specific monitoring and a strategic approach may be more appropriate.</p>

Summary of Written Representation	Applicant's Response
As the current draft MMMP relates to piling only, we are not yet able to comment on marine mammal and noise monitoring approaches for UXO clearance. We highlight that there are gaps in evidence to support the effectiveness of mitigation and advocate that this must be factored into the monitoring plan.	Noted and the evidence gaps existing at the time will be factored into the monitoring plan.
TWT advocates a strategic approach to marine mammal monitoring. We are pleased that the applicant is supportive of this approach. Developers all agree that a strategic approach to monitoring is the most effective approach but consistently highlight that a mechanism for delivery is lacking.	The Applicant acknowledges this position. The Applicant is supportive of strategic initiatives and will continue to work alongside other developers, Regulators and SNCBs.
TWT advocates the introduction of a conditioned underwater noise fund, whereby all offshore wind farm developments should contribute funding and participate in the delivery of strategic monitoring. For further details please see Appendix B of TWT Written representation.	The Applicant notes TWT's proposed underwater noise fund. However, there is currently no mechanism to deliver this strategic mitigation.
Inclusion of fishing in in-combination assessments TWT believe that fishing must be included in all in-combination assessments	The Applicant's response to this position was provided in the Applicant's Comments on Relevant Representations (AS-024).
Post consent engagement with the applicant TWT note the good working relationship with the Applicant and work undertaken thus far to agree a Memorandum of Understanding (MoU). TWT have concerns over the level of consultation that the Applicant would have with them when drafting and finalising documents.	The Applicant is committed to working with TWT to progress the MoU to the benefit of both parties.

1.10 National Grid Electricity Transmission & National Grid Gas REP2-077

Summary of Written Representation	Applicant's Response
National Grid objects to the Authorised Works being in close proximity to their Apparatus in the area. National Grid equally objects to any	The Applicant acknowledges the written representation submitted on behalf of National Grid PLC (NG). The Applicant acknowledges NG's objection

Summary of Written Representation	Applicant's Response
<p>compulsory acquisition powers for land, rights or other related powers being invoked which would affect their Apparatus, or right to access and maintain their apparatus. This is unless and until suitable protective provisions and any necessary related amendments to the DCO have been agreed and included in the Order.</p>	<p>to the authorised works, and that this is to be maintained until suitable protective provisions and any related agreements have been secured. The Applicant continues to work with NG towards an agreed set of protective provisions; the Applicant expects to reach agreement before the end of the examination.</p>
<p>National Grid contends that the proposed Order does not yet contain fully agreed protective provisions expressed to be for the protection of National Grid to National Grid's satisfaction, and that it is essential that such provisions are addressed to its satisfaction to ensure adequate protection for its assets and statutory undertaking.</p>	<p>The Applicant is committed to continue to work with NG towards an agreed set of protective provisions that are satisfactory to both parties. The Applicant is confident that agreement will be reached before the close of the Examination.</p>
<p>National Grid shall continue negotiating to resolve the remaining outstanding issues. Should this not be possible, and attendance at a Compulsory Acquisition Hearing or Issue Specific Hearing is necessary, then National Grid reserves the right to provide further written information in advance in support of any detailed issues remaining in dispute between the parties at that stage.</p>	<p>Noted.</p>

1.11 RSPB REP2-096

Summary of Written Representation	Applicant's Response
<p>The RSPB's primary concerns result from a number of methodological issues about the assessment of various impacts and the implications these have for the overall conclusions on impacts of the Norfolk Boreas proposal. Concerns focus on the following aspects:</p> <ul style="list-style-type: none"> • The impact of collision mortality on the kittiwake population of the Flamborough and Filey Coast SPA in-combination with other plans and projects; • The impact of collision mortality and operational displacement on the gannet population of the Flamborough and Filey Coast SPA alone and in-combination with other plans and projects; • The impact of collision mortality on the lesser black-backed gull population of the Alde-Ore Estuary SPA alone and in-combination with other projects. • The impact of operational displacement on the razorbill population of the Flamborough 	<p>The concerns raised by the RSPB relate primarily to some of the methods used for assessment. As a consequence the RSPB reaches different conclusions compared with those reached by the Applicant. The methodological points raised by the RSPB are summarised in the table below, with the Applicant's responses.</p> <p>In addition, the Applicant has provided an updated assessment at Deadline 2 (REP2-035) which includes consideration of all of the impacts identified by the RSPB and addresses the key methodological points raised. These are highlighted in the rows below and further details are presented in REP2-035.</p>

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<p>and Filey Coast SPA in-combination with other plans and projects;</p> <ul style="list-style-type: none"> • The impact of operational displacement on the guillemot population of the Flamborough and Filey Coast SPA in-combination with other plans and projects; • The impact of all potential effects on the breeding seabird assemblage feature of Flamborough and Filey Coast SPA in combination with other plans and projects • Cumulative collision mortality to North Sea populations of kittiwake and great black-backed gull; and • Cumulative operational displacement to North Sea populations of red-throated diver, guillemot and razorbill. <p>Our key methodological concerns are listed below:</p>	
<ul style="list-style-type: none"> • Approach to apportioning of mortality to SPAs for kittiwake and lesser black-backed gull; 	<p>Apportioning among SPAs during the breeding and nonbreeding seasons has been conducted using available evidence and follows the approaches used for previous offshore wind farm applications (e.g. Norfolk Vanguard and East Anglia THREE). This has included consideration of the RSPB kittiwake tracking data from the Flamborough and Filey Coast SPA and regional population sizes for lesser black-backed gull. The updated ornithology assessment submitted at Deadline 2 (REP2-035) has also presented additional assessment using apportioning estimates for kittiwake of up to 100% in the breeding season (as requested by Natural England). Lesser black-backed gull apportioning to the Alde-Ore Estuary SPA uses the same rates applied in the original assessment (APP-201), of up to 30%, and Natural England has confirmed to the Applicant (AS-029) that this covers the range of values that they advise for this assessment.</p>
<ul style="list-style-type: none"> • Inclusion of unjustified criticisms of kittiwake tracking data; and 	<p>The Applicant's concerns about the kittiwake tracking data (specifically with respect to the potential for the behaviour of tagged birds to be modified for a variety of reasons and the potential that tagged birds are unrepresentative of the population due to the difficulty in catching birds at this site; see APP-201 for more details) were based on the experience of the Applicant's ornithological consultants and reviews of tagging effects on this and similar species. These concerns are therefore not unjustified and should be taken into account when interpreting the tracking data. The Applicant acknowledges that the RSPB has attempted to minimise and test for these potential effects, however for reasons of practicality and worker health and safety (the cliffs at this colony are up to 300m high) sample size is likely to remain low and there is therefore always likely to remain some degree of uncertainty about these issues.</p>

Summary of Written Representation	Applicant's Response
<ul style="list-style-type: none"> Breeding season gannet avoidance rate of 98.9% applied by the Applicant (and advised by the Natural England) compared to 98% suggested by the RSPB. 	<p>The Applicant acknowledges the RSPB's position on gannet collision avoidance rates, but notes that the Statutory Nature Conservation Bodies (SNCBs; including Natural England) do not share this position and recommend the use of an avoidance rate of 98.9%. Recent work has further supported that this is a precautionary rate for this species (e.g. Skov et al. 2018 and Bowgen and Cook 2018). Furthermore, in the most recent study of avoidance rates (Bowgen and Cook 2018) it was recommended that the gannet avoidance rate could be increased to 99.5%. This would reduce predicted collisions at all wind farms by more than 50%, highlighting the precautionary nature of the current project alone and in-combination assessment.</p> <p>The Applicant also notes Natural England's response on this aspect, which was reiterated in their response to WQ 8.10.3 submitted at Deadline 2 (REP2-080) which is repeated below: <i>We acknowledge RSPB's advice regarding this. However, we note that the work underpinning the SNCB advice note (Cook et al. 2014; SNCBs 2014) looked at all the data available and determined that 98.9% across all seasons was the most appropriate advice. We note that there is no empirical evidence to calculate an avoidance rate of 98% for gannet in the breeding season.</i></p> <p>It is therefore clear that Natural England does not agree with the RSPB on this aspect of the assessment.</p>
<ul style="list-style-type: none"> Lack of assessment of breeding seabird assemblage feature of Flamborough and Filey Coast SPA 	<p>The Applicant has included consideration of the potential for an impact on the seabird assemblage feature of the Flamborough and Filey Coast SPA in the updated ornithology assessment submitted at Deadline 2 (REP2-035). The assessment has concluded that there is no risk of an adverse effect on the integrity of this feature for the following reasons:</p> <ol style="list-style-type: none"> Species which are named features of the SPA in their own right (gannet, kittiwake, guillemot and razorbill) have been assessed in full for Norfolk Boreas alone and in-combination with other plans and projects and the Applicant has concluded that there is no risk of adverse effects on any of these species. The remaining species which comprise the seabird assemblage (i.e. not those species named above) are fulmar, herring gull, puffin, cormorant and shag. The risk of likely significant effects for these species has been ruled out due to very low likelihood of connectivity with Norfolk Boreas (herring gull, cormorant and shag), very low risk of impacts (fulmar) and very low abundance (annual mean of

Summary of Written Representation	Applicant's Response
	<p>less than 0.1 individual) on the wind farm as recorded in the baseline surveys (puffin). Further detail on these is presented in the updated ornithology assessment (REP2-035).</p>
<ul style="list-style-type: none"> • Approach to consented capacity versus built-out capacity of other windfarms 	<p>The Applicant welcomes the RSPB's acknowledgement that the principle of incorporating reductions in wind farm impacts which result from design revisions made post-consent is acceptable.</p> <p>The RSPB considers that this should only be applied when these changes have been made in a project's DCO. The RSPB's justification for this, is that this ensures legal certainty that the developer cannot construct more wind turbines. The Applicant acknowledges that an amended DCO is helpful in these cases, however the RSPB's position omits several other practical and legal aspects of wind farm construction which mean that in reality operational wind farms could not be further developed (as is suggested by the RSPB) without a new marine licence and updated ES not least because the original design plan submitted pursuant to the deemed marine licence would need updating and the update would need to be environmentally assessed. The duration and timing of wind farm construction are defined in the DCO and once completed (as is the case for operational wind farms) any further construction work would require a new marine licence and updated ES. Wind turbines generate turbulent air flow in their wake and this dictates the separation distance between turbines. Consequently new turbines would not be installed between existing ones as this would result in elevated mechanical stresses on components and reduced generation. The wind farm order limits could only be extended with a new application. Any turbines installed at a later stage in the life span of a wind farm would be subject to the same date for decommissioning and would therefore represent much lower generation potential during the wind farm's operating period.</p> <p>For these reasons the Applicant considers that cumulative and in-combination assessment should be based on predicted impacts which reflect actual wind farm designs (either built or defined in updated DCOs) rather than those on which the consent was based and which typically predicted impacts up to 40% higher as shown in Appendix 2.</p>

Summary of Written Representation	Applicant's Response
<p>In order to present robust evidence on which a sound assessment can be based, we consider that the Applicant should provide the following updates:</p>	<p>With respect to these specific requirements requested by the RSPB, these are addressed in the rows below.</p>
<ul style="list-style-type: none"> • Use of the standard breeding season in assessment of collision risk for kittiwake, gannet and lesser black-backed gull. 	<p>The original assessment (APP-201 and APP-226) included consideration of both the migration free and full breeding seasons for kittiwake, gannet and lesser black-backed gull, as defined in Furness (2015). This approach has also been followed in the updated ornithology assessment submitted at Deadline 2 (REP2-035). The focus of the updated assessment is on the full breeding season, as requested by both the RSPB and Natural England. However, the Applicant considers this to be precautionary since an unknown, but likely very large, proportion of birds recorded in months at the beginning and end of the breeding season will be migrating to and from a large number of breeding colonies located further north.</p>
<ul style="list-style-type: none"> • Consideration of displacement rates of up to 100% and mortality rates of up to 10% in assessments of displacement for auks and red-throated diver. 	<p>The original assessment (APP-201 and APP-226) included assessment of red-throated diver, guillemot and razorbill displacement impacts applying displacement and mortality rates as advised by Natural England (auks: 30-70% displaced and 1-10% mortality; red-throated diver: 90-100% displaced, 1-10% mortality) and these rates have also been applied in the updated assessment submitted at Deadline 2 (REP2-035). The Applicant notes that these ranges encompass highly precautionary values, in particular the mortality rate of 10%, and has presented evidence reviews for these species which have identified 1% mortality as appropriately precautionary (Appended to REP2-035). Furthermore, Natural England has stated that they agree auk mortality 'is likely to be at the low end of the range' (of 1% to 10%) (RR-099).</p>
<p>The RSPB does not agree that there is sufficient robust evidence available to support conclusions of no adverse effect on the integrity of the Flamborough and Filey Coast SPA or the Alde-Ore Estuary SPA, or to rule out significant effects on North Sea populations of kittiwake, great black-backed gull, red-throated diver, guillemot and razorbill.</p>	<p>While the Applicant does not agree with all the precautionary approaches advocated by Natural England and the RSPB (particularly when these are combined), the updated assessment submitted at Deadline 2 (REP2-035) has presented outputs following the advice provided by Natural England (RR-099). Furthermore, the assessment is based on a considerable amount of evidence, including detailed reviews conducted by the Applicant (e.g. on displacement and mortality rates; appended to REP2-035). Therefore the Applicant disagrees with the RSPB's statement that the assessment does not include sufficient robust evidence to be able to rule out significant effects. The Applicant has derived conclusions using the best available evidence and reached conclusions of no significant impacts for the project alone or cumulatively and of no adverse effects on the integrity of SPAs for the project alone and in-combination with other plans and projects.</p>

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<p>The RSPB recommends that mitigation is provided through raising the turbine draught height for the purposes of reducing the project's collision risk when considered alone, and its contribution to in-combination collision risk. The RSPB therefore requests that collision risk to key species for height rises up to and including 35m are modelled.</p>	<p>Using appropriately precautionary assessment methods, the Applicant has been able to conclude that Norfolk Boreas will not have any significant impacts or adverse effects on SPA integrity due to collisions at the project alone, cumulatively or in-combination with other wind farms. Nonetheless, the Applicant is giving consideration to options for further reducing the risk of collisions and this includes the possibility of raising the turbine draught height to reduce the proportion of bird flights at rotor height. The Applicant will provide further updates to the Examining Authority once options for additional mitigation have been considered further.</p>
<p>The RSPB does 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 reasons for this are outlined in Green et al. (2016) and the reviews by Cook and Robinson (2015) and O'Brien et al. (2017) and are not that density dependence does not exist, but rather that the RSPB does 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. Whilst the RSPB 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. 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.</p>	<p>It is important to state that the results from both density independent and density dependent population models were presented in the assessment (APP-201) and this remained the case in the updated assessment (REP2-035).</p> <p>The Applicant appreciates the RSPB's view that, because estimating density dependence in seabird populations is difficult, it should not be considered in population models. However, as the RSPB also notes, density dependence is known to exist in seabird populations, even if these studies do not necessarily provide specific parameter values for use in population modelling. The Applicant therefore considers it to be appropriate to give consideration to including density dependence in models of seabird populations.</p> <p>Furthermore, one of the key strengths of population modelling is that a range of parameter values can be used as inputs and the effect on the population of varying these rates can be explored with the aim of identifying plausible values. This exploratory analysis was undertaken for the Flamborough and Filey Coast SPA and Alde-Ore Estuary SPA population models. Outputs from a range of simulations using different strengths of density dependence were compared with population trends reported for a large range of seabird species (Cury et al. 2012). Thus, the density dependent models made use of the best available evidence and are considered to provide a robust guide for impact assessment purposes.</p> <p>The RSPB states that density dependent regulation can act in a depensatory manner as well as the compensatory one used in the population models. The Applicant is in agreement that such effects can occur. However, this point is one which is relevant to small populations, typically due to the elevated levels of predation that can occur, or difficulties in</p>

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	<p>adults finding mates. The current assessments do not relate to such small populations and therefore this point is not relevant in the current circumstances.</p> <p>Overall, therefore, the Applicant considers that realistic density dependent models such as those used in the Norfolk Boreas assessment are robust and valid for the purposes of impact assessment.</p> <p>The RSPB also states in their written response that the population models predict there will be decreases in the SPA populations (e.g. of 16% in the Flamborough and Filey Coast SPA kittiwake population; of 40% in the SPA's gannet population; of 43% in the SPA's guillemot and razorbill populations and of 25% in the Alde-Ore Estuary SPA's lesser black-backed gull population). The Applicant considers that these statements appear to be misinterpretations of the population viability analysis (PVA) results. These refer to the counterfactual of population size predictions. This metric is the ratio of the impacted population size to that predicted in the absence of the impact. Thus, this indicates how much smaller the population may be following the imposition of any given magnitude of impact. However, contrary to the RSPB statements, this is not the same as a decrease in the population size, but rather indicates how much smaller the impacted population will be than the non-impacted one. Furthermore, the results referred to by the RSPB were derived from the density independent PVA models. These models permit unlimited population growth which is biologically unrealistic (but preferred by the RSPB and Natural England). Thus, the comparison is between populations which grow exponentially with the consequence that very large differences can occur between the impacted and non-impacted after a simulated growth period of 30 years. The fact that the impacted population is predicted to be, for example, 25% smaller after 30 years, does not mean there will be a 25% decline: both populations may in fact have increased, albeit at different rates.</p> <p>It is for these reasons that the Applicant considers that the counterfactual of population growth rate is a more robust metric for interpreting density independent simulations, and this is the focus of the Applicant's assessment. On this basis the Applicant has reached conclusions of no adverse effects on the integrity of the SPA populations assessed.</p>

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<p>The RSPB does not consider that the great black-backed gull nocturnal activity rate used in the collision risk model should be reduced.</p>	<p>The nocturnal activity rates used to date for most species in the collision risk model are not based on empirical evidence but on expert opinion. More critically still, the original values used were based on a relative scale, comparing how active each species is against others (i.e. a species assigned a value of 50% was considered to be twice as active at night as one assigned 25%). Crucially these scores provided no absolute level of nocturnal activity, however the Band collision model took these percentage values and assigned them as absolute levels of nocturnal activity relative to daytime levels. In this formulation, a species given a nocturnal rate of 50% is considered to be half as active at night as during the day. Use in this manner has absolutely no basis in evidence. All studies to date have indicated that the rates applied in the Band model for all species are over-estimates (Furness et al. 2018; EATL 2015). Therefore it is considered appropriate to present collisions predictions derived using lower rates, and this approach is also supported by Natural England (APP-226).</p>
<p>The RSPB reports that recent kittiwake census data indicates breeding success has declined and suggest that this should be taken into account in the population modelling.</p>	<p>The kittiwake PVA for the Flamborough and Filey Coast SPA used two alternative productivity rates, one based on a wider rate across colonies (0.672 chicks fledged per pair per year) and one derived from the SPA itself for the period 2009 to 2014 (0.847). The outputs from the two rates in the PVA were very similar, and the one which predicted the greater impact was used as the basis for impact assessment (on the basis this was more precautionary). The average SPA productivity rate calculated with the additional data as presented in WR-096 (i.e. for 2015 to 2017) reduces the value from 0.847 to 0.77. This remains higher than the more precautionary value (0.672) on which assessment was based, therefore this update has no effect on the conclusion that collisions at Norfolk Boreas alone or in-combination would not have an adverse effect on the SPA's integrity.</p>
<p>The RSPB states that the apparent resilience of the Sula Sgeir SPA gannet population to the harvesting of up to 2,000 chicks each year should not be taken as an indication that gannet populations are generally robust to human impacts.</p>	<p>The Applicant acknowledges that different gannet populations may experience different demographic rates, as suggested by the RSPB. However, considering that the Sula Sgeir SPA gannet population increased from 9,225 pairs to 11,230 pairs between 2004 and 2013, despite the annual chick harvest, the Applicant still considers that this example provides an indication that gannet populations are relatively robust to both the actual loss of productivity and the associated disturbance. Over the same period the Flamborough and Filey Coast SPA population increased from 3,940 to 11,000. Thus it could be argued that if anything the</p>

