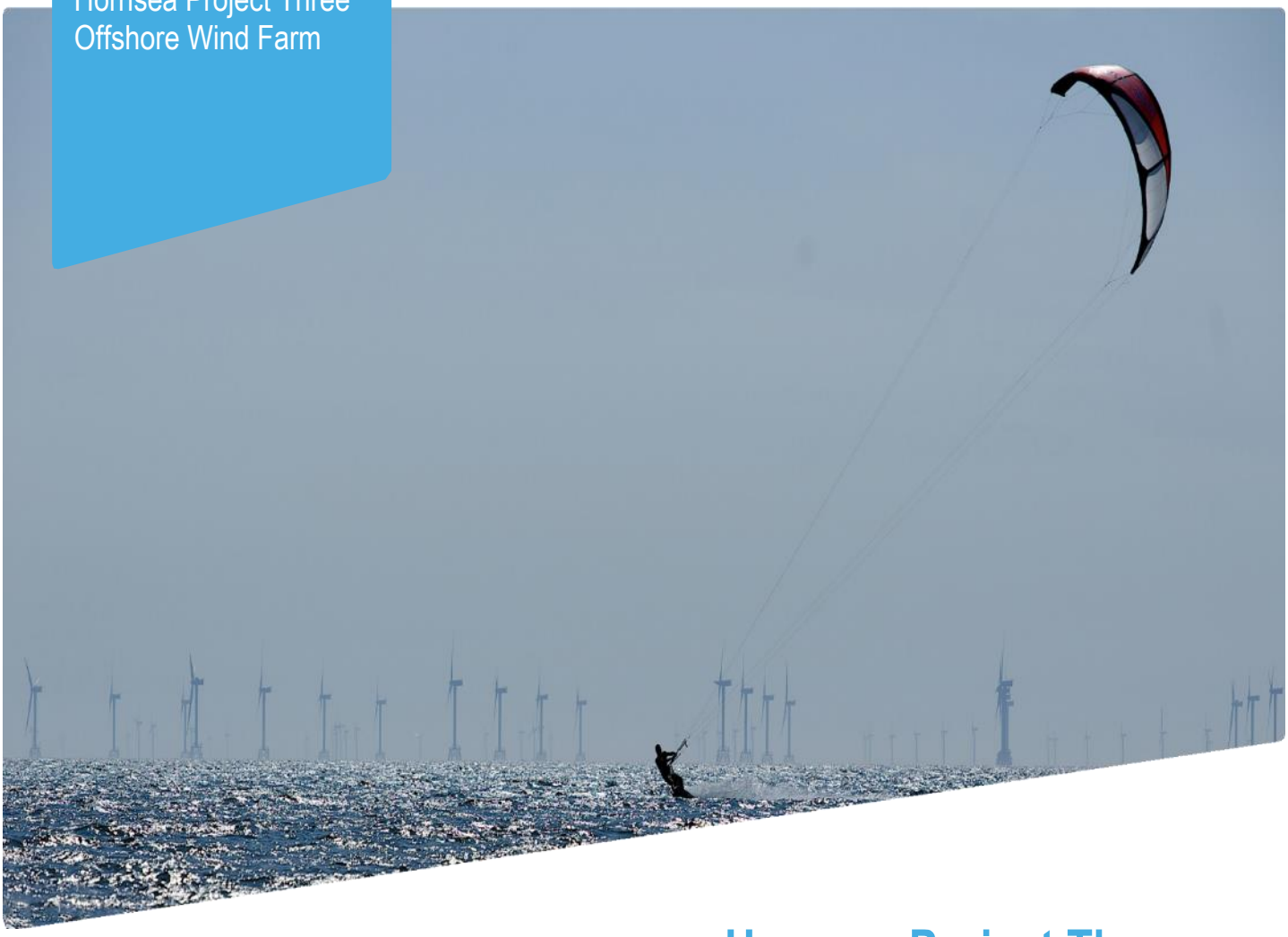
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Statement of Common Ground between Orsted Hornsea Project Three (UK) Ltd and Norfolk Vanguard Ltd and Norfolk Boreas Ltd
Hornsea Three Deadline 9

Date: March 2019

Hornsea 3
Offshore Wind Farm

Ørsted

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Ørsted

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Front cover picture: Kite surfer near a UK offshore wind farm © Ørsted Hornsea Project Three (UK) Ltd., 2019.

Revision History

Version	Date	Author	Context
1	8th October 2018	Orsted	1st draft discussion
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1. Introduction

Overview

1.1 This Statement of Common Ground (SoCG) has been prepared by Hornsea Project Three (UK) Ltd ('the Applicant'), Norfolk Vanguard Limited and Norfolk Boreas Limited (jointly), together 'the parties', as a means of clearly stating the areas of agreement, and any areas of disagreement, between the parties in relation to the proposed Development Consent Order (DCO) application for the Hornsea Project Three offshore wind farm ('the Project').

1.2 The Applicant is committed to working with Norfolk Vanguard Limited and Norfolk Boreas Limited and the parties are in regular contact at all levels of Hornsea Three. The parties have sought, and will continue to seek, to liaise on environmental matters both through the Examination of each project and as part of any future delivery of these nationally significant infrastructure projects.

Approach to SoCG

1.3 This SoCG has been developed based on the Relevant Representation submitted by Norfolk Vanguard Limited and Norfolk Boreas Limited [RR-102 and RR-100]. The structure of this SoCG is as follows:

- Section 1: Introduction;
- Section 2: Cumulative Impact (between Hornsea Three and the proposed Norfolk Vanguard offshore wind farm (NV) and between Hornsea Three and the proposed Norfolk Boreas offshore wind farm (NB) (where presented in the NV application); and
- Section 3: Electro-Magnetic Fields;
- Section 4: Design Interaction and Co-Operation Agreement; and
- Section 5: Compulsory Acquisition.

1.4 It is the intention that this document will help give the Examining Authority (Ex.A) an early sight of the level of common ground between both parties from the outset of the examination process.

Hornsea Three

1.5 Hornsea Three is a proposed offshore wind farm located in the southern North Sea and will include all associated offshore (including up to 300 turbines) and onshore infrastructure.

1.6 The key components of Hornsea Three include:

- Turbines and associated foundations;
- Turbine foundations;
- Array cables;
- Offshore substation(s), and platform(s) and associated foundations;
- Offshore accommodation platform/s and associated foundations;
- Offshore export cable/s;
- Offshore and/or onshore High Voltage Alternating Current (HVAC) booster station/s (HVAC transmission option only);
- Onshore export cables; and
- Onshore High Voltage Direct Current (HVDC) converter/HVAC substation.

1.7 The Hornsea Three array area (i.e. the area in which the turbines are located) is approximately 696 km^2 and is located approximately 121 km northeast off the Norfolk coast and 160 km east of the Yorkshire coast.

1.8 The Hornsea Three offshore cable corridor extends from the North Norfolk coast, offshore in a north-easterly direction to the western and southern boundary of the Hornsea Three array area. The Hornsea Three offshore cable corridor is approximately 163 km in length.

1.9 From the Norfolk coast, underground onshore cables will connect the offshore wind farm to an onshore HVDC converter/HVAC substation, which will in turn, connect to an existing National Grid substation. Hornsea Three will connect to the Norwich Main substation, located to the south of Norwich. The Hornsea Three onshore cable corridor is approximately 55 km in length at its fullest extent.

Norfolk Vanguard

1.10 NV is a proposed offshore wind farm located in the southern North Sea and will include all associated offshore (including up to 200 turbines) and onshore infrastructure.

The key offshore components of NV include:

- Wind turbines with an export capacity of up to 1800MW;
- Offshore electrical platforms;
- Accommodation platforms;
- Met masts;
- Measuring equipment (LiDAR and wave buoys);
- Array cables;
- Interconnector cables; and
- Export cables.

The key onshore components include:

- Landfall;
- Onshore cable route, accesses, trenchless crossing technique (e.g. Horizontal Directional Drilling (HDD)) zones and mobilisation areas;
- Onshore project substation; and
- Extension to the Necton National Grid substation and overhead line modifications.

1.11 NV comprises two distinct areas, NV East and NV West, which are located in the southern North Sea, approximately, 70km and 47km from the coast of Norfolk respectively (at the nearest points).

1.12 NV East area is 297km^2 and 70km to shore (closest point of the site to the coast) and NV West area is 295km^2 and 47km to shore.

1.13 The offshore wind farm would be connected to the shore by offshore export cables installed within the offshore cable corridor from the wind farm to a landfall point at Happisburgh South, Norfolk. From there, onshore cables would transport power over approximately 60km to the onshore project substation near Necton, Norfolk.