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	latter population would be even more robust to additional losses.
<p>The RSPB does not consider that a 4 km buffer for assessing red-throated diver displacement should be considered precautionary.</p>	<p>The Applicant has assessed displacement using a 4km buffer, as advised by Natural England, and proposed by the RSPB, and concluded there would be no significant effects on red-throated diver from displacement at Norfolk Boreas alone or cumulatively.</p> <p>The Applicant acknowledges that, although a recent study has reported displacement distances of up to 16km (Mendel et al. 2019), an evidence review conducted for Norfolk Vanguard (which included consideration of Mendel et al. 2019) reported much shorter displacement distances at UK wind farms and taking all the available evidence, concluded that a buffer of 1.5 km was appropriate (this review is appended to REP2-035). Thus the Applicant still considers that a 4km buffer is precautionary.</p>
<p>The RSPB states that the In-Principle Monitoring Plan proposes that no project level monitoring will be conducted.</p>	<p>The Applicant considers that the RSPB has slightly misinterpreted the Norfolk Boreas In-Principle monitoring Plan (REP1-029). The plan states that: <i>there may be little purpose or advantage in any site specific monitoring for ornithology and therefore a strategic approach may be more appropriate in providing answers to specific questions where significant environmental impacts have been identified at a cumulative/in-combination level.</i></p> <p>Thus, the Applicant has stated that strategic level monitoring may be more valuable for improving understanding of wind farm impacts, however this does not preclude such monitoring being conducted at Norfolk Boreas itself. The Applicant considers that at this stage it is premature to discuss monitoring options in further detail (the requirement for monitoring is detailed under Condition 14(1)(l) of the Generation DMLs, Schedule 9 and 10 of the DCO). However it is anticipated that this will be an area of active discussion between the Applicant, Natural England and the RSPB at the appropriate time.</p>
<p>The RSPB, having considered options to address the predicted impacts, does not consider mitigation measures will be possible to avoid the increased mortality that is predicted by Norfolk Boreas alone and in-combination with other projects. Therefore, we expect the Applicant to provide information to the examination that addresses:</p> <ul style="list-style-type: none"> • No alternative solutions; • Imperative reasons of overriding public interest; <p>and</p>	<p>The Applicant has undertaken a thorough and robust assessment of the potential impacts of Norfolk Boreas on seabirds and concluded that the project will not have a significant effect alone or cumulatively and will not have any adverse effects on the integrity of any SPAs either alone or in-combination with other plans and projects.</p> <p>As a consequence the Applicant considers that there is no requirement for consideration of alternative solutions, imperative reasons of overriding public</p>

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<ul style="list-style-type: none"> • Compensatory measures to protect the overall coherence of the Natura 2000 network. <p>We will review further information on these issues as it is presented and provide more detailed comments.</p> <p>In this context, the RSPB draws the Examiners' attention to BEIS's decisions to delay determination of Hornsea Three and Norfolk Vanguard offshore wind farms. The delay on each scheme is to, among other things, seek the views of the Applicant's and interested parties in respect of the in-combination impacts on the Flamborough to Filey Coast SPA (and in the case of Norfolk Vanguard, also the Alde-Ore Estuary SPA) and the implications of those impacts for the derogation tests set out in the Habitats and Offshore Regulations and summarised in paragraph 3.2.2 above. The RSPB considers such matters are directly relevant to examination of the Norfolk Boreas scheme.</p>	<p>interest (IROPI) and compensatory measures as suggested by the RSPB.</p> <p>Furthermore, in the absence of significant project alone or cumulative impacts and the absence of adverse effects on SPA integrity for the project alone or in-combination with other plans and projects, the Applicant does not consider there to be a requirement for further mitigation. Nonetheless, as a responsible developer, the Applicant is giving detailed consideration to design modification with the aim of achieving reduced impact magnitudes as far as possible (e.g. increases in rotor draught height).</p> <p>It should also be noted that the reasons for BEIS delaying determination of Hornsea Three are different to the reasons to delay determination of Norfolk Vanguard. In the case of the derogation tests, for Norfolk Vanguard, the views of the Applicant are only sought in the alternative to the Applicant's views on mitigation measures to lessen or avoid impacts.</p>
<p>We understand that further assessment may now have been undertaken by the Applicant concerning some of the above matters. The RSPB will consider any further information submitted to the Examination by the Applicant and review our position accordingly. However, on the basis of the information currently before the Examining Authority, it is our view that consent cannot be granted. We reserve the right to review and/or change our position in light of new information being submitted to the Examination.</p>	<p>An updated ornithology assessment was submitted at Deadline 2 (REP2-035). This update addressed all the points raised by Natural England (RR-099) and many of those raised by the RSPB (RR-054; although as noted in this response, the Applicant disagrees with several issues raised by the RSPB, such as use of a 98% avoidance rate for gannet in the breeding season). The Applicant considers that both the original application (APP-201, APP-226) and the updated assessment submitted at Deadline 2 (REP2-035) provide robust evidence in support of the Applicant's conclusions that there will not be any significant impacts due to Norfolk Boreas alone or cumulatively and it can be concluded that there will be no adverse effects on the integrity of any SPAs due to the project alone or in-combination with other plans and projects.</p>

1.12 Whale and Dolphin Conservation REP2-112

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<p>WDC are concerned that despite the lack of scientific evidence, there is reliance on embedded mitigation methods and an assumption that these mitigation methods will ensure no Adverse Effect on Integrity (AEoI) on the SNS SAC harbour porpoise population.</p>	<p>The Southern North Sea Site Integrity Plan (document reference 8.17, APP-708 (SNS SIP) and Marine Mammal Mitigation Protocol (document reference 8.13, APP-704) for piling will be developed in the pre-construction period and based upon best available information and methodologies. Developing the SIP and MMMP in the pre-construction period will allow for a detailed review and assessment of the most effective and appropriate</p>

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<p>The Applicant has used an appropriate methodology to assess the impacts of pile driving on harbour porpoise. However, when possible this has taken into account the embedded mitigation when assessing the potential magnitude of each effect. WDC do not agree with this approach as these embedded mitigation measures are unproven, and this approach will lead to inaccurate and misleading results. Additionally, the Applicant has concluded that through the Marine Mammal Mitigation Protocol (MMMP) for piling, MMMP for UXO and Site Integrity Plan (SIP), impacts will be reduced to within acceptable limits. WDC strongly disagree with this as these documents will be designed closer to construction, at which time the mitigation methods will be decided upon. Currently these plans are little more than a commitment to use mitigation methods, until the details of the plans are decided it is erroneous to conclude that these plans will ensure that impacts from Norfolk Boreas can be mitigated</p>	<p>mitigation methods at that time, including the latest scientific evidence for embedded mitigation methods.</p> <p>The assessments have been conducted on the worst-case scenarios and without mitigation, then where relevant proposed mitigation measures have also been taken into account. This is deemed appropriate, as the proposed mitigation will reduce the potential impacts of pile driving on harbour porpoise.</p> <p>As outlined above, the MMMP for piling and SNS SIP will be developed in the pre-construction period and based upon best available information and methodologies. Developing the MMMP and SIP in the pre-construction period will allow for a detailed review and assessment of the most effective and appropriate mitigation methods at that time, including the latest scientific evidence for embedded mitigation methods.</p> <p>The proposed approach for the MMMP and SIP reflects the commitment of the Applicant to undertake required measures to reduce the potential impacts on harbour porpoise, whilst allowing scope for refinement of the measures through consultation once the final construction methods for the project have been confirmed. This will enable use of the most appropriate project related measures to be confirmed based on best knowledge, evidence and proven available technology at the time of construction.</p> <p>The SIP is secured through the draft DCO [REP1-008], Schedules 9 and 10 Part 4 Condition 14(m) and Schedules 11 and 12 Part 4 Condition 9(l) which state:</p> <p><i>In the event that piled foundations are proposed to be used, the licensed activities, or any phase of those activities must not commence until a Site Integrity plan which accords with the principles set out in the in principle Norfolk Boreas Southern North Sea Special Area of Conservation Site Integrity Plan has been submitted to the MMO and the MMO is satisfied that the plan, provides such mitigation as is necessary to avoid adversely affecting the integrity (within the meaning of the 2017 Regulations) of a relevant site, to the extent that harbour porpoise are a protected feature of that site.</i></p> <p>This provides the commitment that construction cannot commence until the MMO agrees there would be no AEoI, and therefore allows the Information to Support HRA report to conclude that there would be no AEoI.</p> <p>It should also be noted that the draft Review of Consents (RoC) for the SNS SAC (BEIS 2018) currently endorses the use of MMMPs and SIPs, concluding that “the consents under review will not have adverse effects on the integrity of the Southern North Sea SAC either alone or in-combination with other plans or projects. The conclusions</p>

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	<p><i>are supported by having agreed mitigation measures in place within each projects' Marine Mammal Mitigation Plan (MMMP). Further, a preconstruction Marine Licence condition requiring a Site Integrity Plan (SIP) will ensure that the parameters used in order to undertake this assessment will not be exceeded."</i></p>
<p>General Comments</p> <p>WDC recognise that the conclusions drawn are a 'worst case scenario' when assessing the impact on marine mammals, and believe this to be appropriate given the considerable unknowns surrounding the development of the wind farm. But, as they are deemed realistic, they should be treated accordingly. However, the worst case scenarios are based on impacts of pile driving; if alternative foundations are used there will be significantly different impacts on the environment.</p>	<p>This is acknowledged by the Applicant.</p>
<p>Location of Norfolk Boreas Offshore Wind Farm</p> <p>Norfolk Boreas offshore windfarm lies directly within the SNS SAC, in the summer area and adjacent to the summer and winter habitat for harbour porpoises with Norfolk Boreas overlapping the year round area (JNCC, 2017, 2016). WDC concern is that the windfarm construction will impact the SAC both alone and in-combination, with the potential to impact the harbour porpoise population of the site year-round.</p> <p>As an SAC the Southern North Sea is a strictly protected site, designated under the EC Habitats Directive, with a specific Conservation Objective of "<i>To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to maintaining Favourable Conservation Status for the UK harbour porpoise.</i>" (JNCC, 2017).</p> <p>Developing this area is of particular concern to WDC as the noise generated during construction, from pile driving in particular, has the potential to displace cetaceans and particularly harbour porpoises from the site. Studies on the impacts of pile driving suggest that harbour porpoises did not later return to their usual numbers (Brandt <i>et al.</i>, 2011; Carstensen <i>et al.</i>, 2006; Teilmann and</p>	<p>It should be noted that the location of Norfolk Boreas Offshore Wind Farm was determined before the designation of the SNS SAC.</p> <p>To take the designation of the SNS SAC for harbour porpoise into account, assessments were conducted based on the current SNCB advice. In addition to the area based assessments for both the summer and winter areas, assessments were also conducted on the harbour porpoise North Sea Management Unit population. In addition, an assessment in the Information to Support HRA [APP-201] was conducted on the estimated number of harbour porpoise that the SNS SAC site could support.</p> <p>Assessments in the Information to Support HRA accounted for the current Conservation Objectives for the SNS SAC.</p>

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<p>Carstensen, 2012), and it is not clear if the animals are returning to the area, or using it in the same way.</p> <p>The applicant should take into account the draft Conservation Objectives provided in the SAC consultation documents - that the site integrity must be maintained and there is no adverse impact on the population of harbour porpoise at the site. Site based protection cannot be met by assessing the whole North Sea population, but only by assessing the impacts for the number of individuals that are supported by the site (Rees <i>et al.</i>, 2013).</p>	
<p>European Protected Species (EPS)</p> <p>WDC recognise the timeframe within which the industry is required to build in order to meet targets, however, the requirement to understand and mitigate impacts to ensure strict protection of European Protected Species (EPS), including all cetacean species, remains. If pile driving is conducted, an EPS licence will be required.</p>	<p>An EPS licence application, if required, will be submitted post-consent, when the final design and construction methodology of Norfolk Boreas has been determined.</p>
<p>Baseline Survey Methodology</p> <p>WDC recognise that a number of site surveys have been undertaken to understand the use of the area by marine mammals, and provide a baseline upon which to assess the impacts of the development. WDC is pleased to see that two years of site surveys have been undertaken to understand the use of the area by marine mammals, and provide a baseline upon which to assess the impacts of the development. WDC believe that two years is the absolute minimum survey required to provide a reliable baseline data.</p>	<p>The Applicant Acknowledges this and would add that in addition to the survey data for the Norfolk Boreas site, data from other nearby offshore wind farm (OWF) surveys, SCANS and other surveys were also reviewed to provide additional information over a wider timescale.</p>
<p>Aerial Surveys</p> <p>WDC agrees that high definition aerial surveys are suitable for surveying for marine mammals, and are pleased to see that the methodology used is suitable for collecting marine mammal data.</p> <p>Our only concern regarding the aerial surveys is that only a buffer of 4 km around Norfolk Boreas was used when undertaking the surveys, we feel this is inadequate to assess the numbers of marine mammals that could be impacted by the development, given the distances at which construction noises can disturb porpoises, these distances are</p>	<p>The Applicant acknowledges this position.</p> <p>The aerial survey methodology with 4km buffer was agreed with Natural England and Expert Topic Group (ETG) as part of the EPP for Norfolk Boreas and Norfolk Vanguard prior to the surveys commencing. This follows a standard procedure for most OWFs.</p> <p>The extent of the area allowed the transects covering the Norfolk Boreas site and buffer zone to be conducted in a single day. The advantages of this is that there was less change for double counting a single individual, the survey was more likely to have consistent whether conditions and there was enough flexibility to make use of the best conditions to ensure that all the required surveys can be completed in good conditions to provide an accurate</p>

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<p>highlighted in the 'potential impacts' section below.</p> <p>Additionally we are pleased to see that all images were analysed, the methodology used and that marine mammals were identified to species level where possible as analysing the complete is only way to provide a reliable baseline for the assessment.</p>	<p>data set. Had the area been any larger it would not have been possible to complete the surveys in a single day.</p>
<p>Additional data sources on marine mammals</p> <p>WDC are pleased to see the inclusion of other data sources detailed in section 12.5.2. Chapter 12 Norfolk Boreas Offshore Wind Farm Environmental Statement, particularly the use of the aerial surveys for the former East Anglia Zone. The data from these surveys are useful for providing reliable baseline for Norfolk Boreas and surrounding area, however the surveys were completed in 2011, and we are concerned that there is a significantly large gap of seven years where no recent data outside the 4km buffer of the recent aerial surveys has been collected.</p> <p>We are also concerned that the other datasets are not recent, are ad-hoc data and that are not dedicated marine mammal surveys and some only cover small parts of the Norfolk Boreas area, if at all. Whilst useful information they cannot be relied upon to provide a reliable baseline or plug gaps in knowledge.</p> <p>We are pleased to see that SCANS data, including the recent SCANS III data has been included to assist with assessing marine mammal populations, and potential impacts on marine mammals. However, the SCANS surveys are only one seasonal snapshot in time, with a 10 year gap between datasets. It is not therefore appropriate to be used for estimates of density and finer-scale information is required where such data are not available (Green et al., 2012).</p> <p>Data from East Anglia ONE surveys has been included; we are concerned by the use of this data as the methodology that was used for the boat-based surveys was designed for ornithology surveys, not for marine mammals. Marine mammal surveys that are developed as an add-on to boat-based bird surveys are inadequately designed monitoring programmes that cannot provide a sufficient baseline to characterise the environment. Harbour</p>	<p>All currently publicly available data including recent surveys undertaken at other OWF sites, for example, Norfolk Vanguard, East Anglia ONE North and East Anglia TWO was included.</p> <p>The SCANS-III data has been used to provide context for the wider area. Along with other data sources including the Joint Cetacean Protocol (JCP) data and seasonal maps produced by Gilles <i>et al.</i> (2016),</p> <p>It should be noted that the East Anglia ONE surveys were referred to, along with numerous other data sources, to provide background information on marine mammal species in the area and the data was not used in the assessments.</p> <p>Assessments were based on the worst-case (highest) density estimates currently available for the area.</p>

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<p>porpoise can potentially spend a significant amount of time underwater asleep, in periods of up to 24 minutes (Wright et al., 2017). These dives are often devoid of any vocalisation, and therefore are undetectable to passive acoustic monitoring (PAM), resulting in any environmental impact assessment underestimating the potential impacts on cetaceans (Wright et al., 2017).</p>	
<p>Pile Driving</p> <p>WDC note that the foundation type has yet to be finalised, and are pleased to see that various foundation types are being considered for Norfolk Boreas. However, we are concerned to see that foundations requiring piling are included; there needs to be a move away from foundations requiring pile driving to reduce noise pollution in the marine environment. Pile driving, even with the use of pin piles, has the potential to cause physical harm, as well as displacement, particularly to harbour porpoises. We strongly recommend that monopile, or pin pile, foundations are not used due to the noise levels generated by pile driving and the location of Norfolk Boreas within the SNS SAC.</p>	<p>Piling has been assessed as worst-case, but other foundation options are being considered. The requirement for pile driving will be based on the several factors, such as underlying ground conditions and the safest way to successfully install and operate the turbines.</p>
<p>Noise levels during construction remain a key marine mammal concern due to pile driving of foundations. We recognise that worse case scenarios have been used when modelling the noise impact on marine mammals from pile driving and believe this to be appropriate given the considerable unknowns surrounding the development of the wind farm. However we would like to see consideration of the full range of potential impacts from other foundations being assessed as many will still involve piling activity and will have different potential impacts i.e. gravity foundations will create less noise, however they could have a much larger impact on the benthic fauna including sandeels, a main prey species for harbour porpoises and northern minke whales (<i>Balaenoptera acutorostrata</i>).</p>	<p>The worst-case scenario for benthic and fish ecology have been assessed in the relevant chapters of the ES [APP-223 and APP-224 respectively], including the potential impacts of gravity based foundations. The potential assessment of any changes to prey availability for marine mammals has taken into account these worst-case scenarios, including underwater noise from pile driving.</p>
<p>Reactions of harbour porpoises to the pile driving process have been recorded at distances many kilometres from the piling location (Brandt et al., 2018, 2011; Carstensen et al., 2006; Dähne et al., 2013; Thomsen et al., 2006). Research has shown the noise generated</p>	<p>The assessments for the potential disturbance and possible behavioural response in harbour porpoise was based on the currently advised thresholds and criteria for underwater noise modelling, as well as the SNCB recommended 26km EDR. In addition, a review of all</p>