1.14 As part of the NV DCO application, Norfolk Vanguard Limited is also seeking to obtain consent to undertake some works for the NB project, these include:

- Installation of ducts to house the NB cables along the entirety of the onshore cable route from the landward side of the transition pit at the landfall to the onshore project substation; and
- Overhead line modifications at the Necton National Grid substation for both projects.

1.15 NV will only deploy HVDC technology.

Norfolk Boreas

1.16 The development area for the 1.8GW Norfolk Boreas Offshore Wind Farm (NB) is located adjacent to the NV project area, it covers 725km^2 and is approximately 73km from shore at its nearest point. The timeline for NB is approximately one year behind NV and the aim is to share a common route for the underground electrical connection from landfall at Happisburgh to the National Grid substation near Necton.

1.17 Based on this, and as noted in paragraph 1.13 above, Norfolk Vanguard Limited is seeking to obtain consent to undertake some onshore works for NB within the NV DCO application (application reference no. EN010079). In this regard, NB could be delivered in two scenarios:

- Scenario 1: NV consents and constructs transmission infrastructure which would be used by NB. This includes, cable ducts and overhead line modification at the Necton National Grid substation; or
- Scenario 2: NV is not constructed and therefore NB consents and constructs all required project infrastructure including cable ducts, extension to the Necton National Grid Substation, overhead line modification and any landscape and planting schemes.

1.18 NB will also only deploy HVDC technology.

Physical Overlap between the Parties

1.19 Figure 1 shows the geographic extent of Hornsea Three, NV (EN010079) and NB, including the point of onshore cable overlap near Reepham as well as the access routes associated with the Main Construction Compound for Hornsea Three, and the cable logistics areas proposed by NV and NB at The Street, Oulton.