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<p>by the construction of offshore wind farms was loud enough to be audible by harbour porpoises beyond 80 km from the source and could mask communication at 30 – 40 km (Thomsen et al., 2006).</p> <p>Bottlenose dolphins (<i>Tursiops truncatus</i>) could exhibit behavioural responses at distances of up to 40 km from pile driving locations (Bailey et al., 2010).</p>	<p>relevant publications was conducted to put the assessment into context.</p> <p>There is no evidence that bottlenose dolphin would be present in the area of the Norfolk Boreas site, however, the MMMP and SIP although aimed primarily at harbour porpoise would provide mitigation for other cetaceans and EPS.</p>
<p>The research conducted so far has shown the potential for pile driving to cause behavioural changes in harbour porpoises which leave the area during construction and in some instances did not later return to their usual numbers (Brandt et al., 2011; Carstensen et al., 2006; Teilmann and Carstensen, 2012). Some studies have shown harbour porpoise start to return in one area, yet years later have not returned to other areas (Snyder and Kaiser, 2009). The longest running study into the effects of windfarms on harbour porpoises shows that ten years later, the population has only recovered to 29% of the baseline level (Teilmann and Carstensen, 2012). Even where areas have been recolonised, it is not clear if these are the same animals returning or new animals moving into the area, or if the animals are using the area in the same way.</p>	<p>Vattenfall has been heavily involved in the development of DEPONS (Disturbance Effects of Noise on the Harbour Porpoise Population in the North Sea), which used at a strategic level would allow consideration of the biological fitness consequences of disturbance from underwater noise, and the conclusions of a quantitative assessment to be put into a population level context.</p>
<p>Currently there are limited studies to demonstrate the potential impacts of pile driving on other cetacean species; however minke whales are vulnerable to the impacts of intense noise pollution. There was a significant decrease in northern minke whale sightings rates in western Scotland during periods of naval exercises (Parsons et al., 2000). From recordings taken during pile driving in the Moray Firth, (Bailey et al., 2010) suggested that northern minke whales, and other mid- and low-frequency hearing cetaceans, may exhibit behavioural disturbance up to 50 km away from the source.</p>	<p>The marine mammal species included in the assessments were agreed through the EPP as reflected in the SoCGs with: Natural England [AS-028]; the Wildlife Trusts [REP2-057] and Whale and Dolphin Conservation [REP2-048].</p> <p>All available data and information for other cetacean species was considered in determining the species that could be impacted.</p> <p>As outlined above, the MMMP and SIP, although aimed primarily at harbour porpoise, would provide mitigation for other cetacean species.</p>
<p>WDC note that the maximum construction period would be 18 months for a single phase or 9 months per phase for two phase option with the potential of the two phases being conducted consecutively, with the potential of two vessels piling at one time in either scenario. This means the worse-case scenario could be 18 months of piling activity. Whilst we</p>	<p>The assessments have been undertaken based on the worst-case scenarios as defined within the ES [APP-225] and HRA [APP-201].</p>

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<p>recognise that there will potentially be breaks in piling activity due to weather, between phases etc., this is a realistic worst-case scenario and therefore the impacts of this should be considered as such.</p>	
<p>Harbour porpoises would be excluded from the site for the duration of the pile-driving phase(s). The construction of Norfolk Boreas has the potential to have a very high impact on the harbour porpoise, in particular the population supported by the SNS SAC. Harbour porpoise are reported to live up to 23 years, but rarely live over 12 years of age. They reach sexual maturity at 3-4 years and calving occurs every 2 years; therefore the potential impact of pile-driving from either scenarios on the harbour porpoise population is high, and potentially affecting breeding and feeding activity.</p> <p>Harbour porpoise use echolocation to detect their prey, and due to a high metabolism they need to feed continuously to meet energy needs, therefore they are highly sensitive to disturbance (Wisniewska et al., 2018b, 2016). Loud noises, such as pile driving, can cause harbour porpoise to be displaced (Dähne et al., 2013) from potential important feeding grounds. Additionally harbour porpoise can lose 4% of their body weight in just 24 hours from starvation (Kastelein, 2018). Prolonged disturbance and restricted access to feeding grounds has the potential to pose a risk to life for individuals and as a result an impact on the harbour porpoise population. Given the importance of the Norfolk Boreas area and the SNS SAC for harbour porpoise, most likely as prime foraging areas, displacement from the area could be very significant.</p> <p>Although it is likely that pile driving activity will not be constant, the installation of monopile foundations has been found to have a profound negative effect on harbour porpoise acoustic activity up to 72 hours after pile driving activity (Brandt et al., 2011). It is unlikely that harbour porpoises will return to an area during these gaps, resulting in them most likely being excluded from the area for the entire duration of construction.</p>	<p>As outlined above, Vattenfall has been heavily involved in the development of DEPONS (Disturbance Effects of Noise on the Harbour Porpoise Population in the North Sea), which used at a strategic level would allow consideration of the biological fitness consequences of disturbance from underwater noise, and the conclusions of a quantitative assessment to be put into a population level context.</p> <p>Nabe-Nielsen <i>et al.</i> (2018) developed the DEPONS model to stimulate individual animal's movements, energetics and survival for assessing population consequences of sub-lethal behavioural effects. The model was used to assess the impact of offshore windfarm construction noise on the North Sea harbour porpoise population, based on the acoustic monitoring of harbour porpoise during construction of the Dutch Gemini offshore windfarm. Local population densities around the Gemini windfarm recovered 2–6 hours after piling, similar recovery rates were obtained in the model. The model indicated that, assuming noise influenced porpoise movements as observed at the Gemini windfarm, the North Sea harbour porpoise population was not affected by construction of 65 wind farms, as required to meet the EU renewable energy target (Nabe-Nielsen <i>et al.</i> 2018).</p> <p>The DEPONS model determined that at the North Sea scale, population dynamics were indistinguishable from those in the noise-free baseline scenario when porpoises reacted to noise up to 8.9km from the construction sites, as at the Gemini windfarm. Underwater noise from offshore windfarm construction noise only influenced population dynamics in the North Sea when simulated animals were assumed to respond at distances exceeding 20–50km from the windfarms. Indicating that in these scenarios, the population effect of noise was more strongly related to the distance at which animals reacted to noise (Nabe-Nielsen <i>et al.</i> 2018).</p>
<p>WDC note that there could be two vessels driving piles at any one time, and that pile-</p>	<p>The cumulative impact assessment takes into account the potential for concurrent piling at each of the OWF sites.</p>

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<p>driving will start at one site, and then continue at another (which may be adjacent to the pile already being driven or in another area of the wind farm). We are concerned that the cumulative impact assessment does not include pile driving commencing at a second location, whilst the first is still being driven. The impact of the second pile driving location on cetaceans is highly dependent upon the location of the second pile-driving site which is likely to have a different potential area of impact to the first.</p> <p>In addition, having a second pile-driving location will increase the noise levels generated and have a cumulative impact. We recommend that the same consideration is given to marine mammals when the second pile-driving occurs as is given to the first and that it is not assumed that animals have moved out of the area as pile driving has already commenced elsewhere.</p>	<p>However, it is highly unlikely that five offshore wind farms could be concurrently piling at exactly the same time. Therefore, this is reflected in the impact significance.</p>
<p>WDC are pleased to see that National Oceanic and Atmospheric Administration (NOAA) guidance (National Marine Fisheries Service (NMFS), 2018) has been used to model underwater noise levels from the construction of Norfolk Boreas, we agree this is the most appropriate and reliable model currently available. Additionally we are pleased that alongside permanent threshold shift (PTS), temporary threshold shift (TTS) has been included as the impacts can be just as significant as those from PTS. Although the recovery time from TTS varies widely and is dependent on the length of exposure and the level of exposure (Kastelein et al., 2012; Lucke et al., 2009), with a potential construction window of 18 months, TTS could significantly impact harbour porpoise population (both stand-alone and cumulatively), in particular on feeding behaviour. Also multiple displacement (such as from multiple construction phases) can lead to higher stress levels and a potential for hearing impairment (Dähne et al., 2013; Forney et al., 2017) and impacts on survival and reproduction (Forney et al., 2017).</p>	<p>The Applicant acknowledges WDC's position and the studies referenced.</p>
<p>When assessing the magnitude of effects on the harbour porpoise population, we notice that the results take into account the embedded noise mitigation measures, and conclude that with the use of MMMP for piling, MMMP for UXO and the SIP, that the</p>	<p>As outlined above, the assessments have initially been conducted using the worst-case scenarios and without mitigation. Following this assessment, where relevant, proposed mitigation have also been taken into account. This is deemed appropriate, as the proposed mitigation will reduce the potential impacts on harbour porpoise.</p>

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<p>magnitude will be reduced to negligible. WDC strongly disagrees with this approach, particularly for the cumulative assessment which includes soft-start and ramp-up. Including unproven mitigation measures (see the mitigation measures section below) will result in inaccurate and misleading results which will under-represent the realistic impacts of the piling. As a result we cannot agree with conclusion of magnitude from disturbance from piling activities.</p>	
<p>Due to the sensitivity of harbour porpoises to noise disturbance, the location of Norfolk Boreas within the SNS SAC and that alternative foundations are available that have significantly less noise impact, we strongly recommend that foundations requiring piling are removed as an option for Norfolk Boreas.</p>	<p>As outlined above, piling has been assessed as worst-case, but other foundation options are being considered. The requirement for pile driving will be based on the several factors, such as underlying ground conditions and the safest way to successfully install and operate the turbines.</p>
<p>Prey availability</p> <p>WDC have considerable concerns about prey impacts resulting from the development, particularly on sandeels, mackerel, whiting and sprat – all of which are major prey species for the harbour porpoise and are in the Norfolk Boreas area. Any development has the potential to change the prey availability and it is uncertain if marine mammals would be able to adapt to any changes. As harbour porpoise need to feed almost continuously (Wisniewska et al., 2018a, 2016), small changes to their ability to forage, and their prey availability has the potential to have a significant impact (Kastelein, 2018).</p>	<p>As described above the worst-case scenario for benthic and fish ecology have been assessed in the relevant chapters of the ES [APP-223 and APP-224 respectively], The potential assessment of any changes to prey availability for marine mammals has taken into account these worst-case scenarios, including underwater noise from pile driving.</p> <p>The cumulative and in-combination assessments, accounted for the potential changes in prey based on the worst-case scenarios.</p>
<p>Operational noise</p> <p>Whilst it is anticipated that operational noise levels will be much lower than construction noise, there are limited data available on operational noise impacts on marine mammals, so a long-term monitoring plan should incorporate operational noise impacts on cetaceans if the development goes ahead, that covers the life span of the development.</p>	<p>Assessments of the potential impacts of operational noise have been based on the worst-case scenarios and currently available information.</p> <p>The IPMP [REP1-029] provides the framework to agree monitoring requirements.</p>
<p>Vessel noise</p> <p>WDC is concerned about the impacts of increased vessel activity throughout the life of the development, but particularly during construction and decommissioning. Increased vessel noise can interrupt harbour porpoise foraging behaviour and echolocation, which</p>	<p>Assessments on the potential impacts of vessels have been based on the worst-case scenarios.</p> <p>Where possible, all vessel movements will be kept to the minimum number that is required to reduce any potential collision risk. Additionally, vessel operators will</p>

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<p>can lead to significantly fewer prey capture attempts (Wisniewska et al., 2018b). There is an increased risk of collision and disturbance to cetaceans from increased vessel activity (Dyndo et al., 2015; James, 2013).</p>	<p>use good practice to reduce any risk of collisions with marine mammals.</p>
<p>Cumulative Impact Assessment</p> <p>The purpose of the Cumulative Impact Assessment (CIA) is to try and assess the effects of the development on the population of cetaceans in the area; therefore all projects that have the potential to impact that population must be considered. WDC is pleased to note the applicant has included a number of offshore industries in this assessment (as detailed in 12.4.2 of Chapter 12 Marine Mammals and Appendix 12.3 Marine Mammal CIA Screening), and that activities, including those across boundaries with the potential to disturb the harbour porpoise SAC population have been included.</p>	<p>The Applicant Acknowledges WDCs position.</p>
<p>WDC are pleased to see that activities other than development of offshore wind farms have been considered; increased vessel activity during construction of Norfolk Boreas in particular, have not been included. We recommend that vessel activity is included in the in-combination assessment as increased vessel noise can interrupt harbour porpoise foraging behaviour and echolocation, which can lead to significantly fewer prey capture attempts (Wisniewska et al., 2018b). This has the potential to be a significant impact due to the potential duration of the construction period and the location of Norfolk Boreas in both summer and year round areas of the SNS SAC. Additionally we do not agree with the Applicant that harbour porpoises will be “habituated to the presence of vessels and therefore be expected to be able to detect and avoid construction vessels” as there is no evidence to base this assumption on, this should not be presumed particularly in the SNS SAC where harbour porpoises will be feeding and potentially breeding.</p>	<p>The underwater noise from vessels during construction has been included in the CIA as part of the ‘construction, other than piling’ assessment and underwater noise from vessels during OWF operation and maintenance has been included in the CIA as part of the ‘OWF operation and maintenance’ assessment.</p>
<p>WDC are also concerned that the CIA does not consider the impact of pile driving at two locations during construction of Norfolk Boreas. Having a second pile-driving location will increase the noise levels generated in the area and have a cumulative impact, and the severity</p>	<p>The CIA includes single and concurrent piling at the Offshore wind farm sites. However, the conclusions of the assessments have been based on the realistic assessment of the five UK OWFs single piling, which would allow for some of these sites not to be piling at the</p>

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<p>of the impact will depend on the location of the two piling locations.</p>	<p>same time while others, including Norfolk Boreas, could be concurrent piling.</p>
<p>WDC does not agree with the conclusion of the CIA that impacts will only be of minor significance for harbour porpoise, particularly as this conclusion is based on the use of embedded mitigation measures, and a Site Integrity Plan (SIP) for the SNS SAC. See SIP section below for comments on this plan. Additionally a robust monitoring programme should be a requirement of consent to ground-truth any assessment conclusions.</p>	<p>The approach used in the CIA presents a range for the worst-case scenarios based on concurrent and single piling. The assessment also demonstrates that with scheduling that no AEoI would be possible, which will be considered further in the SIP.</p> <p>The IPMP [REP1-029] provides the framework to agree monitoring requirements.</p>
<p>Mitigation Methods</p> <p>WDC notes that the JNCC guidance for minimising the risk of injury to marine mammals from piling noise (JNCC, 2010) have been detailed in the ES. We recognise that currently these are the only guidelines available to developers to use to minimise the impacts of piling activity on marine mammals, however it is widely known that these guidelines are outdated, and do not use the latest scientific evidence.</p> <p>The in-situ methods in the JNCC guidelines have been widely criticised as arbitrary and with a lack of supportive evidence (Wright and Cosentino, 2015). Additionally the guidelines have not been updated for a number of years and therefore do not include the latest and increasing body scientific data of the impacts of noise on marine mammals (Wright and Cosentino, 2015).</p> <p>WDC, in particular, have concerns over the guidance that soft-starts should be used and the use of Marine Mammal Observers (MMOs). WDC do not consider 'soft-start' to be an adequate mitigation measure as they are only a reduction in sound source at the initiation of a piling event. It cannot be assumed that cetaceans will leave an area during a soft-start as they may be remain the area due to prey availability or breeding despite the harmful noise levels (Faulkner et al., 2018). Whilst a common sense measure, soft-starts are not a proven mitigation technique and so cannot be relied upon to mitigate impacts, especially for developments in close proximity to important and critical habitat areas.</p> <p>WDC also have serious concerns regarding the JNCC protocol for using marine mammal</p>	<p>As outlined above, the MMMP for piling will be developed in the pre-construction period and will be based upon best available information and methodologies. Developing the MMMP in the pre-construction period will allow for a detailed review and assessment of the most effective and appropriate mitigation methods at that time, including the latest scientific evidence for embedded mitigation methods.</p> <p>Reference to the JNCC guidance (JNCC, 2010), was provided for context as it is currently the latest SNCB guidance, however, the MMMP will detail the appropriate mitigation measures to reduce the risk of any physical or permanent auditory injury (PTS) to marine mammals, based on the maximum potential PTS impact range.</p>

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<p>observers (MMOs) and PAM operators to ensure that no marine mammals are within 500m of a pile driving site before commencing pile-driving. The use of MMOs and passive acoustic monitoring (PAM) to detect animals is a monitoring measure, not a mitigation measure.</p>	
<p>WDC are concerned that acoustic deterrent devices (ADDs) such as pingers may be used to move marine mammals out of the area. Not only will this add another source of noise into the environment (Faulkner et al., 2018), the use of ADDs has not been proven as a mitigation for pile driving and cannot be relied upon for the range of species likely to be encountered in the wind farm region. The range of displacement from ADDs has the potential to exceed the range of displacement from pile driving itself when using bubble curtains (Dähne et al., 2017).</p> <p>Furthermore, the short and long-term impacts of ADDs on marine mammals need to be thoroughly considered.</p>	<p>The potential disturbance from the proposed use of ADDs has been assessed.</p> <p>The use of ADDs is provided as an example of possible mitigation, but as outlined above all effective and appropriate mitigation methods will be reviewed during the development of the MMMP.</p>
<p>WDC has concerns with the SNCB guidance on noise management within mobile species marine protected areas (MPAs), and WDC views and recommendation with their document appended to their Written Representation [REP2-112].</p>	<p>The Applicant acknowledges this submission.</p>
<p>A number of mitigation methods to reduce noise from piling activities have been proven in demonstration scale trial studies (AdBm Corp, 2014; Diederichs et al., 2013; Wilke et al., 2012). Studies at full scale offshore wind farms have shown that the use of bubble curtains during pile driving activities can reduce the disturbance area on harbour porpoises from ~15 km to ~5 km compared to piling with no mitigation, totalling ~90% reduction in harbour porpoise disturbance area (Nehls et al., 2016).</p> <p>Other studies have shown a smaller, but still significant reduction in noise levels and disturbance area, bubble curtains can reduce the range at which pile driving can be heard by harbour porpoises (Brandt et al., 2018) and may reduce temporary habitat loss and risk of hearing loss in harbour porpoises (Dähne et al., 2017). Harbour porpoise detections at 10-15 km from a piling location declined by around 50% without a bubble curtain, but with this</p>	<p>As outlined above, the SIP and MMMP for piling will be developed in the pre-construction period and based upon best available information and methodologies. Developing the SIP and MMMP in the pre-construction period will allow for a detailed review and assessment of the most effective and appropriate mitigation methods at that time, including the latest scientific evidence.</p> <p>The Applicant is committed to using effective, proven and appropriate mitigation methods based on the latest scientific evidence.</p>

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<p>mitigation in place there was only a 17% decline (Brandt et al., 2018). When this is extrapolated to the potential 180 piling locations for Norfolk Boreas, these mitigation methods could provide a significant reduction in the impact of piling on harbour porpoise in particular.</p> <p>WDC strongly recommend that only mitigation methods that are proven should be considered.</p>	
<p>Mitigation and the Southern North Sea SAC</p> <p>Studies have shown that in areas of high site fidelity, traditional mitigation methods that attempt to minimise injury by moving animals out of an area as noise levels are gradually increased, can be counterproductive for small, localised marine mammal populations for which displacement may cause harm. This is a particular concern in breeding and feeding areas (Forney et al., 2017).</p> <p>A study analysing benefits of noise reduction to harbour porpoise during offshore wind construction found that if wind farms inside the Southern North Sea SAC reduced their noise levels by the equivalent of around 8dB, the risk of a 1% annual decline in the North Sea porpoise population can be reduced by up to 66% (WWF, 2016). As bubble curtains have the potential to reduce noise levels by 7dB (Brandt et al., 2018) using these proven mitigation methods is the only way to reduce the far reaching avoidance distances for cetaceans.</p> <p>Whilst a 7dB noise reduction at 750 m may seem a limited area, this reduction could also be enough to change the noise levels from piling activities from 'lethal' down to 'disturbance levels'. This could be very important, especially when extrapolated for hundreds of piling events.</p>	
<p>Marine Mammal Mitigation Protocol (MMMP)</p> <p>WDC are pleased to see a commitment to a MMMP. We recognise that the MMMP will be designed closer to construction, once all details and plans are known, and that mitigation methods to be used will be decided at that time. We believe this to be appropriate as this enables the latest proven mitigation methods to be included in the MMMP.</p> <p>However, until the details of the MMP are decided it is inaccurate to conclude that the</p>	<p>As outlined above, the MMMP for piling will be developed in the pre-construction period and based upon best available information and methodologies. Developing the MMMP in the pre-construction period will allow for a detailed review and assessment of the most effective and appropriate mitigation methods at that time, including the latest scientific evidence.</p> <p>As outlined above, reference to the JNCC guidance (JNCC, 2010), was provided for context as it is currently the latest SNCB guidance, however, the MMMP will detail the appropriate mitigation measures to reduce the risk of</p>

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<p>MMMP will ensure that impacts are adequately mitigated. We are concerned that the MMMP currently only includes mitigation methods from the JNCC guidelines, and claims that this will mitigate any auditory or physical injury. WDC strongly disagrees with this conclusion, and would like to see a commitment to ensure that only proven mitigation methods are included in the MMMP.</p> <p>Currently there is no modelling of noise mitigation methods. As methods such as bubble curtains show a potential significant reduction in the impacts of noise on harbour porpoise, it is recommend that modelling the effect of this technology is undertaken (Faulkner et al., 2018) in particular to assess cumulative impacts.</p> <p>We recommend that the MMMP should include marine mammal observers (MMOs) and passive acoustic monitoring (PAM) used in conjunction at all times, and shut-down when marine mammals approach within a specified distance of operations (mitigation zone).</p> <p>WDC request to be involved in the consultation of the MMMP to ensure that is sufficient as we have concerns regarding effectiveness of some mitigation methods.</p>	<p>any physical or permanent auditory injury (PTS) to marine mammals, based on the maximum potential PTS impact range.</p> <p>The Applicant is committed to using effective, proven and appropriate mitigation methods based on the latest scientific evidence.</p> <p>Once the mitigation methods have been determined, noise modelling, if required and appropriate, will be conducted.</p> <p>As part of the SIP, where possible and if known, the proposed mitigation measures for other OWFs will be taken into account.</p> <p>The draft MMMP currently considers the option for using MMOs and PAM.</p> <p>As outlined above, the MMMP will include the most effective and appropriate mitigation methods.</p> <p>The Applicant is keen to continue the good relationship with WDC post-consent and during the development of the MMMP and SIP</p>
<p>Site Integrity Plan (SIP)</p> <p>WDC welcome the inclusion of the Site Integrity Plan (SIP), and the opportunity to comment on it through the EWG. We appreciate the commitment Norfolk Boreas is making to the implementation of mitigation to ensure no Adverse Effect on Integrity (AEoI) on the SNS SAC during the construction of Norfolk Boreas offshore wind farm. We recognise that there is a lack of detail on the final project design, which makes it difficult to determine the type of mitigation required. However, there is still a large degree of uncertainty on if the use of the SIP can conclude no adverse effect on site integrity beyond scientific doubt.</p> <p>We acknowledge that there is a lack of guidance from SNCBs on what to include in a SIP, however we are concerned that the SIP for Norfolk Boreas does not contain a commitment to proven mitigation methods or an assessment of the effectiveness of proposed mitigation methods. Currently the SIP is little more than a commitment to use mitigation methods and</p>	<p>See responses above for information regarding the use of the MMMP and the SIP and the mitigation.</p>

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<p>therefore cannot remove all reasonable scientific doubt as to the effects of the project on the SNS SAC, therefore it cannot be relied upon to ensure no AEoI and it is inaccurate to conclude that due to the SIP any impacts from Norfolk Boreas will result in negligible impacts on marine mammals.</p> <p>WDC recommend that the SIP should include a commitment to using proven mitigation methods alongside modelling the effectiveness of proposed mitigation measures, supported with case studies on how these measures reduce noise disturbance on marine mammals. The SIP should also include a commitment to ground-truthing the effectiveness of these mitigation measures.</p> <p>WDC request to be involved in the consultation of the SIP to ensure that is sufficient to ensure no AEoI on the SNS SAC.</p>	
<p>Habitats Regulations Assessment (HRA)</p> <p>With Norfolk Boreas located within the SNS SAC, the wind farm construction will impact the SNS SAC both alone and in-combination. Therefore there an assessment must be undertaken not only against the North Sea management unit, but also for the harbour porpoise population supported by the SNS SAC to ensure there is no Adverse Effect on Integrity (AEoI) from the development.</p> <p>One of our main concerns is that the assessment on the harbour porpoise population in the SNS SAC is not being based upon the population of the site, but against the North Sea Management Unit. The HRA must take into account the draft Conservation Objectives provided in the SNS consultation documents - that the site integrity must be maintained and there is no adverse impact on the population of harbour porpoise at the site (JNCC, 2016). Site based protection cannot be met by assessing the whole North Sea population, but only by assessing the impacts for the number of individuals that are supported by the site (Rees et al., 2013).</p> <p>WDC acknowledges that the advice from the SNCB's, and within the SNS Site Selection Document, is "because this estimate is from a one-month survey in a single year it cannot be considered as a specific population number for the site. It is therefore not appropriate to use</p>	<p>Assessments were conducted based on the current SNCB advice. In addition to the area based assessments for both the summer and winter areas, assessments were also conducted on the harbour porpoise North Sea Management Unit population and additional assessment for the Information to Support HRA [APP-201] on the estimated number of harbour porpoise that the SNS SAC site could support.</p> <p>Assessments in the Information to Support HRA took into account the Conservation Objectives for the SNS SAC.</p> <p>As outlined above, the Applicant is committed to using effective, proven and appropriate mitigation methods based on the latest scientific evidence.</p> <p>As outlined above, the SIP will set out the approach to deliver any project mitigation or management measures in relation to the SNS SAC, including in-combination effects, to ensure there is no AEoI.</p>

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<p>site population estimates in any assessments of effects of plans or projects (i.e. Habitats regulation Assessments), as these need to take into consideration population estimates at the MU level, to account for daily and seasonal movements of the animals” (JNCC, 2017). WDC strongly disagree with this advice, and have raised this issue previously. The European Commission guidance on managing Natura 2000 sites also states that the integrity of the site (habitat and species) must be maintained (European Commission and Office for Official Publications of the European Communities, 2000).</p> <p>As agreed at the ETG, we are pleased to see the inclusion of Appendix 12.4 Additional Assessment in relation to the Southern North Sea Special Area of Conservation (SAC). Our comments on this assessment are below.</p> <p>WDC cannot agree with the conclusion of the HRA that there will be no likely significant effect/ adverse effect from in-combination. Although we are pleased to see commitment to mitigation measures, without saying which mitigation measures will be used we cannot agree with this conclusion. We acknowledge that Vattenfall are committed to using the latest mitigation measures and that these technologies changes as new technologies are likely to emerge closer to the construction window, however without knowing which methods will be used, or if these mitigation methods are proven it is misleading to conclude that there will be no likely significant effect/ adverse effect as there is no scientific evidence to back up this claim.</p> <p>Whilst WDC agree with the list of potential effects considered in the Information for the Habitats Regulations Assessment, Document Reference: 5.3. We are concerned that embedded mitigation measures have been taken into account when assess the potential, magnitude of effect. We strongly disagree with this approach, as outlined in the Mitigation Measures section above these methods lack evidence to support their effectiveness and this approach will produce inaccurate and misleading results which will potentially underestimate the impacts of the activities on the harbour porpoise population and the SNS SAC.</p>	

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<p>It is also assumed that the MMMP for UXO, MMMP for piling and the SIP will mitigate the impacts. For reasons detailed in the relevant sections above, WDC strongly disagree with this approach. Until the mitigation measures are finalised, and only proven mitigation measures are used that can be effectively assessed to understand their effectiveness, it is inaccurate to conclude these plans can mitigate the impacts.</p> <p>As the plans for Norfolk Boreas offshore wind farm are highly likely to affect conservation and management objectives of the SNS SAC for harbour porpoises, and due to the serious concerns outlined above, WDC strongly disagrees with the conclusions of the HRA.</p>	
<p>Additional Assessment in relation to the Southern North Sea candidate Special Area of Conservation (cSAC)</p> <p>WDC appreciate the time the Applicant has spent to conduct this assessment. We agree with the methodology undertaken and that the latest SCANS-III data has been used to estimate the number of harbour porpoises that could be supported by the site. We are pleased that the assessment has used the 'worst case scenario' when assessing the impact on marine mammals, and believe this to be appropriate however, as they are deemed realistic, they should be treated accordingly.</p> <p>The results of the in-combination assessment are of particular concern. The results demonstrate the potential for large areas of the SNS SAC where harbour porpoises could be disturbed by piling activities, with very high percentages of the population being disturbed. This is a high percentage of the population that could be disturbed from feeding and potential breeding activity and has the potential to cause barrier to movements to access other areas of the SNS SAC.</p> <p>We are concerned that the in-combination effects in particular are likely to cause AEol.</p>	<p>As outlined above, assessments were conducted based on the current SNCB advice. In addition to the area based assessments for both the summer and winter areas, assessments were also conducted on the harbour porpoise North Sea Management Unit population and additional assessment for the Information to Support HRA [APP-201] on the estimated number of harbour porpoise that the SNS SAC site could support.</p> <p>The approach used in the in-combination assessment presents a range for the worst-case scenarios based on concurrent and single piling. The assessment also demonstrates that with scheduled piling, no AEol would be possible, which will be considered further in the SIP.</p> <p>The SIP will set out the approach to deliver any project mitigation or management measures in relation to the SNS SAC, including in-combination effects, to ensure there is no AEol.</p>
<p>In-field impact monitoring</p> <p>All in-field impact monitoring should be undertaken during construction and operation to ensure that the proposed population modelling impacts calculated in theory are accurate. Should any more negative impacts</p>	<p>The IPMP [REP1-029] provides the framework to agree monitoring requirements.</p>

Summary of Written Representation	Applicant's Response
<p>occur then the development should be halted and mitigation methods revisited. However we note that it is likely that any long-term negative impacts are unlikely to be documented during the timing of construction itself, unless these impacts are dramatic.</p> <p>To fully understand the impacts of piling activities on cetaceans, in particular harbour porpoises and the SNS SAC, the monitoring should be robust enough to demonstrate the responses of harbour porpoise to piling activities. Monitoring should be undertaken throughout the construction period, and into the operational phase, across the Norfolk Boreas site to fully assess the impacts of piling. Additionally we would like to see the commitment to monitor piling to any foundations requiring pile driving, not just monopile foundations.</p>	
<p>Decommissioning</p> <p>WDC are pleased to see that at the moment there are no plans to use explosives during the decommissioning of the wind farm, and that instead decommissioning will most likely will involve cutting of piles and grinding or drilling techniques. We hope that this will continue to be the case when the detailed plan is drawn up because the use of explosives in decommissioning has the potential to cause physical harm or be lethal to cetaceans (Prior and McMath, 2008).</p> <p>We do have concerns regarding the noise levels that may be generated by decommissioning, and recognise that this will be dependent on the methods used to remove the turbine foundations. Until the removal methods are decided the impacts of such activity remain unknown.</p>	<p>The Applicant acknowledges this position.</p>
<p>Recommendations</p> <ul style="list-style-type: none"> • Pile driving is not used at all during construction. • If the recommendation of no pile driving is disregarded, strict limits be placed on 	<ul style="list-style-type: none"> • The inclusion of piled foundations is important to the commercial viability of the Project. Other foundation types are also included in the design envelope to increase engineering flexibility. However, the assessments were based on the worst-case scenario, which was underwater noise during impact piling. • The In-Principle Site Integrity Plan (SIP) [APP-708] includes noise reduction as a potential mitigation option. The Site Integrity Plan, required under DCO Schedules 9 and 10 Part 4 Condition 14(m) and Schedules 11 and 12 Part 4 Condition 9(l), in

Summary of Written Representation	Applicant's Response
<p>noise levels during construction, including cumulative noise.</p> <ul style="list-style-type: none"> • Only proven mitigation measures (such as a bubble curtain) are in place around the source to mitigate the impacts of radiated noise levels. • That WDC is included as a consultee on the design of the MMMPs and SIP. • That the monitoring strategy is appropriate to consider the cumulative impacts of all developments in the region. • Ground-truthing of modelled noise assessment data should be undertaken. • An assessment report be publicly available within a reasonable timeframe of construction completion. 	<p>accordance with the In-Principle SIP, provides the framework for agreeing mitigation measures with the Marine Management Organisation (MMO) prior to construction. The SIP will be based on the best available information and guidance at that time.</p> <ul style="list-style-type: none"> • Noise reduction measures, e.g. bubble curtains are included in the MMMP [APP-704] and In Principle SIP as a potential mitigation option. However, developing and finalising the MMMPs and SIP pre-construction will allow for the latest, most effective, suitable and proven mitigation measure to be taken into account. • The Applicant has taken a consistent approach to the commitment for pre-construction engagement with WDC as that of other projects, e.g. East Anglia THREE and Norfolk Vanguard, having committed to consult with WDC in the initial review of the Site Integrity Plan and to provide the updated plan to WDC when it is submitted to the MMO and Natural England for review and approval. At that stage, it is at the MMO's discretion which stakeholders to consult. Likewise, the MMMP will be submitted to the MMO for approval and it is at the MMO's discretion which stakeholders to consult. • The In Principle Monitoring Plan (IPMP) [REP1-029] provides the framework to agree monitoring requirements with the MMO prior to construction. Section 4.5.2 of the IPMP acknowledges that there may be little purpose or advantage in site specific monitoring and a strategic approach may be more appropriate in providing answers to specific questions where significant environmental impacts have been identified at a cumulative/in-combination level. • The IPMP [REP1-029] provides outlines the proposals for construction noise monitoring (if pile driving is required) of the first four piled foundations of each foundation type to be installed. • Reporting of monitoring results will be submitted to the MMO at a timeframe agreed through the Construction Programme and Monitoring Plan (as required under DCO Schedules 9 and 10 Part 4 Condition 14(1)(b) and Schedules 11 and 12 Part 4 Condition 9(1)(b) and pursuant to Condition 18-20 of Schedule 9 and 10, and Condition 13-15 of Schedule 11-12). • The full range of potential impacts from all foundation types within the design envelope has

Summary of Written Representation	Applicant's Response
<ul style="list-style-type: none"> Further assessments are made on alternative foundations to fully understand the potential impacts on marine mammals and prey species. Visual and acoustic monitoring should be ongoing throughout construction. Activities should be halted when marine mammals approach within a specified distance of operations (mitigation zone). That the monitoring strategy is appropriate to consider cumulative impacts of developments within and adjacent to the SNS SAC. <p>Collected data are made available to all stakeholders, and that acceptable levels of impact(s) are clearly identified through the Marine Mammal Mitigation Plan and that an adaptive approach is applied, where development is halted should significant impacts be observed.</p>	<p>been assessed. The worst-case scenario for seabed impacts is associated with gravity base foundations which has been assessed in ES Chapter 10 Benthic Ecology and Chapter 11 Fish and Shellfish Ecology. The conclusions of this chapter informed the assessment of the impact of changes to prey resource on marine mammals assessed in Chapter 12 Marine Mammals.</p> <ul style="list-style-type: none"> As stated above, the IPMP [REP1-29] provides the framework to agree monitoring requirements with the MMO prior to construction. The current JNCC guidance for minimising the risk of injury to marine mammals from piling noise (2010) states: "When piling at full power, there is no requirement to cease piling or reduce the power if a marine mammal is detected in the mitigation zone." The MMMP, required under DCO Schedules 9 and 10 Part 4 Condition 14(1)(f) and Schedules 11 and 12 Part 4 Condition 9(1)(f), in accordance with the draft MMMP (APP-704) provides the framework to identify appropriate marine mammal mitigation based on the best available information and guidance prior to construction. As stated above, the IPMP [REP1-029] provides the framework to agree monitoring requirements prior to construction. <p>Monitoring results will be submitted to the MMO in accordance with the procedure to be agreed through the Construction Programme and Monitoring Plan (as required under DCO Schedules 9 and 10 Part 4 Condition 14(1)(b) and Schedules 11 and 12 Part 4 Condition 9(1)(b) and pursuant to Condition 18-20 of Schedule 9 and 10, and Condition 13-15 of Schedule 11-12)). The MMMP, required under DCO, Schedules 9 and 10 Part 4 Condition 14(1)(f) and Schedules 11 and 12 Part 4 Condition 9(1)(f), in accordance with the draft MMMP (document reference APP-704) will be completed prior to construction, based on the best available information and guidance prior to construction.</p>

1.13 Anglian Water Services Ltd REP2-099

Summary of Written Representation	Applicant's Response
<p>Existing Assets Affected</p> <p>There are a number of water and water recycling assets in Anglian Water's ownership</p>	<p>The dDCO includes protective provisions specifically for the benefit of Anglian Water (Schedule 17, Part 6), which captures this detail.</p>