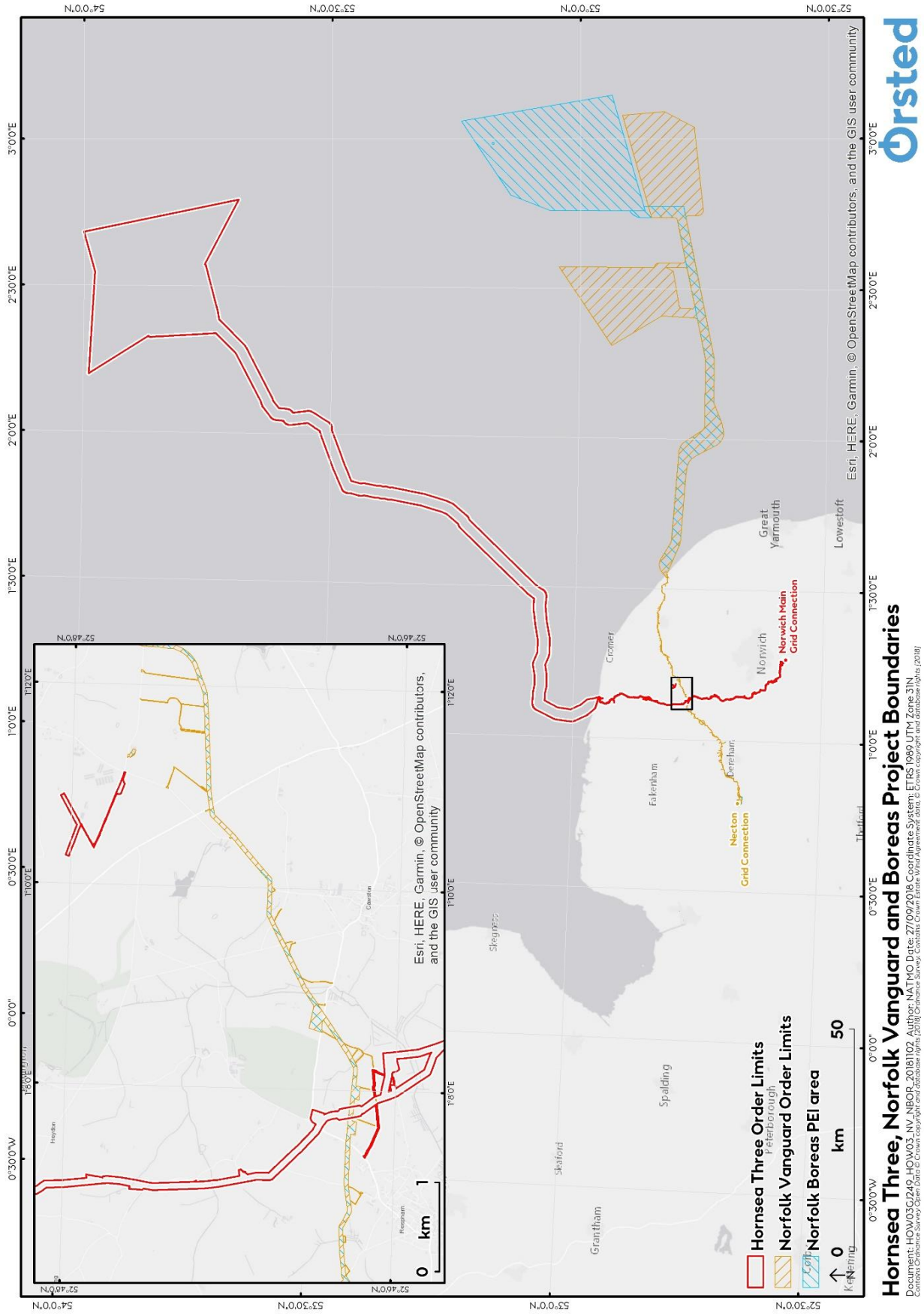


Figure 1 – Hornsea Three, NV and NB (PEI) Project Boundaries

2. Cumulative Assessment

2.1 Section 2 provides a summary of the cumulative assessment approach and conclusions as reported in the Hornsea Three and NV applications (application reference no. EN010079).

Cumulative Assessment Approach

Hornsea Three

2.2 Hornsea Three's approach to Cumulative effects assessment is documented in Volume 1, Chapter 5, Section 4 of the Environmental Impact Assessment Methodology [APP-060]. The Cumulative Effect Assessment (CEA) considers the likely effects arising from Hornsea Three alongside the likely effects of other development activities in the vicinity of Hornsea Three, based on the information available.

2.3 Hornsea Three adopted a tiered approach to its cumulative assessment in line with standard industry practice and in accordance with The Planning Inspectorate Advice Note Nine and its complementary guidance in Advice Note 17. In the case of NV (application reference EN010079), this has been included in the CEA (Tier 3 development) for Hornsea Three due to the fact that the project remained 'in planning', and at the time of writing the ES was typically reliant upon material presented during NV PEIR.

2.4 In line with the RenewableUK Cumulative Impact Assessment Guidelines for offshore wind farms (RenewableUK, 2013), the cumulative assessment of other North Sea Round 3 developments has taken an approach that attempts to incorporate an appropriate level of pragmatism. This is demonstrated in the confidence levels applied to various developments, particularly those that were known at the point of the submission of Hornsea Three but at that time lacked detailed project application documentation, such as NB, which at the time of preparation of the Hornsea Three application was at scoping stage. NB has only been considered for CEA only in those chapters where it is considered that the Scoping Reports contain sufficient detail with which to undertake a meaningful assessment.

2.5 Whilst the Tier 3 assessment presents information publicly available at the time of preparation of the Hornsea Three application, the data necessary to undertake a full assessment of impacts for some topics, taking into account NV, was not publicly available at the point of submission of the application for Hornsea Three. Since submission of the NV application, the Applicant has undertaken an assessment of in combination effects of the NV as submitted (as opposed to PEIR). This assessment does not form part of this SoCG (but will be made available to all Interested Parties as part of the Applicants response to Examiners First Written Question 1.15.3).

2.6 In addition, Hornsea Three has considered experience from other projects located within the former Hornsea Zone through work undertaken for Hornsea One, Hornsea Two, its other projects in operation, construction and development and those by other developers across the wider southern North Sea; and other UK projects.

Norfolk Vanguard (EN010079)

2.7 NV approach to cumulative effects assessment is documented in Chapter 32 Offshore Cumulative and Transboundary Impacts and Chapter 33 Onshore Cumulative Impacts.

2.8 Offshore, the scope of the CIA (in terms of relevant issues and projects) has been established with consultees (including through the Evidence Plan Process and liaison with other developers) as the EIA has progressed, this is also detailed in Chapter 6 EIA Methodology and in each offshore technical chapter (chapters 8-18). Norfolk Vanguard Limited has taken advice and guidance from various sources to inform the CIA. The CIA also draws from findings of earlier studies undertaken to inform the East Anglia Zonal Environmental Appraisal (ZEA) (EAOW, 2012a) which considered cumulative impacts arising from the development of the whole former East Anglia Zone.