Summary of Written Representation	Applicant's Response
<p>located within the boundary of the onshore cable for the proposed offshore windfarm. These assets are critical to enable us to carry out Anglian Water's duty as a water and sewerage undertaker.</p> <p>In relation to the water and water recycling assets within the boundary of the Development Consent Order, having laid the asset under statutory notice, Anglian Water would require the standard protected easement widths for these assets and for any requests for alteration or removal to be conducted in accordance with the Water Industry Act 1991 and the Protective Provisions sought by Anglian Water.</p> <p>The standard easements required are set out in the written representation.</p>	
<p>If it is not possible to avoid any of Anglian Water's water recycling assets, then the asset may need to be diverted in accordance with Section 185 of the Water Industry Act 1991. Anglian Water is, pursuant to Section 185 under a duty to divert sewers if requested to do so unless it is unreasonable to do so. A formal application will need to be made to Anglian Water for a diversion to be considered. Diversionary works will be at the expense of the applicant.</p> <p>Anglian Water expects to have further discussion with the applicant regarding the proposed design of any required crossings of Anglian Water's existing assets within the onshore cable route.</p>	<p>The Applicant has not identified any requirement for the diversion of Anglian Water assets. The Applicant and Anglian Water are in discussion regarding the proposed design of any required crossings of Anglian Water's existing assets within the onshore cable route.</p>
<p>Groundwater sources</p> <p>There are existing boreholes for public water in the vicinity of the proposed cable route. It is essential to protect the aquifers identified in the Environmental Statement and Anglian Water's existing assets from contamination from any activities that might cause pollution. Anglian Water would expect mitigation measures to be put in place to prevent any pollution of the chalk aquifers from surface activities.</p> <p>Anglian Water has had constructive discussion to date with the applicant regarding groundwater sources and the proposed mitigation measures.</p>	<p>The Applicant and Anglian Water have had constructive discussions on this matter and, as detailed in the SoCG submitted at Deadline 2 (ExA.SoCG-1.D2.V1, REP2-058), it is agreed by both parties that the Application identifies appropriate mitigation measures in relation to water resources and groundwater, subject to detailed design post-consent. Consultation will continue with Anglian Water post-consent as detailed information becomes available.</p>

Summary of Written Representation	Applicant's Response
<p>Connections to the water supply / foul and surface water sewage networks</p> <p>Anglian Water understand that a connection to the water supply network is likely to be required for the onshore project substation with final requirements to be confirmed post consent. Anglian Water is not aware of any wastewater requirements made upon them for the development. Should a water supply or wastewater service be required and once agreement has been reached, there are a number of applications required to deliver the necessary infrastructure. These are outlined in the written representation.</p>	<p>The Applicant and Anglian Water agree that the necessary application process for the any connections to the mains water supply or public sewage network will be followed, as detailed in the SoCG submitted at Deadline 2 (ExA.SoCG-1.D2.V1, REP2-058).</p>
<p>Draft Development Consent Order</p> <p>Anglian Water has had constructive dialogue with the applicant regarding the wording of protective provisions specifically for the benefit of Anglian Water to be included in the Draft Development Consent Order (DCO). The DCO as currently drafted includes protective provisions specifically for the benefit of Anglian Water (Schedule 17, Part 6) as previously requested.</p> <p>Therefore Anglian Water are supportive of the wording of the protective provisions included in the Draft DCO as submitted.</p>	<p>The Applicant acknowledges Anglian Water's support for the protective provisions as they are currently worded in the dDCO at Schedule 17, Part 6 (document 3.1, REP1-008).</p>
<p>Statement of Common Ground</p> <p>Anglian Water has agreed a Statement of Common with Norfolk Boreas Limited. It is expected the agreed Statement of Common Ground will be submitted by Norfolk Boreas Limited to the Examining Authority on behalf of both parties by deadline 2.</p>	<p>The Applicant confirms the agreed Statement of Common Ground was submitted at Deadline 2 (ExA.SoCG-1.D2.V1, REP2-058).</p>

1.14 Ministry of Defence

Summary of Written Representation	Applicant's Response
<p>Ministry of Defence (MoD) provided a Written Representation to PINS on 4th December 2019 and raised the following points:</p>	<p>MoD Written Representation welcomed by the Applicant.</p>
<p>MoD does not anticipate that the onshore development will adversely affect MoD interests.</p>	<p>The Applicant agrees with this statement.</p>
<p>The scheme will not physically impact upon MoD offshore Danger and Exercise Areas or adversely affect defence maritime navigational interests.</p>	<p>The Applicant agrees with this statement.</p>

Summary of Written Representation	Applicant's Response
The turbines and some of the tall ancillary offshore structures will affect military low flying training activities conducted in this area. As such it will be necessary for these structures to be fitted with appropriate aviation warning lighting to maintain the safety of military air traffic.	The Applicant agrees with this statement.
MoD assessments have determined that, when operational, the proposed wind farm will cause unacceptable and unmanageable interference to the effective operation of this (Trimingham) air defence radar. This issue has been recognised by the Applicant. The Applicant has submitted a technical mitigation concept to address the adverse impacts of the development upon the air defence radar. This has been accepted by the MoD.	The Applicant welcomes this statement.
MoD maintains no safeguarding objection to this application subject to the inclusion of two requirements (12 and 13), as detailed in the dDCO, in any DCO that may be granted for this scheme.	The Applicant welcomes this statement and agrees with the wording of Requirements 12 and 13 as detailed in the dDCO.

1.15 Network Rail Infrastructure Limited REP2-109

Summary of Written Representation	Applicant's Response
Network Rail (NR) do not agree to compulsory powers being granted or executed in relation to its operational railway land but NR is willing to enter into agreements and protective provisions for the benefit of NR to enable the proposed development to be carried out.	The Applicant acknowledges Network Rail (NR)'s position. The Applicant is in discussions with NR to reach agreement on the protective provisions and related property agreement in order to adequately protect NR's apparatus.
Network Rail and the Applicant are in advanced discussions regarding the protective provisions to be included in the Order and the agreements to be entered into to enable Network Rail to withdraw its objection to the Order.	The Applicant concurs that the parties are at an advanced stage of negotiations regarding the protective provisions to be included in the Order together with the related agreements.
NR have provided an amended version of the protective provisions for inclusion in Schedule 17. If NR and the Applicant are able to agree the Protective Provisions and the related agreements referred to in the Written Representation then NR will be able to withdraw its objection to the DCO.	Noted. The Applicant is confident that agreement will be reached before the close of Examination.

1.16 Patricia Lockwood REP2-110

Summary of Written Representation	Applicant's Response
REP2-110 expresses the same concerns over the implications of the cumulative effect of the National Grid substation and 2 extensions plus Dudgeon, Vanguard, and Boreas all in the same site, as REP2-110, and also seeks information on mitigation measures to prevent accidental, engineering (equipment / system failure) or terrorism related incidents from taking place.	As REP2-110 is substantially identical to REP2-101, please refer to the Applicant's response to REP2-101 (above).

1.17 Colin King REP2-100

Summary of Written Representation	Applicant's Response
REP2-100 expresses the same concerns over the implications of the cumulative effect of the National Grid substation and 2 extensions plus Dudgeon, Vanguard, and Boreas all in the same site, as REP2-101, and also seeks information on mitigation measures to prevent accidental, engineering (equipment / system failure) or terrorism related incidents from taking place.	As REP2-100 is substantially identical to REP2-101, please refer to the Applicant's response to REP2-101 (below).

1.18 Great Yarmouth Borough Council REP2-071

Summary of Written Representation	Applicant's Response
<p>The port, town and borough of Great Yarmouth is, as is recognised in the application documentation, very well-placed to contribute to the wider economic benefits the scheme would generate. This includes especially through the potential use of Great Yarmouth port for windfarm construction and then operations & maintenance (O&M) activities - Vattenfall</p> <p>signed an agreement with Peel Ports in 2018 to reserve space for an operations base for both the Boreas and Vanguard proposals (subject to DCO consents being granted).</p> <p>Vattenfall has included a Skills and Employment Strategy Planning Condition / Requirement within the Boreas DCO, ensuring that there is a skills legacy to the project. The Council warmly welcomes this and recognises that this should allow for creation of apprenticeships, internships and work</p>	<p>The Applicant acknowledges Great Yarmouth Borough Council's support for the Skills and Employment Strategy (8.22, APP-713), as secured through Requirement 33 of the dDCO (document 3.1, REP1-008).</p>

Summary of Written Representation	Applicant's Response
<p>experience to benefit the wider economy and area.</p>	
<p>The Council does not have any particular comments to make on the onshore elements of the DCO proposal (as they fall outside the Council's area), save that the environmental and amenity impacts should be minimised and any opportunities to facilitate the use of the electricity generated within local electricity distribution networks (132 kv or below) should be explored.</p>	<p>As presented in the Applicant's comments on Relevant Representations (AS-025) at Section 28.1 Table 28, row 1, there are no planning or regulatory mechanisms through which the Applicant could identify direct 'infeeds' into the regional distribution network in Norfolk.</p>
<p>In relation to potential offshore effects, the potential impact on commercial fishing operations is recognised in the DCO application (especially during construction) and the Council asks that Vattenfall continues the dialogue with fishing interests to ensure that any negative effects are minimised and mitigated.</p>	<p>As presented in the Applicant's comments on Relevant Representations (AS-025) at Section 1.9, Table 9, row 1, where there is likely to be a demonstrable impact (i.e. during construction; operation and/or decommissioning) on commercial fishing affecting communities in Norfolk, individual agreements will be reached as necessary, with any agreements based on evidence and track record and in accordance with FLOWW Best Practice Guidance for Offshore Renewables Developments.</p>

2 Comments on Additional Submissions

2.1 Natural England REP2-081

2. Natural England submitted an updated Risk and Issues log at Deadline 2. The Applicant has reviewed this document and has provided comment in the table below. The Risk and issues log is Natural England's Relevant Representation transposed into Tabular form. Therefore, the Applicant responded to the various issues and risks in the Applicant's Comments on Relevant Representations [AS-024]. The Applicant has updated the Natural England Statement of Common Ground for Deadline 2 [REP2-054] to reflect areas where the Applicant considers agreement and/or progress has been made. It should be noted that, although issues and updates to that version (2) of SoCG have been discussed with Natural England, in view of Natural England's position to engage in the SoCG process at the start and end of the examination only, the updates have not been approved by Natural England.
3. The Applicant notes that the document has had limited updates in the version submitted at Deadline 2. However, the Applicant considers that a number of the identified risks and Issues have now been resolved or at least can be updated to reflect the progress made. These are provided in the Table below.

Summary of Written Representation	Applicant's Response
Offshore ornithology	
Issue number 1. <i>'We also recommend that a range of apportionment rates for the breeding season are considered when assessing the likely impacts of the proposal on kittiwake at the FFC SPA and LBBGs at the Alde-Ore Estuary'</i>	Natural England confirmed in the SoCG (AS-029) that the Applicant had already provided the requested range of apportioning estimates for lesser black-backed gull (up to 30%) and that no higher values are required. The Applicant therefore considers that this aspect is no longer outstanding. With respect to kittiwake, up to 100% apportioning has been provided in the updated assessment (REP2-035), although the Applicant acknowledges that this update was submitted later than the NE issues log.
Issue number 6. Point 2. <i>'We recommend that if the Applicant undertakes any further collision risk modelling that this is undertaken using the Marine Scotland Science (MSS) stochastic collision risk model (sCRM).'</i>	Natural England confirmed in the SoCG (AS-029) that the Marine Scotland sCRM is currently producing incorrect outputs and that until the model has been revised the Applicant should continue to use the Band (2012) model. Hence this is the approach taken by the Applicant in the updated assessment submitted at Deadline 2 (REP2-035).
Issue number 6. Point 4. <i>'The assessments do not consider the CRM predictions from the Band Option 1 outputs, only those for Option 2.'</i> And <i>'Whilst we acknowledge the contractors concerns over the aerial survey data flight height figures, we recommend that the Applicant takes a more narrative approach to the assessment, and considers the Option 1 outputs for the above species in the context of the relevant Option 2 figures for the 95% confidence intervals (CIs) of the density data, as part of a more range-based approach to consideration of CRM impacts.'</i>	Natural England confirmed in the SoCG (AS-029) that the appropriate collision model option to use in the assessment is option 2 (generic flight height data) due to issues in the estimation of seabird flight height identified by the aerial survey contractor and furthermore this approach was agreed during the Evidence Plan Process. Therefore the Applicant believes this is not an issue for this assessment.

Summary of Written Representation	Applicant's Response
<p>Issue 11. Aims and approaches for post-consent monitoring.</p>	<p>Natural England and the Applicant have agreed in the SoCG (AS-029) on high-level aims for post-construction monitoring, with a focus on validation of the assessment methods/models used in the impact assessment. Therefore the Applicant considers this issue has been progressed and should not be highlighted as an outstanding area of concern.</p>
<p>Benthic Ecology</p>	
<p>Issue number 14. Second point: <i>We would wish areas of Annex 1 Sabellaria spinulosa reef to be avoided when depositing the sediment.</i></p>	<p>The Applicant committed to dispose of sediment at least 50m away from any <i>S.spinulosa</i> reef as part of the application. The Applicant has since included additional mitigation within the updated Haisborough, Hammond and Winterton (HHW) SAC SIP [REP1-033] designed to give further confidence that this can be achieved. Therefore, the Applicant believe that progress has been made and this should be recognised in the log.</p>
<p>Issue number 16 It is stated that the “<i>worst case scenario (WCS) of up to 8km of cable protection within Annex 1 habitats of the HHW SAC</i>”.</p>	<p>This is now incorrect as the project has committed to a maximum of 4km of cable protection within the SAC and additional work has been submitted as Appendix 3 of the updated HHW SAC SIP [REP1-033] which demonstrates that it is likely that none of the cable protection would be placed within the areas to be managed as Annex 1 <i>S.spinulosa</i> reef. The further work also demonstrates that it is also likely that it would be possible to avoid placing cable protection in the areas to be managed as Annex 1 Sandbanks.</p>
<p>Issue number 18 It is stated that “<i>Should sandwave clearance be necessary to achieve burial depth and avoid the use of cable protection then, as above, it would need to be demonstrated that impacts are short-lived, the feature can recover, and that dredged material is retained in the system and can be deposited on material of the same grain size.</i>”</p>	<p>The Applicant considers that the additional commitments made by the Applicant for disposal as described in section 5.4.1 of the updated HHW SAC SIP [REP1-033] should allow progress or agreement on this issue.</p>
<p>Issue number 20 It is stated that: <i>Operations and Maintenance activities should either be excluded from within this designated site (at the consenting stage with option to apply for a separate marine licence at a later date) or sufficiently restricted to ensure no adverse effect.</i></p>	<p>The Applicant has now confirmed that any additional cable protection required in new areas would be subject to a separate marine licence and therefore this issue should be resolved.</p>
<p>There are a number of detailed benthic issues contained in pages 22 to 28, however the areas where the Applicant consider that progress has been made are generally covered by the summary points provided above. None of the issues on pages 22 to 28 have been updated since the previous version of the Risk and Issues log submitted at Deadline 1 [REP1-056]. The Applicant consider that the additional mitigation that the Applicant has provided for disposal of material from sand wave levelling as described in section 5.4.1 of the updated HHW SAC SIP [REP1-033] and the additional work submitted as Appendix 3 of the updated HHW SAC SIP, should be reflected within the Risk and issues log.</p>	

Summary of Written Representation	Applicant's Response
Onshore ecology	
<p>Issue 22, 27</p> <p>Natural England have requested a more thorough HDD methodology and assessment of the effects of a drilling break out on designated sites and species.</p>	<p>The Applicant provided a clarification note on Trenchless Crossings and Potential Effects of Breakout on the River Wensum at Deadline 1 [REP1-039] which the Applicant considers should have resolved this issue, however this is not reflected in the issues log.</p>
<p>Issue 23 and 32</p> <p>It is stated that: <i>“Broadland SPA and Ramsar are currently scoped-out,”</i> and a request is made to update the OLEMS to commit to mitigation measures to ensure no AEol for the site.</p>	<p>This is now incorrect as the updated integrity matrices submitted on the 4th November 2019 [AS-004] include the Broadland SPA and Ramsar and the updated OLEMS [REP1- 021] include the additional mitigation to ensure no AEol as requested by Natural England. Therefore, the Applicant considers that these issues should have been updated for Deadline 2.</p>
<p>Issue 24</p> <p>States: <i>“Mitigation agreed during the Vanguard examination, as detailed within the Code of Construction Practice (CoCP) and OLEMS should be incorporated into the Boreas OWF DCO documents at the earliest opportunity”.</i></p>	<p>All mitigation measures agreed for Norfolk Vanguard were included in the versions of the Outline Landscape and Ecological Monitoring Strategy [REP1- 021] and the OCoCP [REP1-019] which were submitted at Deadline 1, therefore the Applicant considers that these issues have been resolved.</p>
<p>Issue 25</p> <p>It is stated that: <i>“Natural England advise that a commitment to monitoring is also included [within the OLEMS] for other designated habitats and species which will be effected, such as hedgerows used by bats, grasslands, ponds, cereal field margins etc.”</i></p>	<p>The OLEMS [REP1- 021] contain commitments to monitor the species and habitats that Natural England list in this issue and therefore the Applicant considers that this issue has been resolved.</p>
<p>Issue 28</p> <p>It is stated that <i>“a mitigation plan should be drawn up and agreed with Natural England. The plan should include for the improvement of the hedgerows either side of the section to be removed including any gapping up, tree management and the development of scrub/rough grassland margins. The mitigation plan should be in place for 7 years or until the original hedgerow has recovered fully.”</i></p>	<p>The OLEMS [REP1- 021] has been updated to contain a commitment to the plan as requested by Natural England and therefore the Applicant considers that this issue has been resolved.</p>
<p>Issue 29</p> <p>Natural England request that a commitment is made to producing site specific water crossing plans.</p>	<p>Site specific water crossing plans are secured through Requirement 25 of the DCO [REP1-008] and therefore the Applicant considers that this issue has been resolved.</p>
<p>Issue 31 Natural England has received a draft Great Crested Newt Licence Application and is currently considering issuing a Letter of No Impediment.</p>	<p>Letter of No Impediment was issued to the Applicant on the 9th of September 2019, therefore this should be updated in the Issues and Risk log, to reflect the current position.</p>
<p>There are a number of detailed issues contained in pages 30 to 34, however the areas where the Applicant consider that progress has been made are generally covered by the summary points provided above.</p>	

Summary of Written Representation	Applicant's Response
Marine Mammals	
<p><i>"Natural England would welcome further discussion with the Applicant regarding their conclusion of no adverse effect on integrity of the Humber Estuary SAC considering up to 37% of the grey seal population of the SAC could potentially be impacted from Norfolk Boreas and all other projects and plans."</i></p>	<p>As stated in Natural England's - Responses to ExA's Written Question [REP2-080] Q8.11.3.</p> <p><i>Natural England is in agreement with the explanation provided by the Applicant to this point in AS-024. Natural England considers it is reasonable to put the impact to grey seal in the context of the wider in-combination reference population here and agrees it is unlikely that all the grey seal potentially impacted will be from the Humber Estuary SAC.</i></p> <p>Therefore, the Applicant considers that this issue has been resolved.</p>
Development Consent Order	
<p><i>All references to Natural England should be amended to the Statutory Nature Conservation Body and an interpretation should be added to define the Statutory Nature Conservation Body.</i></p>	<p>This was updated in the version of the draft DCO that was submitted on the 4th November 2019 [AS-019]. Therefore, the Applicant considers this issue resolved.</p>
<p><i>"The code of construction practice details Environment Agency for consultation, but not Natural England."</i></p>	<p>The Applicant has agreed to include Natural England within the list of consultees for Requirement 20 and this is reflected within the dDCO submitted at Deadline 1 [REP1-008].</p>
<p><i>Natural England requests that the maximum hammer energy to be used while piling be included within the requirements and within the Deemed Marine Licences. This is an important metric in the measurement of noise impact and represents a significant part of the projects Rochdale envelope.</i></p>	<p>The maximum amount of hammer energy is secured within the dDCO at Condition 14(3) (Schedule 9-10), and Condition 9(3) (Schedule 11-12) of the DMLs.</p> <p>Following discussions with the Natural England on the 28th November 2019 the Applicant understood that Natural England is content that the maximum piling energy is secured appropriately and therefore this should be reflected in the Risk and Issues log.</p>
<p><i>"The DCO and ES project description provide assessment of specific volumes of boulder relocation work. However, there is no mention of this as a licensed activity nor of the limits of this licensed and potentially damaging activity within any of the DMLs."</i></p>	<p>Following discussions with the Natural England on the 28th November 2019, the Applicant understands that Natural England are content that because boulders would not be lifted to the surface, this would not require specific mention within the DMLs. Therefore, this should be reflected in the Risk and Issues log.</p>
<p><i>Natural England does not agree that cable protection can be deployed under this licence for the duration of operation.</i></p>	<p>The Applicant can confirm that any new areas of cable protection required during the operation stage would be subject to a separate marine licence. The wording of the current DCO does not allow for the Applicant to install new areas of cable protection during operation. Furthermore, the applicant considers that the updates to the Outline Offshore Operation and Maintenance Plan (OOOMP) [REP1-028] make it clear that any additional cable protection placed in new areas during operation would be subject to a separate new marine licence.</p> <p>Following discussions on the 28th November 2019, it was the Applicant's understanding that this had been</p>

Summary of Written Representation	Applicant's Response
	agreed and therefore this should be reflected within the Risk and Issues log.

2.2 The Coal Authority REP2-097

Summary of Written Representation	Applicant's Response
The Coal Authority would have no objection to our Informative Note being included in the Outline Code of Construction Practice document, secured through the Development Consent Order for the project (if made) in order that all contractors would be required to adhere to during construction of the project.	The Applicant welcomes the Coal Authority's acceptance of this proposal and confirm that this can be found in the updated Code of Construction Practice submitted at Deadline 1 (REP1-018).

2.3 Jan Burley REP2-104

Summary of Written Representation	Applicant's Response
REP2 104 highlights a newspaper article which describes the issue of coastal erosion for homeowners at Happisburgh and more generally around the UK. https://inews.co.uk/news/long-reads/coastal-erosion-norfolk-happisburgh-climate-changeretirement-examined-1327600?fbclid=IwAR1qto5zrhjYE9DBOWFM6nyE_RY9ZGZGLtrzasZR7FAI8df9f0J_ic2Es	The Applicant has addressed the issue of coastal erosion at Happisburgh in the response to WQ10.0.1 in Norfolk Boreas Responses to the Examining Authority's Written Questions (REP2-021).

2.4 Jenny Smedley REP2-105

Summary of Written Representation	Applicant's Response
REP2-105 requests that the Applicant provides a photomontage showing the appearance and position of the new pylon at the National Grid substation extension in relation to existing overhead pylons.	The Landscape and Visual Impact Assessment (LVIA) visualisations presented in the Environment Statement (ES Figures 29.23 to 29.46 (APP-509 to APP-532) include the overhead line modifications (required under Scenario 2) as well as the National Grid substation extension and the onshore project substation. The Applicant has included three images at Appendix 1 to illustrate the proposed changes to the overhead electricity transmission line adjacent to the National Grid substation extension. The first image (Figure 1) shows the model of the tower that was used in the production of the LVIA visualisations. This model was selected as it best matched the dimensions of the proposed towers. The second image (Figure 2) is a zoomed in extract from Viewpoint 3: Lodge Lane North, showing the baseline view - that is the view without the addition of the project. The third image (Figure 3) is a zoomed in extract from the visualisation produced for Viewpoint 3: Lodge Lane North for Scenario 1 (ES Figure 29.25, APP-511), Scenario 1 is the worst case as it includes the National Grid substation extensions required for Norfolk Boreas and Norfolk Vanguard, as well as the

Summary of Written Representation	Applicant's Response
	<p>proposed changes to the overhead electricity transmission line (which under Scenario 1 would have been undertaken by Norfolk Vanguard). While these present an accurate representation of the size and scale of the new tower and replaced tower, the final detailed appearance of the tower is yet to be confirmed.</p>

2.5 George Freeman MP REP2-102

Summary of Written Representation	Applicant's Response
<p>The Written representation submitted by George Freeman – MP for Mid-Norfolk expresses his opposition to the Project on the following grounds:</p> <ol style="list-style-type: none"> Lack of proper community consultation or a sufficient environmental impact assessment <p>In relation to this point, REP2-102 notes: <i>“We in Mid Norfolk (those in Necton itself, the surrounding villages, local councillors and myself) believe that, IF the community is to accommodate such Nationally Significant Infrastructure, then it should be given a proper voice to help site and screen it correctly – and also receive a substantial amount of community recompense.”</i></p>	<p>Since 2016, the Applicant has followed a programme of extensive pre-application consultation with local communities and statutory and non-statutory consultees. This was recorded in the Norfolk Boreas Consultation Report (document 5.1 APP-027), and the executive summary, section 1.6 Responses to feedback and Project decisions influenced by consultation, in particular, describes the many decisions taken by the Applicant as a result of the consultation process in order to adapt the initial design of the Project– as is the purpose of the NSIP process (the need for the project being established by National Policy Statements, as described in Chapter 2 of the ES and being outside the remit of the consultation).</p> <p>Throughout the Project, the EIA has been carried out in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) and the Planning Act 2008 (as amended by the Localism Act 2011). Furthermore, the approach to the EIA and the production of the ES closely follows relevant guidance including:</p> <ul style="list-style-type: none"> National Infrastructure Advice Notes in relation to the Planning Act 2008 process (as amended); Assessment of the environmental impact of offshore wind-farms (OSPAR Commission, 2008); Planning Inspectorate Advice Notes (the Planning Inspectorate, 2015; 2017a; 2017b; 2017c, 2018a, 2018b); Overarching National Policy Statements for Energy EN-1, Renewable Energy Infrastructure EN-3, and Electricity Networks Infrastructure EN-5 (Department of Energy and Climate Change (DECC), 2011); Relevant guidance issued by other government and non-governmental organisations; and Receptor-specific guidance documents. <p>All aspects of the EIA are therefore robust and sufficient. Full details on the EIA methodology are provided in Chapter 6 Environmental Impact Assessment Methodology (APP-219).</p> <p>In addition, in REP2-021(Deadline 2 Submission) - Responses to ExA's Written Questions – the Applicant's response to Q9.2.8 provides a comprehensive description of the Norfolk Boreas EIA process, including consultation, which led to the proposed siting of the onshore project substation.</p>

	<p>The Applicant notes the reference in REP2-102 to “a substantial amount of community recompense” that should take the form of a junction solution at the A47/Tuns Road. As noted in the Consultation Report [APP-027, Table 15.1] and [APP-027, Table 17.1, the Applicant has met with Mr Freeman to discuss the topic of highways safety in relation to the Project and highway improvements, which Mr Freeman has championed, and visited the junction in question with Mr Freeman, Highways England and representatives of Necton PC (in September 2017). The meeting did not conclude an unequivocal need for a roundabout to accommodate entry onto the A47 at Necton. However, the Applicant agreed to share any relevant traffic monitoring data with the authorities, who would continue to consider the issue whilst working with Necton Parish Council to understand the local challenges and opportunities in the area.</p> <p>The sister project of Norfolk Boreas, Norfolk Vanguard is preparing to enter into dialogue with relevant parties in relation to a Community Benefit scheme to recognise the role that local communities play in hosting essential infrastructure that allows the UK to move towards carbon neutral energy generation and consumption. Vattenfall (Norfolk Vanguard Limited and Norfolk Boreas Limited. - the Applicant) has been consistently clear that this process of engagement in relation to a community benefit fund, or equivalent should not influence the NSIP process, and hence such a dialogue will not commence (in relation to either Norfolk Vanguard, nor the Project) until the appropriate time. This topic was discussed during the Norfolk Vanguard Examination Process, at which point, NCC and the LPAs accepted this, as the proper way to proceed.</p>
<p>2. Inappropriate siting of the substation and</p> <p>3. Failure to properly consider alternative sites</p>	<p>Points 2&3 of REP2-102 are addressed by the Applicant in REP2-021 Q9.2.8</p>
<p>4. Announcement of an official Review by the Secretary of State</p>	<p>Vattenfall is collaborating with the Offshore Wind Sector in consultation with Offshore Transmission Operator representation and The Crown Estate, coordinated by the Offshore Wind Industry Council (OWIC), , to consider</p> <ul style="list-style-type: none"> - Proposed solutions to the short term areas of concern associated with the OFTO regime and potential solutions; and - Longer term, strategic solutions addressing issues relating to the current planning process arrangement and transmission regime towards meeting offshore targets and the need for a more holistic review in advance of TCE R4. <p>Matters for the consideration of relevant stakeholders include options to connect future offshore wind farm projects not yet in development, as the demand for new capacity is going to grow significantly in line with the UK’s shift to net zero carbon emissions by 2050. However, as Norfolk Boreas is well advanced in the planning process, the Applicant does not expect progress to be affected by any future review.</p>

<p>5. The Secretary of State's delaying of a decision on the Norfolk Vanguard Offshore Wind Farm application.</p>	<p>The Applicant has responded to the implications of the Secretary of State's decision to delay Norfolk Vanguard within document reference ExA.AS-1.D3.V1 submitted at Deadline 3.</p>
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2.6 Necton Substation Action Group REP2-107

Summary of Written Representation	Applicant's Response
<p>REP2-108 poses the following questions:</p> <p>1 "Which of these terribly dangerous elements will be used in Boreas? What will be the procedure if any substances leak? How will residents be protected?"</p>	<p>1. The onshore project substation will be secured through perimeter fencing and other security measures to prevent unauthorised access. The infrastructure will include transformers which will be surrounded by a blast wall (standard in any design) to further contain any potential explosion risks. The detailed design of the onshore project substation and National Grid substation extension will take full account of industry standard design and handling approaches to substances used as insulating mediums within the substation. This will include the use of bunds and containment systems. Regular monitoring and maintenance of the equipment through the lifetime of the substation will allow further preventative actions to be taken before any leaks occur.</p>
<p>2: Would any of the Applicant's live close to their own substation? If not, why not?</p>	<p>2.The Applicant has worked through the EIA process to minimise and mitigate against the potential impact of the substations, such that residents can feel assured there will be no adverse effects of living near well designed and well operated electrical infrastructure.</p>
<p>3: How will the applicant stop windblown fire risk to residents, as there will be residents on each and every side, so no matter which direction the wind is in fire can rapidly spread. If a choice is available, what will be the priority, saving the substation and maybe preventing further spread, or saving residents?</p> <p>4: Neighbouring residential and commercial properties are under threat if the fire cannot be contained, and smoke can cause breathing difficulties across a wide area, especially for those with existing respiratory conditions. Can the applicant assure us that Boreas will never catch fire, or that residents will</p>	<p>3&4. The Applicant would like to reassure the residents of Necton that Health and Safety is a very high priority for the Applicant in relation to all development - including operational and decommissioning activities. Substations are generally not a significant fire risk because of the measures put in place to minimise that risk, including suppression and containment systems. Any potentially flammable assets are not located near the perimeter of the infrastructure, and the ground materials and other physical barriers included in the design will contain any fire to within the compound. The risk of substation fires is historically low; however, substation fires can impact the supply of electricity and create a localised fire hazard. The highest appropriate levels of fire protection and resilience will therefore be specified for the onshore project substation to minimise fire risks. The energy sector has some of the highest health and safety requirements and these standards will be incorporated into substation design.</p>

Summary of Written Representation	Applicant's Response
never be out in danger either from fire or smoke inhalation?	
5: Could the applicant tell us how they will stop birds and other flying creatures, and of course drones from entering?	5. Birds and bats will not be prevented from entering the substation compound. They do not present a safety risk to the substation nor to the animals themselves. The same applies to drones
6. If offered two similar properties, one with a substation of the capacity of theirs close by, and one without, which one would the Applicant's buy and which one would they pay more for?	<p>6. As the Applicant outlines in Table 31.1 of Chapter 6 Socio-economics (APP-244) , the NPS EN-1 Section 5.6 sets out the assessment criteria for socio-economic impacts. This identifies that the assessment should consider:</p> <ul style="list-style-type: none"> • The creation of jobs and training opportunities. • The provision of additional local services and improvements to local infrastructure, including the provision of educational and visitor facilities. • Effects on tourism. • The impact of a changing influx of workers during the different construction, operation and decommissioning phases of the energy infrastructure. <p>A search was undertaken of the Journal of Property Investment and Finance, which showed little evidence to establish a quantifiable link between house prices and renewable energy infrastructure. This was reported within ES Chapter 31 Socio-Economics (APP-244). The scope of the socio-economic impact assessment was agreed during the scoping exercise and reaffirmed through Section 42 consultation. Neither the NPS nor the agreed scope of the assessment identified a requirement to consider the impact on local house prices.</p>

3 References

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4 Appendix 1 – Figures 1-3

Norfolk Boreas Offshore Wind Farm

Applicant's comments

on Written

Representations

Appendix 1

Figures 1-3

Applicant: Norfolk Boreas Limited
Document Reference: ExA.WQR.D3.V1
Deadline 3

Date: December 2019
Revision: Version 1
Author: Royal HaskoningDHV

Photo: Ormonde Offshore Wind Farm

1 Introduction

1. This appendix contains Figures 1 to 3 associated with the Applicant's Comments on Written Representations, more specifically within Section 2, Table 2.2, REP2-.
2. The figures illustrate the proposed changes to the overhead electricity transmission line adjacent to the National Grid substation extension.
3. Figure 1 shows the model of the tower that was used in the production of the Landscape and Visual Impact Assessment visualisations (presented in the Environment Statement (ES) Figures 29.23 to 29.46 (APP-509 to APP-532)). This model was selected as it best matched the dimensions of the proposed towers.
4. Figure 2 is a zoomed in extract from Viewpoint 3: Lodge Lane North, showing the baseline view - that is the view without the addition of the project.
5. Figure 3 is a zoomed in extract from the visualisation produced for Viewpoint 3: Lodge Lane North for Scenario 1 (ES Figure 29.25, APP-511), Scenario 1 is the worst case as it includes the National Grid substation extensions required for Norfolk Boreas and Norfolk Vanguard, as well as the proposed changes to the overhead electricity transmission line (which under Scenario 1 would have been undertaken by Norfolk Vanguard).
6. It is important to note that while these present an accurate representation of the size and scale of the new tower and replaced tower, the final detailed appearance of the tower is yet to be confirmed.

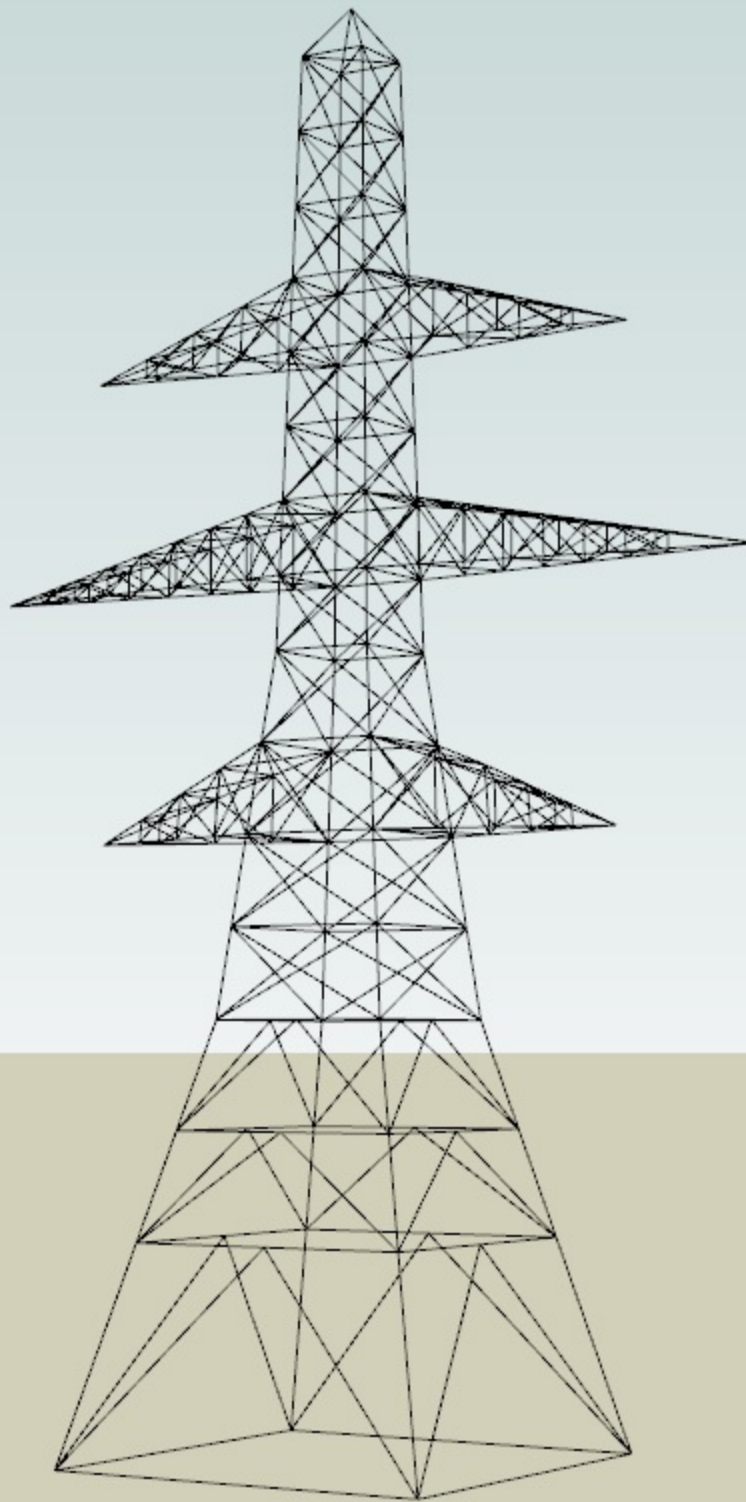


Figure 1 - Model of the towers used



Figure 2 - Viewpoint
3: Lodge Lane North



Figure 3 - Viewpoint 3, which includes the National Grid substation extension

5 Appendix 2 – Ornithological Assessment

Norfolk Boreas Offshore Wind Farm Applicant's comments on Written Representations and Additional Submissions Appendix 2

Applicant: Norfolk Boreas Limited
Document Reference: ExA.WRR.D3.V1
Deadline 3

Date: December 2019
Revision: Version 1
Author: MacArthur Green

Photo: Ormonde Offshore Wind Farm

Reference as:

Trinder, M (2016). Estimates of Ornithological Headroom in Offshore Wind Farm Collision Mortality. Unpublished report to The Crown Estate (submitted as Appendix 43 to Deadline I submission Hornsea Project Three: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/projects/EN010080/EN010080-001095-DI_HOW03_Appendix%2043.pdf)



**Assessment of Ornithological Headroom for Potential
Future Offshore Wind Farm Development**

Workshop Report and Proposed Scopes of Work

The distribution of this report and its content is at the discretion of The Crown Estate

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1. BACKGROUND

As the manager of UK rights for offshore wind generation, The Crown Estate plays a major role in the offshore wind energy industry. As a responsible estate manager The Crown Estate is considering what options are available for undertaking assessment(s) of ornithological ‘headroom’ to inform spatial consenting risks and opportunities for any potential future development for offshore wind. Given the prominence given to potential impacts on seabirds in wind farm assessments together with the conservative nature of consenting which assumes development impacts that are greater than the eventual as-built configuration, The Crown Estate is interested in exploring options for how a re-assessment of collision mortality could be conducted for existing and consented wind farms through the development of Scopes of Work (SoWs) which could be tendered to suitable organisations.