2.9 In addition, Norfolk Vanguard Limited has considered experience from other projects located within the former East Anglia Zone through work undertaken for East Anglia ONE (EAOW, 2012b) and East Anglia THREE (EATL, 2015); the wider southern North Sea; and other UK projects.

2.10 In accordance with The Planning Inspectorate Advice Note Nine and its complementary guidance in Advice Note 17, Norfolk Vanguard Limited has considered plans and projects in the CIA based on a tiered approach, based on the development status of other projects and the availability of information for each project to enable further assessment.

2.11 In line with the RenewableUK Cumulative Impact Assessment Guidelines for offshore wind farms (RenewableUK, 2013), the cumulative assessment of other North Sea Round 3 developments has taken an approach that attempts to incorporate an appropriate level of pragmatism. This is demonstrated in the confidence levels applied to various developments, particularly those that are known but currently lack detailed project application documentation, such as those projects at the scoping stage only. These projects have been considered for CIA only in those chapters where it is considered that the Scoping Reports contain sufficient detail with which to undertake a meaningful assessment.

2.12 In the case of the Hornsea Three this has been included in the NV CIA as Tier 5 development, following the suggested approach in JNCC and Natural England (2013). At the time of the NV DCO submission, all the data necessary to undertake a CIA for some topics, taking into account Hornsea Three (and vice versa), was not publicly available (only that typically presented in the PEIR for the project), and assumptions had to be made, such as the approach Hornsea Three would take to mitigate certain impacts.

2.13 In response to the Section 51 Advice from The Planning Inspectorate, Norfolk Vanguard Ltd have submitted an updated Offshore Ornithology CIA in the Response to Section 51 Advice which was accepted by The Planning Inspectorate on 15 October 2018. This document provides a summary of the updated cumulative totals and impact significance reflecting the final DCO submissions for Hornsea Three and Thanet Extension Offshore Wind Farm.

2.14 Onshore, the key aim of the CIA for NV was to assess whether impacts on a receptor may occur on a cumulative basis between NV and other projects, activities and plans (either consented or forthcoming) in the onshore study area.

2.15 The scope of the CIA (in terms of relevant issues and projects) has been established with consultees (including other developers) as the EIA has progressed, this is also detailed in Chapter 6 EIA Methodology and in each onshore technical chapter (chapters 19-32) of the Environmental Statement. Norfolk Vanguard Limited has followed relevant advice and guidance from various sources to inform the CIA.

2.16 The final submissions of both Hornsea Three and Thanet Extension have been reviewed by Norfolk Vanguard Limited for all EIA topics to consider any differences to their PEIR, and potential implications on NV CIA assumptions. With the exception of potential cumulative traffic and transport impacts between Hornsea Three and NV (discussed in detail in Table 2) no other areas were identified that would require any further update by Norfolk Vanguard Limited.

Update: 13th March 2019

2.17 Updated construction traffic numbers and an associated cumulative impact assessment for Hornsea Three have been submitted to the Hornsea Three Examination (11th February 2019). The submission of this information is allowing NV to also progress the cumulative impact assessment work for NV along road links shared by both projects.

2.18 The NV cumulative traffic impact assessment (taking into account Hornsea Project Three updated traffic numbers) will be submitted to the NV examination at Deadline 5 (20th March 2019) and will also take into account any associated cumulative noise and vibration and air quality impacts. NV is reviewing the mitigation schemes proposed by Hornsea Three along The Street at Oulton and the B1145 at Cawston. Further engagement has been undertaken by both projects with Norfolk County Council to inform the scale and extent of the mitigation schemes for each project alone and both projects cumulatively. The scale of any mitigation required by NV will be captured within an update to the NV outline TMP.

Summary of Cumulative Assessment Conclusions

2.19 **Table 1** documents those topic chapters where the potential cumulative impact as a result of Hornsea Three, NV (EN010079) and NB in combination has been considered in the Hornsea Three application and the NV application.

Table 1 - Summary of Hornsea Three, NV and NB as they conclude on the other project

Assessment	Hornsea Three CEA of NV (EN010079)	NV (EN010079) CIA of Hornsea Three	Hornsea Three CEA of NB
Offshore			
Benthic Ecology	NV scoped out	HOW03 scoped out	CEA anticipated not to be required due to geographical difference
	No cumulative effects identified.	No long term cumulative effects identified.	
Marine Processes	NV scoped out	HOW03 scoped out	CEA anticipated not to be required due to geographical difference
	No cumulative effects identified.	No long term cumulative effects identified.	
Fish and Shellfish	NV scoped out	CEA considered.	CEA anticipated not to be required due to geographical difference
	Cumulative effects scoped out.	No significant cumulative effects identified.	No long term cumulative effects identified.
	CEA considered.	CIA considered.	No long term cumulative effects identified.