The development of these SoWs and any work that may subsequently be taken forward are intended for internal use at The Crown Estate, in order to allow a better understanding of indicative ornithological headroom that may be available across the existing offshore wind portfolio. The distribution of this report and its content is at the discretion of The Crown Estate.

2. INTRODUCTION

Ornithological assessment for offshore wind farms typically focuses on the potential for impacts resulting from two aspects; collision with turbine rotors and displacement from foraging areas. Wind farms are assessed on the basis of both their project alone impacts and also cumulatively with other wind farms (and other relevant developments) with which their effects may be combined. As the number of wind farms increase so does the cumulative impact. Of these two potential wind farm effects, mortality as a result of collisions has been the primary focus of recent assessments and consent decisions, with considerable scrutiny on modelling methods and input data. Displacement assessments have been subject to a lower degree of scrutiny and impacts are generally not considered to be of the same significance.

In reaching a determination of impact significance, the cumulative total number of birds predicted to be subject to either collision or displacement impacts is assessed against the relevant population. This implies that the total effect size is considered in relation to an estimated acceptable threshold.

As the number of offshore wind farms increases, the cumulative totals increase and as a consequence it seems reasonable to conclude that, at some point, the cumulative mortality will reach a level no longer deemed acceptable by the relevant Statutory Agency (e.g. Natural England, Scottish Natural Heritage, etc.) with the consequence that further wind farm development may not be possible. The difference between the cumulative mortality and the acceptable threshold is referred to hereafter as ‘headroom’. The headroom represents the potential extent for new wind farm development.

The acceptable thresholds for any given species are not known (and the Statutory Agencies have been unwilling to set them; see e.g. Natural England 2015). However, if it is assumed that the limits

will remain unchanged (at least in the medium term) then the primary option for increasing headroom is through reducing cumulative mortality.

Mortality due to collisions is currently of greater concern than that due to displacement and therefore the focus of the remainder of this document is on collision risk headroom. While this is expected to remain the case for the foreseeable future, it should be noted that in some cases displacement risk may be considered to be more significant than collision risk, and as assessment methodologies change the situation may change.

In the UK, Collision Risk Modelling (CRM) methods have become largely standardised, simplifying interpretation of the results obtained. In order to ensure that potential impacts are not underestimated wind farms are typically assessed on the basis of the worst case scenario (WCS) in terms of predicted numbers of collisions. This is usually represented by the largest number of small dimension turbines which could be installed (i.e. within the range of options under consideration by the developer at the time of the assessment). Wind farm assessments are also required to take into account the potential cumulative mortality across all wind farms which may affect the same seabird populations. The cumulative totals for each species are made up of the WCS mortality for each contributory wind farm, taken either from the wind farm Environmental Statement (ES) or the Development Consent Order (DCO). Wind farm alone mortality is rarely considered to be of concern for any individual wind farm development. However, the cumulative totals (for Environmental Impact Assessment, EIA) and in-combination totals (for Habitats Regulations Assessment, HRA, in relation to Special Protection Areas, SPAs) are often subject to considerable scrutiny during the assessment and consenting process. Constructed wind farms rarely use the number or type of turbines on which the application was consented and typically attain their generating capacities with fewer, larger dimension turbines. Collision mortality is almost always lower for these ‘as-built’ developments when compared with consented designs. Therefore there is potential to recalculate collision mortality for built wind farms using the dimensions of the actual turbine used rather than the consented one. This will almost certainly reduce the predicted mortality, often by a considerable amount, thereby increasing collision headroom. This calculation is uncontroversial for constructed wind farms, however consented but as yet unbuilt or partially built wind farms may not have reached a final determination on turbine model (and number) making updates potentially less reliable. However, at such sites it is likely that the smaller consented turbines will have subsequently been ruled out in favour of a smaller number of larger turbines. Thus updates can also be applied to these developments, albeit with the proviso that this can only be indicative and that further recalculation is likely to be required in future.

In addition, the methods for calculating collision mortality and the parameters used may have changed since the original assessment, opening up the potential for updates to these aspects too.

The Crown Estate (TCE) is interested in exploring options for how a re-assessment of collision mortality could be conducted through the development of Scopes of Work (SoWs) which could be tendered to suitable organisations. MacArthur Green have been exploring options for the content of suitable SoWs, with the aim of developing up to three, covering a range of complexities (e.g. costs) and predicted benefits and risks. Following a workshop with TCE staff at which this work was discussed, this report presents recommendations for a single primary SoW and an explanation of

how this SoW was identified. In addition, a secondary SoW is discussed which would be designed to take the results of the primary SoW and provide an indication of the spatial extent of estimated headroom (e.g. with reference to individual SPAs).

This work also builds on a project which MacArthur Green recently undertook for the Marine Management Organisation (MMO) and TCE which was developed as part of the offshore wind industry's Coping Strategy. That project (title: 'Ornithological data inventory for offshore wind farm consenting') involved collating publically available data for offshore wind farm collision estimates. The data sought for the project included the predicted mortality estimates for all wind farms as well as the data used in their calculation (e.g. seabird densities, turbine specifications, etc.). These data were brought together in a single Excel file (hereafter the 'collision mortality database'). The collision mortality database would form the basis for recalculation.

This report summarises:

- The key wind farm data required for offshore wind farm collision mortality estimation and the availability of the consented and as-built values;
- A high level review of options for re-estimating collision mortality;
- A recommendation for the most appropriate method for recalculating mortality (i.e. the primary SoW);
- Consideration of spatial aspects which could be developed into an additional SoW; and,
- Itemised task lists with estimated time requirements for both SoWs.

3. OVERVIEW OF COLLISION RISK MODELLING PARAMETERS

Collision mortality at offshore wind farms is calculated using a Collision Risk Model (CRM) which combines bird data and wind farm data to estimate the predicted number of collisions due to birds being struck by moving rotor blades. In British waters collision modelling has predominantly been conducted using a CRM developed by Bill Band (the Band model). The original offshore model followed the same approach used for onshore wind farms (Band et al. 2007) but this has been updated for offshore wind farms and also extended to incorporate refinement to the distribution of flight heights (Band 2012). The following discussion of CRM parameters assumes use of the current Band CRM, in both its 'basic' and 'extended' forms.

Parameters in the model can be divided into:

- Site-based bird parameters;
- Generic bird parameters; and,
- Wind farm parameters.

3.1 Site-based parameters

Site-based bird parameters in the model are:

- Density of birds in flight (monthly); and,
- Proportion of flights at collision height (PCH; for Band Options 1 and 2; note that the proportion can also be generic rather than site-specific),

Bird density will typically have been estimated using data collected from two years of monthly surveys following a standard methodology. For the purposes of the current SoWs it has been assumed that recalculation of seabird densities will not be undertaken as this will introduce additional and unnecessary complexity into the process, breaks the connection to the data used to obtain consent and would probably meet considerable opposition from the wind farm operators.

Site-based estimates of PCH may reflect either the height bands used during data collection (e.g. 0-20, 20-125, 125m+) or the actual rotor swept heights for the consented turbine specification. If the latter, then the proportion will have been adjusted from the surveyed bands to account for differences between the two. For example, if data were collected in bands as defined above and the actual rotor height was 30-125m then the following adjustment to the PCH will have been applied $[(125-30)/(125-20) = 0.9]$ on the assumption that birds within the height band are evenly distributed at all heights. If this approach has been followed but the raw numbers recorded in each height band are not provided it is unlikely that recalculation for different rotor swept heights will be possible.

3.2 Generic bird parameters

Generic bird parameters in the model are:

- PCH (for Band Op1 and 2; note that the proportion can also be site based rather than generic);
- Flight height distribution (for Band Op3; occasionally also site based);
- Nocturnal activity;
- Avoidance rate;
- Bird dimensions (length, wingspan);
- Flight type (flapping/gliding).
- Flight speed; and,
- Month assignment (breeding/nonbreeding/migration etc.).

Of these generic parameters, the avoidance rate has the biggest influence on the collision estimates. The accepted value for this has changed (upwards) as more data have been accumulated at operational wind farms. The avoidance rate is applied as the final step in the CRM, and is simply used as multiplier of the without avoidance collision estimate. It is therefore very simple to apply retrospective adjustment to this value. While this makes it an attractive proposition for the current SoWs, this correction has already been applied to the most recent cumulative assessments and therefore much of the potential gain in headroom due to this adjustment has already been accounted for, unless there are any further increases in Statutory Agency guidance on avoidance rates. That seems unlikely in the short term, as the higher avoidance rates for large gulls are now based on empirical species-specific data and seem unlikely to be increased from the present values. In the case of kittiwake and gannet, precautionary avoidance rates are advised in the absence of species-specific data, so those might be increased once species-specific data become available. There is no expectation that this will occur in the near future, but it is possible that the on-going ORJIP study at Thanet may provide robust species-specific avoidance rates for gannet and kittiwake.

There may be scope to reduce nocturnal activity values (preliminary consideration of this has been presented in the assessment for East Anglia THREE wind farm) and there is potential to develop this

further. This would require a literature and data review in order to generate robust evidence based values. The effect of adjusting nocturnal activity in the CRM varies with both wind farm latitude and month: the effect of changing the nocturnal activity level is greater in winter than summer. As a consequence nocturnal activity can only be adjusted when monthly mortality values are available.

Generic proportions of flights at PCH are typically used when insufficient site-based observations were collected to permit a site-based estimate. The values used in original assessments and those now recommended may differ for some species. This adjustment can be simply applied retrospectively to collision mortality. However, if the PCH value has increased, so will the estimated collision mortality. Therefore, adjusting PCH may reduce headroom for some species and increase it for others.

Assignment of calendar months to breeding/nonbreeding/migration seasons may have varied between wind farms and may differ from current recommendations. This is relevant for assigning mortality among different populations (e.g. during migration, wintering and breeding seasons), and is therefore likely to be of most interest for assessment in relation to designated (SPA) populations. As with proportions of flights at rotor height, reassignment of months to different biological seasons may not necessarily create headroom but might alter estimates up or down in different cases.

The parameter values used for bird dimensions, flight speed and flight type are likely to have remained fairly consistent across wind farm consents and therefore there is unlikely to be much gain from adjusting these parameters.

3.3 Wind farm parameters

Wind farm parameters in the model are:

- Number of turbines;
- Latitude;
- Wind farm dimension (only used for large array correction in current CRM);
- Tidal offset (if Band Op3 used);
- Hub height (if Band Op3 used);
- Rotor RPM;
- Rotor radius;
- Max blade width;
- Rotor blade angle; and,
- Operational percentage.

The number of turbines is the parameter which is likely to have varied by the greatest amount. All else being equal (i.e. if the same turbine models have been used), collision mortality simply scales with ratio of built to planned turbines (e.g. halving the number of turbines halves the mortality). However, if the turbine specification has also changed then other components of the mortality calculation will be affected.

Rotor dimensions (radius, blade width, blade angle) and RPM feed into two aspects of the model: the total rotor frontal area (rotor area x no. of turbines) and the probability that a bird will be struck by a rotating blade during a single pass through the rotor sweep. The former can be easily applied

(total rotor frontal area) as correction factors but the probability of collision is calculated using rotor dimensions and bird parameters and needs to be recalculated for each combination of turbine design and species. However, this is not a difficult process (the Band CRM tool provides this calculation) and only needs to be undertaken once for each species/turbine combination.

Hub height and tidal offset are only of relevance when the extended model (Op3) has been used. This only applies to more recent wind farm submissions, none of which have been built (and which therefore offer less opportunity for updating from WCS to final development). Therefore, at present there is limited requirement to consider adjustment of these parameters. In addition, the extended model is currently only accepted by the Statutory Agencies for the calculation of mortality for large gull species (herring gull, lesser black-backed gull and great black-backed gull). This further limits the benefit of recalculation.

Operational percentage is applied as a multiplier to the estimated collision mortality (e.g. if turbines are expected to be rotating 85% of the year a value of 0.85 is used). This can therefore be readily applied retrospectively, if updated values are available.

Wind farm latitude is only broadly defined (and used to estimate relative day/night length) and won't be affected by differences between consented and built wind farms. Wind farm dimension is only applied as a 'large array adjustment' in the more recent model and has very little effect on the values obtained. Although this value is expected to differ between consented and built wind farms, it has little effect on the mortality estimates.

3.4 Key collision risk modelling parameters

The following are the key parameters identified in the preceding sections (in order of expected influence), for which further consideration is warranted for how they could be incorporated into proposed SoWs.

- Number of turbines;
- Rotor dimensions;
- RPM;

These all relate to wind farm design.

- Nocturnal activity; and,
- Avoidance rate.

These reflect changes in understanding species' behaviour and ecology.

4. OPTIONS FOR CRM RECALCULATION

In the original request to undertake the current work it was envisaged that approximately three SoWs would be proposed, reflecting a hierarchy of options (e.g. low to high cost and basic to comprehensive), each with associated risks and benefits. During the process of considering the available options it became evident that there was an 'intermediate' option which was actually comparatively straightforward to undertake in terms of data requirements and effort required but which would also yield the majority of the potential gain in headroom with low risk (in terms of

Statutory Agencies acceptance). This section sets out the process by which this preferred SoW was identified.

The outputs from the SoWs are currently expected to be only for internal use by the TCE, however it is possible that the reports could be released to stakeholders and other interested parties in the future. For both purposes it would be important that the methods and outputs are reported in a transparent manner. Indeed, this is regarded as an essential requirement to ensure acceptance of re-estimated collision mortality by the Statutory Agencies. It is also worth noting that calculating additional headroom would be undertaken for each wind farm independently, with each contributing to the cumulative total. Therefore, while some aspects of the proposed re-calculation may only be possible for wind farms where the necessary data can be obtained, this need not detract from the output (i.e. a piecemeal option with the type of re-assessment determined by data would also be feasible and will still offer gains in headroom).

4.1 Comprehensive CRM re-estimation

This approach requires re-running of the collision mortality model for all consented wind farms, assuming the necessary data can be obtained (see Section 3). All input parameters would be reviewed, and the most recent CRM used.

Advantages:

- Robust estimates likely to be accepted by Statutory Agencies.
- Generate a CRM parameter dataset suitable for future re-estimation following further refinements (e.g. addition of wind farms, revised avoidance rates, etc.).

Disadvantages:

- Potentially time-consuming and expensive.
- Data availability (monthly seabird densities and site based PCH) very likely to either limit extent of re-estimation possible or require extensive re-analysis to generate the necessary input parameters.

Conclusion: this approach is considered unlikely to be beneficial due to limited data availability which will restrict the number of wind farms which could be included.

4.2 Basic CRM re-estimation

The wind farm parameter which is expected to have changed the most and is therefore the one with the greatest potential to yield reduction in collision mortality is the number of turbines. Because collision mortality is calculated (inter alia) as the product of the risk of collision for one turbine multiplied by the number of turbines, changes in the number are straightforward to apply. This adjustment can give a very quick estimate of change in mortality expected for a change in wind farm design.

However, unless there has been no modification to the turbine specifications (which is unlikely) then applying this adjustment may over-estimate the reduction. This is because collision risk is also a function of the total rotor frontal area (calculated as rotor area multiplied by the number of turbines) and the single transit risk of collision (which is turbine specific). Thus, in terms of

calculating robust updated mortality estimates, turbine only adjustment is very unlikely to be accepted by the Statutory Agencies.

Advantages:

- Very simple and quick re-estimation possible (only requires old and new turbine numbers for each wind farm).

Disadvantages:

- Doesn't include re-estimation of other CRM aspects affected by changes to rotor specification, hence almost certainly will not be accepted by Statutory Agencies for assessment purposes.

4.3 Intermediate CRM re-estimation

Further consideration of the collision model and the wind farm parameters used, backed up with a proof of concept test, led to the development of an intermediate level option. This approach uses turbine parameters which should be readily available for all wind farms to adjust the existing mortality estimates without the need to re-run the collision model. Tests indicated that this approach produced results identical to those obtained from a full model re-run.

To apply this method to update the original mortality the parameters required (both the original and updated values) are:

- Number of turbines;
- Rotor radius;
- Blade pitch;
- Blade width; and,
- RPM.

There are two steps for re-calculating collision mortality:

1. Calculate the species-specific probability of collision for a single transit for old and new turbine specifications; and,
2. Calculate the adjusted mortality using Equation (1).

$$\boxed{\text{Updated mortality} = \text{Original mortality} \times (r_0/r_1) \times (trf_1/trf_0) \times (p.\text{collision}_1/p.\text{collision}_0)} \quad [1]$$

Where:

- r = rotor radius
- trf = total rotor frontal area (rotor area x no. of turbines)
- $p.\text{collision}$ = probability of collision on single transit (from Band model)

and,

- subscript 0 = original value,
- subscript 1 = updated value.

Step 1, re-calculating the probability of collision is straightforward, requiring the use of the 'Single transit collision risk' tab in the Band CRM Excel spreadsheet for each species of interest. This uses the rotor radius, blade pitch, blade width and rpm together with species-specific biometric

parameters (bird length, wing span, flight speed, flight type). Step 2, using Equation (1) produces a mortality adjustment value and applies it to the original mortality to produce the updated mortality.

As an indication of the reduction in predicted mortality that this approach could generate, it is informative to consider an example of a similar approach conducted for the Dudgeon wind farm. This work was conducted by MacArthur Green on behalf of the developer as part of discussions around monitoring requirements with Natural England and the MMO. Updated collision modelling for gannet (similar to that outlined above) revealed that the revised annual mortality was approximately 25% of that presented in the original assessment. While the extent of reduction will obviously vary for different wind farms and species this does indicate the large potential for headroom gains.