Assessment	Hornsea Three CEA of NV (EN010079)	NV (EN010079) CIA of Hornsea Three	Hornsea Three CEA of NB
Marine Mammals	The main potential cumulative effects are predicted to occur during periods of overlapping piling where increased anthropogenic noise is highest, and these are the projects that are assessed quantitatively in the CEA, where possible and appropriate. CEA as a whole, it is predicted that the sensitivity of harbour porpoises to disturbance is considered to be medium and the magnitude of all Tier 1 disturbance is deemed to be low. The effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.	The CIA considers potential cumulative effects of underwater noise, changes to prey availability and vessel collision risk. The Site Integrity Plan and Marine Mammal Mitigation Protocol will provide appropriate frameworks for agreeing mitigation measures with the relevant Statutory Nature Conservation Bodies (SNCBs) and the MMO post-consent to ensure the potential cumulative impacts of construction noise, including piling, are not significant (negligible or minor).	
Ornithology	CEA considered.	CIA considered.	CEA considered.
	CEA as a whole - potential significant cumulative effects identified during O&M for displacement and collision of seabirds. No (potential) significant cumulative effects identified when just comparing Hornsea Three, NV or NB.	No significant cumulative effects identified. In response to the Section 51 Advice from The Planning Inspectorate, Norfolk Vanguard Limited has submitted an updated Offshore Ornithology CIA in the Response to s51 Advice. This document provides a summary of the updated cumulative totals and impact significance reflecting the final DCO submissions for Hornsea Three and Thanet Extension Offshore Wind Farm. While there have been minor changes to the cumulative totals due to differences in the predicted impacts presented in the ESs for both the Hornsea Three and Thanet Extension wind farms (compared with those in the project's PEIRs), overall these changes do not affect the cumulative impact significance presented in the NV ES.	No long term cumulative effects identified.
Commercial Fisheries	CEA considered.	CIA considered.	CEA considered.
	The plans and projects included in Tier 3 are not considered to raise the cumulative effect beyond that assessed for the Tier 2 assessment for all fishing fleets. The significance of effect is therefore moderate adverse for demersal trawling fleets, which is significant in EIA terms and minor for all other fleets, which is not significant in EIA terms.	No significant cumulative effects identified.	No long term significant cumulative effects identified.
Shipping and Navigation	CEA considered.	CIA considered.	CEA considered.
	No significant cumulative effects identified.	No long term significant cumulative effects identified.	
Aviation, Military and Communication	CEA considered.	CIA considered.	CEA considered.
	No significant cumulative effects identified.	No long term significant cumulative effects identified.	
Marine Archaeology	NV scoped out	CEA considered. (Note: differences due to assessment approach adopted by NV and the scoping in of all projects within 100km to allow the assessment of setting and the perceptual values associated with the historic seascape character).	CEA not considered to be required due to geographical difference.
	No significant cumulative effects identified.	No long term significant cumulative effects identified.	
	CEA considered.	HOW03 scoped out	CEA considered.