Advantages:

- Straightforward approach
- Necessary data readily available for most wind farms (and included in MMO database)
- Transparent method with high likelihood of acceptance by Statutory Agencies
- Comparatively quick to implement therefore inexpensive

Disadvantages:

- Assumes use of Band CRM
- Only appropriate for option 1 CRM

Although some of the parameters may be difficult to obtain, particularly the values used in the original calculations (e.g. original blade pitch) and some wind farms may have used older collision models (e.g. Band et al. 2007), since the mortality estimates have been accepted for use in subsequent cumulative assessments it is considered reasonable to update these mortalities using the above approach. This is particularly so since the current intention is to understand the potential for future offshore wind development, rather than generate revised numbers for use in cumulative assessment. Thus, although the original mortality may have been generated using a slightly different calculation, the proposed method to generate an adjustment would remain valid. In other words, irrespective of the actual mortality values on which the wind farm was consented, the adjustment value itself is robust. Note that, if the updated collision estimates are to supersede the current values, in the case of assessments which used alternative collision models, it may be necessary to apply the adjustment using the relevant model.

If stakeholder acceptance of updated mortality estimates becomes a goal of this work it is likely that there will be additional scrutiny of the original data and modelling assumptions. For example, changes in the survey methods may be cited as a reason for a more comprehensive re-evaluation of the data (and hence mortality estimates). This could lead to the suggestion that modelling for any given wind farm should be updated using more recent survey data if available (e.g. post-construction monitoring surveys). While the logic behind such a suggestion is reasonable (assessment should be based on the most up to date collision mortality), adopting this approach for extant wind farms would lead to the presence of multiple alternative collision mortalities which could generate considerable confusion for cumulative assessment purposes. The rationale for the proposed method

is that the primary basis (seabird activity) remains unchanged, with only the model and the wind farm parameters being modified. This would maintain the connection to the original mortality estimates rather than presenting entirely revised ones. In addition, if the above is questioned it would be worth stating that the aim of the update is not a wholesale re-evaluation of collision mortality but rather to ensure that existing estimates (as used in impact assessment) reflect realistic as-built wind farm designs rather than that for which consent was granted.

Overall, this ‘intermediate’ option represents a robust, transparent, straightforward approach for updating collision mortality for wind farms where the consented design has been modified. It is strongly recommended that this approach be adopted.

4.4 Potential additional CRM adjustments

In addition to the parameters included in the intermediate approach described above, there are two other components of collision mortality which could potentially be adjusted. Because each wind farm’s contribution to the cumulative total is independent of that from other wind farms, it is possible to apply adjustments separately to each site on the basis of the data available. Since the recommended CRM methods have changed through time, some adjustments may have already been incorporated into the original CRM at some wind farms, while for others the data required may not be readily available.

The following parameters are ones for which there may be benefit in applying adjustments, but this may not be necessary or possible for all wind farms.

- Avoidance rate;
- Proportion at collision height (PCH); and,
- Nocturnal activity.

4.4.1 Avoidance rate

As stated above, in the cumulative assessments presented for recent wind farm proposals the revised avoidance rates accepted for use by the Statutory Agencies (Cook et al. 2014) have been applied to update the previously reported mortalities. Nonetheless, as the intermediate method proposed will use the original mortality values as its starting point, this adjustment will still need to be included in the calculations. However, this is straightforward to implement and it is assumed this will be included.

4.4.2 Potential collision height

The proportion of birds estimated to be at collision height (PCH) will typically have been calculated from survey data for each wind farm, although in some instances generic estimates may have been used. Adjusting mortality for a change in PCH is straightforward (multiply by the ratio of original to updated PCH). In addition, the method used to estimate PCH from surveyed height bands is straightforward. However, the data used in these calculations have not always been provided in the wind farm assessments and thus re-calculation may not be possible. Although it would be preferable to be able to adjust PCH it may not actually vary very much between the original and actual turbine specifications. This is due to the fact that although changing to larger turbines raises the hub height and increases rotor radius, the lower rotor tip height generally remains unchanged (due to the

requirements imposed by shipping). Since seabird height distributions rarely extend beyond the upper rotor tip height (of even the smallest turbines) and the proposed CRM update is based on the assumption of a uniform height distribution (i.e. option 1), there is unlikely to be much change in PCH. Consequently it is proposed that adjustments for change in PCH are treated as an optional extra: if the necessary data are readily available this can be included with minimal time and cost implications, but if they are not this aspect can be omitted with little material effect on the outcome.

4.4.3 Nocturnal Activity

Adjusting mortality for changes in nocturnal activity factors is less straightforward than for the other components due to the fact the adjustment needs to be applied to each month separately (all other aspects can be applied irrespective of temporal unit, e.g. to annual or seasonal estimates). It is also complicated by the fact that current values have been set at precautionary levels by the Statutory Agencies. Any proposed revision to these values will require a sound evidence base and full engagement with the Statutory Agencies to ensure agreement and acceptance. Consequently the first step would be to undertake a review of the published seabird literature to derive evidence-based nocturnal activity estimates and get acceptance for the outputs from the Statutory Agencies. Using these revised values, a monthly species-specific adjustment could then be calculated for each wind farm (the ratio of the original total activity to the updated one) and used to update the original mortalities. An example of this approach is included in the technical reporting for the East Anglia THREE wind farm (MacArthur Green 2015a). The potential reduction in mortality from a reduction in nocturnal activity varies markedly through the year, with the biggest differences in winter. Therefore, for species which are most abundant (and hence at risk of collision) during the breeding season (e.g. kittiwake and gannet) the scope for reduction is relatively small (e.g. 5-10%), whereas for species which are more abundant in winter (e.g. great black-backed gull) the scope for reduction is larger (e.g. 25-30%). Thus, the species for which the gains would be greatest (e.g. large gulls in winter) are rarely the ones of primary concern during wind farm assessment (which tend to be species connected to SPA colonies). In addition, in winter the populations against which impacts are assessed are typically large relative to impacts, further reducing concerns. Consequently, due to the complications involved (the need to get stakeholder agreement on rates, update only possible for monthly mortality) and the smaller predicted gains in terms of species which are consenting risks, there is not considered to be sufficient justification for its inclusion in the current proposals.

4.5 Scope of Work A

As detailed above, the intermediate option represents the best combination of features (robust, cost-effective, high probability of acceptance, etc.) and therefore although the original work proposal was to produce a range of SoWs, targeting alternative options (basic, comprehensive, etc.) through the process of considering options it became clear that the intermediate option represents by far the most appropriate option. Consequently, and in agreement with TCE staff, the primary SoW proposed here just covers this option (hereafter SoW A).

Two components discussed above (section 4.4) have been considered as potential extensions to SoW A (adjusting for changes in avoidance rate and PCH). In recent cumulative assessments avoidance rates have been retrospectively updated for the higher avoidance rates now accepted by the Statutory Agencies. However, it is important that this is captured in the proposed work to ensure

it is included. In addition, including this as an input parameter in the spreadsheets will simplify application of any future updates.

Modifications for changes in PCH are comparatively straightforward and non-controversial, if the data are available. However, in most cases data availability is expected to prevent re-calculation. Consequently this aspect has been included as an optional addition to SoW A which can be undertaken if data permit but is not integral to the proposal. Because each wind farm will be evaluated independently these adjustments can be applied where possible, but if this can't be applied to any sites this does not detract from the overall benefit.

The method and data requirements for undertaking this revision of collision mortality are set out in section 4.3. Most of the necessary data for this are summarised in the output from the Coping Strategy project (the collision mortality database; these are summarised in Table 1). This would be the starting point for updating mortality using the proposed method (NB: sources are provided with these data in case it is necessary to check or confirm any parameters).

Table 1. Overview of data availability for SoW A, based on review of the CRM database (brackets refer to number of wind farms). *It should also be noted that the data summary only reflects the five species (gannet, kittiwake, herring gull, lesser black-backed gull and great black-backed gull) reviewed for the CRM database project.*

Input parameter	Availability of original (consented) value	Availability of updated (as-built) value (for operational and under construction WFs only)	Alternative data sources
Turbine number	All (52 of 52)	All (25 of 25)	
Rotor radius	Partial (48 of 52)	Partial (20 of 25)	Probably obtain missing values from developer or manufacturer.
Blade pitch	Partial (37 of 52)	None	This can either be assumed unchanged or obtained from manufacturer.
Blade width (or chord)	Partial (35 of 52)	Partial (18 of 25)	Probably obtain missing values from developer or manufacturer.
RPM	Partial (43 of 52)	Partial (19 of 25)	Probably obtain missing values from developer or manufacturer.
Annual mortality	Partial (42 of 52)	NA	
Seasonal mortality	Partial (13 of 52)	NA	
Monthly mortality	Partial (3 of 52)	NA	

The missing wind turbine data identified in Table 1 are expected to be relatively straightforward to obtain as all relate to the model specification which should be relatively easy to establish. The

annual, seasonal and monthly collision mortality estimates are likely to be more challenging to obtain. It should also be noted that the above mortality data summary only reflects the five species (gannet, kittiwake, herring gull, lesser black-backed gull and great black-backed gull) reviewed for the CRM database project. If other species (e.g. terns) are to be included then it will be necessary to review the relevant wind farm assessments. It is therefore anticipated that updating annual headroom can be undertaken for most wind farms with a modest amount of additional data collation, while that for seasonal or monthly headroom would require further document searches which could require several days of additional effort (note this has not been included in the breakdown for SoW A).

The primary deliverable would be a series of spreadsheets (one for each species considered). These would contain, for each wind farm, the consented values to be updated (i.e. mortality, relevant wind farm specifications and relevant seabird parameters) along with the revised ones reflecting the as-built wind farm. Using these data, the calculation defined in section 4.3 would be applied within the spreadsheet to give the revised mortality. The spreadsheet would be set out in a clear manner to enable subsequent revision to be applied, with comments as necessary. To facilitate subsequent updates, it would be advantageous to include all wind farms which could ultimately be considered (i.e. consented but not yet installed as well as constructed). This would then ensure the output was set up for straightforward revision as wind farm designs become fixed in the future.

A report would be required to accompany the spreadsheets, clearly stating the methods employed, assumptions made and clearly highlighting any specific issues.

The following time estimates (Table 2) have been based on the provision of the collision mortality database to the successful contractor and that five species will be included (gannet, kittiwake, herring gull, lesser black-backed gull, great black-backed gull). These have been identified on the basis of their relatively high collision risk and widespread distributions.

Table 2. Estimated tasks and time to undertake collision modelling update following the method outlined for SoW A (section 4.3).

No.	Task	Estimated time (days)
1	Review recent cumulative assessments to understand key constraints (species, protected sites, regions, etc.) for inclusion in headroom calculations	3
2	Set up and populate spreadsheets with relevant WF data (consented and as-built) from CRM database for each species	2
3	Populate spreadsheets with collision mortality for each species. Include monthly and annual estimates where available	1
4	Calculate updated collision mortality for each species at each WF	3
4a	<i>Calculate and apply PCH adjustment for WFs where data available</i>	1
5	Produce summary report detailing data sources, methods employed, assumptions illustrated with clear examples	2
6	Data QA	2
7	Report QA	0.5
8	Meetings (KO, Final)	1
9	Project Management	0.5
Total (inc. PCH option)		15 (16)

No expenses are predicted for this work as all meetings can be conducted remotely. WF = wind farm.

At a nominal average day rate for the appropriate staff level (senior to principal) of £500, SoW A represents a cost of approximately £7,500 - £8,000 (excluding VAT). Even if the time has been underestimated by as much as 30% this would only result in a total cost of approximately £11,000 (excluding VAT).

5. SPATIAL ASSIGNMENT OF CRM HEADROOM

5.1 Apportioning headroom gains to SPA populations

While tolerable mortality thresholds have not been set for any species it is clear that, in terms of cumulative effects, some species and populations are of greater concern to the Statutory Agencies than others (thereby implying these populations are nearer their acceptable thresholds). Indeed, the primary focus of attention during the impact assessments and the project examinations for most recent wind farm proposals has been in-combination collision mortality of individuals from SPA populations. This can be seen in relation to recent southern North Sea wind farm applications for which the focus of the assessments have been the breeding populations of gannet and kittiwake at the Flamborough and Filey Coast (FFC) pSPA. Thus it seems probable that acceptable thresholds will be reached first at the level of individual SPA populations (indeed this aspect contributed to the rejection of the Docking Shoal wind farm). It would therefore be beneficial to be able to estimate existing headroom (and any potential gains) at the level of individual SPA populations in order to understand and minimise the risks of future developments being refused on the grounds of collision mortality.

To do this, two related components are required for each wind farm; seasonal mortality and an estimate of species-specific connectivity with the SPA (these are related since connectivity varies by season). During the breeding season, apportioning mortality to an SPA population is relatively straightforward, using published foraging ranges to screen wind farms for inclusion. Allowance can also be made for multiple candidate SPAs on the basis of simple assumptions about distance and available foraging areas (e.g. SNH 2014).

Outside the breeding season it is necessary to consider migration routes and over-wintering areas, both of the focal (SPA) population and also from other breeding populations, since individuals from many colonies may pass through or over-winter in areas of proposed wind farm development. Examples of the application of this approach to wind farm assessments have been presented in recent wind farm applications (e.g. MacArthur Green 2015b) making use of data contained in Furness (2015).

It is therefore conceptually possible to estimate headroom for an SPA population in each biological season and assign this to defined spatial areas. However, the key period in all cases will be the breeding season, during which individuals are much more constrained by the need to return to their nest site. Outside the breeding season, the large areas over which birds spread, combined with mixing of individuals drawn from breeding populations distributed across wide areas, means that the impact on any individual SPA population is relatively much smaller.

For example, wind farms within a species' foraging range from an SPA typically have all of their breeding season mortality assigned to that SPA, while wind farms located beyond the foraging range do not contribute to the SPA breeding season total. However, if these latter wind farms are within the defined nonbreeding area for that species (e.g. the North Sea) they will contribute a small percentage (e.g. 5%) of their non-breeding season mortality to the SPA. Thus, an SPA species' headroom could be accounted for by a small number of developments within foraging range of the colony, or by a larger number of equivalent developments located within the defined non-breeding area.

The proportion of the annual mortality accounted for in the breeding season varies for different species. For example, in the East Anglia THREE gannet assessment, 80% of FFC pSPA gannet mortality was accounted for during the breeding season, while for kittiwake the equivalent figure was 46%. Thus, as a guide for identifying areas of relative consenting risk, assigning breeding season headroom to individual SPAs would be expected to be more useful for gannet, than for kittiwake.

Thus, while collision mortality impacts on SPA populations outside the breeding season should not be ignored, the impacts are generally smaller and can occur across much larger areas. Non-breeding season headroom maps would cover large areas but provide little indication of areas of high and low ornithological sensitivity. For these reasons, it is considered that the focus for spatial headroom assessment should be on the breeding season, as this would be a 'limiting factor' for any further offshore wind farm development.

During the breeding season seabirds may potentially forage over much larger areas (e.g. thousands of square kilometres) than individual wind farm developments. Therefore, maps of breeding season headroom based on foraging ranges would demarcate large areas as suitable for potential

development but would not identify areas of high and low sensitivity within them. However, by combining foraging ranges with other strategic environmental assessments such as the SeaMast spatial modelling (Bradbury et al. 2014), it would be possible to refine the large areas and identify potential development zones which minimise wildlife impacts. SeaMast outputs are plotted at a relatively fine scale when compared with potential seabird foraging areas (e.g. SeaMast resolution is 3x3km cells, while kittiwake have a mean maximum range of 60km, which from a colony located on a straight coastline would cover an area greater than 5,600km²). Therefore, overlaying a species' foraging range radius from an SPA on the SeaMast breeding season map will indicate relative bird density within the foraging radius and help direct planning in relation to headroom (although it should be noted that the SeaMast outputs were generated using data collected between 1979 and 2011, so these may indicate historical distributions).

It is also important to note that headroom (existing and increased through SoW A) and spatial areas will vary between species at each SPA. Since the focus of assessment for any particular wind farm will be on the species perceived to be closest to its tolerable threshold (albeit that thresholds are undefined), the above process would need to be conducted for all species of concern in order to derive a hierarchy of constraint across species. The limiting species would be expected to be the primary focus for any subsequent assessments and would dictate the scale of permissible development.

An indication of the potential generating capacity represented by the available headroom, expressed as individual mortality per MW of output, can be calculated as the current in-combination total mortality divided by the total current generating capacity of the wind farms within each species' foraging range. The potential extra generating capacity represented by the headroom can then be calculated (headroom divided by mortality per MW). It would also be important to make allowance for the fact that not all SPA mortality occurs during the breeding season (i.e. not all the headroom is 'available' for wind farms within the breeding season foraging range).

A proposal for spatially refining breeding season headroom to SPA populations is described below (SoW B). This requires the outputs from SoW A with which it could be included, or it could be undertaken separately following completion of SoW A.

5.2 Scope of Work B

As discussed in section 5.1, assigning mortality from individual wind farms to specific SPA populations requires consideration of biological seasons and connectivity. These aspects are less clearly defined than the parameters used in the collision model which would be updated under SoW A, therefore there is more scope for alternative interpretation and discussion. While an outline approach for assigning headroom to SPA populations has been developed and is presented below (Table 3), this is intended to be less prescriptive than that for SoW A to encourage prospective tenderers to submit proposals with alternative options for how this could be approached. The tasks and time estimates are therefore intended to provide an indication for this scope. It should also be noted that this work would involve elements of expert judgement, so additional effort could be required to ensure the evidence base is accepted by Statutory Agencies (if this is considered to be necessary).

Deliverables would be spreadsheets detailing (for each SPA-species combination) the indicative breeding season headroom, a report detailing the methods and assumptions, plots of each species-SPA foraging range on maps of respective SeaMast outputs and a guide to how the SeaMast plots can be used with the estimated headroom (and optional MW outputs) to identify areas most suitable for further development.

Table 3. Estimated tasks and time to assign collision headroom to SPA breeding populations following the method outlined for SoW B (section 5.2).

No.	Task	Estimated time (days)
1	Determine and agree list of species-SPA populations to be assessed (current estimate based on up to 10 SPAs and up to 3 species assessed at each).	1.5
2	Review recent EIA and HRA in-combination totals for agreed species-SPA combinations and calculate proportion of annual mortality occurring in breeding season.	2.5
3	Calculate headroom for each species-SPA combination: identify wind farms within foraging range, tabulate breeding season mortality values from original wind farm assessments and updated values (i.e. outputs from SoW A).	2.5
4	Plot each species-SPA foraging range on maps of respective SeaMast outputs	2
4a	<i>Calculate current mortality per MW and potential additional MW represented by headroom within each species-SPA foraging range.</i>	2
5	Produce report detailing methods, assumptions and guidance on interpretation of headroom and SeaMast plots. Spreadsheet outputs and GIS figures.	5
6	Meetings (KO, Final)	1
7	QA	1.5
8	Project Management	0.5
Total (inc. MW output option)		16.5 (18.5)

No expenses are predicted for this work as all meetings can be conducted remotely.

At a nominal average day rate for the appropriate staff level (senior to principal) of £500, SoW B represents a cost of approximately £8,250 to £9,250 (excluding VAT). Even if the time has been underestimated by as much as 30% this would only result in a total cost of approximately £12,000 (excluding VAT). Note that while it has been assumed that SoW B would be undertaken after completion of SoW A, thereby making use of the updated headroom estimate from SoW A, the steps involved could be performed using the original (i.e. current) mortalities and subsequently updated if necessary.

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