Assessment	Hornsea Three CEA of NV (EN010079)	NV (EN010079) CIA of Hornsea Three	Hornsea Three CEA of NB
Infrastructure and other users	No significant cumulative effects identified.	Cumulative effects scoped out.	No long term significant cumulative effects identified.
Seascape and Visual Resources	CEA considered.	HOW03 scoped out	No long term significant cumulative effects identified.
	No significant cumulative effects identified.	Cumulative effects scoped out.	
Onshore			
Geology and Ground conditions	CEA considered.	CEA considered.	CEA considered as part of NV (EN010079).
	No significant cumulative effects identified.		
Hydrology and Flood Risk	CEA considered.	CEA considered.	CEA considered as part of NV (EN010079).
	No significant cumulative effects during construction, operation and maintenance, or decommissioning as a result of Hornsea Three, NV and NB in-combination, due to limited land take at point of cross over.	Hornsea Three will result in the direct disturbance of surface watercourses in the Blackwater Drain, River Wensum and River Bure catchments, all of which will also be impacted by NV and NB. In addition, these projects could potentially alter surface runoff and groundwater flows where permanent infrastructure overlaps. Hornsea Three will adopt a similar suite of mitigation measures as NV and NB to minimise disturbance of the river channel, and maintain river flows, sediment transport, and minimise flood risk. This would limit further impacts to a negligible magnitude. As such, impacts will be no greater than those identified for each individual project. No significant cumulative effects identified.	See Hornsea Three CEA of NV (EN010079) column
Ecology and Nature Conservation	CEA considered.	CIA considered.	CEA considered as part of NV (EN010079).
	No significant cumulative effects during construction, operation and maintenance, or decommissioning as a result of Hornsea Three, NV and NB in-combination, due to limited land take at point of cross over.	Ecological features identified with potential cumulative effects where the projects overlap is limited to hedgerows and cereal field margins. The scale of these effects is no greater than each project alone and represents a negligible cumulative magnitude of effect. The hedgerows in this location were not identified as important bat foraging / commuting features. The River Wensum SAC will be crossed by all three projects, However, the crossing points on the Wensum are 10km apart and in addition the projects have committed to trenchless crossings. With these commitments in place cumulative impacts are unlikely to occur. No significant cumulative effects identified.	See Hornsea Three CEA of NV (EN010079) column
	CEA considered.	CIA considered.	CEA considered as part of NV (EN010079).

Assessment	Hornsea Three CEA of NV (EN010079)	NV (EN010079) CIA of Hornsea Three	Hornsea Three CEA of NB
Landscape and Visual	No significant cumulative effects identified as a result of Hornsea Three, NV and NB in-combination, due to geographical separation and or the short-term duration.	The construction of the NV onshore cable route in addition to the Hornsea Three onshore cable route would have a short term significant cumulative effect on the views of walkers on an approximate 200m section of Marriott's Way, but would not have significant effects on the remaining parts of this route or on any other landscape or visual receptors. It is assumed that Hornsea Three would implement similar mitigation measures following construction of their onshore cable route and associated infrastructure, including re-establishment of hedgerows where removals had occurred and the reinstatement of the agricultural land. Overall, no significant cumulative effects identified.	See Hornsea Three CEA of NV (EN010079) column
Historic Environment	CEA considered.	CIA considered.	CEA considered as part of NV (EN010079).
	Minor to Moderate Adverse effects from the construction phase due to potential for cumulative permanent loss of or damage to, buried archaeological remains result in temporary cumulative effects on the historic landscape or settings of heritage assets including SMs, listed buildings, Conservation Areas and Registered Parks and Gardens. Minor to Moderate Adverse effects during the operation and maintenance phase due to potential for cumulative effects on the historic landscape or settings of heritage assets including SMs, listed buildings, Conservation Areas and Registered Parks and Gardens. These cumulative effects are primarily as a result of Hornsea Three effects as opposed to the in combination effects of Hornsea Three, NV and NB. This is due to limited land take at the point of cross over and geographical separation of the above ground infrastructure. No significant cumulative effects during operation and maintenance, or decommissioning.	Due to the geographical overlap between the NV, NB and Hornsea Three projects, there is the potential for direct cumulative impacts upon both above ground and buried archaeological remains. Hornsea Three is anticipated to adopt similar mitigation strategies as NV which will seek to avoid, reduce or offset direct impacts upon both buried and above ground archaeological remains. Such strategies if implemented effectively are considered highly likely to reduce (or offset) the impact significance to a level(s) considered non-significant in EIA terms. No significant cumulative effects identified.	See Hornsea Three CEA of NV (EN010079) column
	CEA considered.	CIA considered.	CEA considered as part of NV (EN010079).

Assessment	Hornsea Three CEA of NV (EN010079)	NV (EN010079) CIA of Hornsea Three	Hornsea Three CEA of NB
Land Use and Recreation	No significant cumulative effects on Agricultural Land Classification or PRoW and other linear routes during construction, operation and maintenance, or decommissioning due to limited land take at point of cross over and proposed mitigation measures.	Due to geographical overlap between the NV project and NB and Hornsea Three there is the potential for direct cumulative impacts upon drainage systems during construction. However, both NB and Hornsea Three are anticipated to adopt mitigation strategies which will seek to avoid, reduce or offset the effects of direct impacts upon drainage. For the NV project, these strategies include a specialist drainage contractor to locate and draw plans of drainage systems, pre-construction Drainage Plan, the temporary damming, culverting or diversion, and installing cables at a depth where they will be laid below the level of typical field drainage pipes to minimise impacts and interaction, which is expected will reduce cumulative impacts to non-significant. No significant cumulative effects identified.	See Hornsea Three CEA of NV (EN010079) column
Traffic and Transport	CEA considered.	CIA considered.	CEA considered as part of NV (EN010079).
	No significant cumulative effects as a result of Hornsea Three, NV and NB in-combination during construction, operation and maintenance, or decommissioning (based on PEIR traffic flows).	There are no significant traffic impacts associated with NV alone (or in combination with NB) on any of the road links that would be shared with Hornsea Three. However, NV has been unable to complete a cumulative impact assessment with Hornsea Three to date due to differences in the ways traffic has been distributed across the road network by both projects. NV anticipate that there may be cumulative impacts on a small number of shared road links and discussions between Hornsea Three and NV are progressing to allow NV to complete that exercise.	See Hornsea Three CEA of NV (EN010079) column
	Refer to subsequent commentary regarding traffic and transport generation in Table 2		
Noise and Vibration	CEA considered.	CIA considered.	CEA considered as part of NV (EN010079).
	No significant cumulative effects as a result of Hornsea Three, NV and NB in-combination during construction, operation and maintenance, or decommissioning.	There is the potential for construction traffic across the three projects to lead to cumulative noise and vibration impacts where the same road links are used. NV anticipates that similar best practice mitigation measures will be implemented by Hornsea Three to reduce construction traffic noise and vibration impacts, and that there would be no additional construction noise impact (along shared road links) compared to NV alone. No significant cumulative effects identified. Traffic related noise and vibration cumulative effects are being revisited - refer to Table 2.	See Hornsea Three CEA of NV (EN010079) column
Air Quality	CEA considered.	CIA considered	CEA considered as part of NV (EN010079).

Assessment	Hornsea Three CEA of NV (EN010079)	NV (EN010079) CIA of Hornsea Three	Hornsea Three CEA of NB
	No significant cumulative effects as a result of Hornsea Three, NV and NB in-combination during construction, operation and maintenance, decommissioning.	A number of shared road links are anticipated to experience cumulative construction traffic. However, pollutant concentrations at all receptors are below the relevant air quality objectives. Air quality impacts may also occur where the cable routes overlap. NV anticipates that similar best practice mitigation measures will be implemented by Hornsea Three to reduce construction air quality impacts, and that there will be no additional impacts compared to NV alone. No significant cumulative effects identified. For traffic related air quality refer to Table 2.	See Hornsea Three CEA of NV (EN010079) column
Socio economics	CEA considered.	CIA considered.	CEA considered as part of NV (EN010079).
	Significant beneficial cumulative effect from the cumulative impact of construction of Hornsea Three on access to construction-related employment and operations (across Greater Anglia and Humber regions) when considered together with the construction and operation of other planned nearby wind farm projects.	Assuming that the labour market develops following investment in response to the pipeline of projects, this may lead to minor to major cumulative beneficial impacts on the labour market associated with the construction and operation of multiple wind farms within the New Anglia LEP. Significant beneficial cumulative effect identified.	See Hornsea Three CEA of NV (EN010079) column

2.20 **Table 2** documents those chapters where the potential cumulative effects between Hornsea Three, NV and NB are being considered further by Hornsea Three and NV. Notwithstanding the position reached on these matters, the parties reserve the right to make further representations throughout the forthcoming examination period.

Table 2 – Status of further consideration between Hornsea Three and NV

Assessment	Further Consideration of Effects
Offshore	
Benthic Ecology	On the basis that cumulative effects have been scoped out, or where CEA has not identified any significant cumulative effects – it is agreed that no further consideration of these effects necessary at this time.
Marine Processes	
Fish and Shellfish	
Ornithology	
Commercial Fisheries	
Shipping and Navigation	
Aviation, Military and Communication	
Marine Archaeology	On the basis that cumulative effects have been scoped out, or where CEA has not identified any significant cumulative effects – it is agreed that no further consideration of these effects necessary at this time.
Infrastructure and other users	
Seascape and Visual Resources	
"In-combination" Report to Inform Appropriate Assessment	

Assessment	Further Consideration of Effects
Marine Mammals	NV's position is that cumulative effects would be reconsidered prior to construction to allow appropriate mitigation measures for underwater noise effects on the Southern North Sea cSAC to be agreed through the Site Integrity Plan. As noted in Table 1, the Site Integrity Plan and Marine Mammal Mitigation Protocol for NV will be updated post-consent in discussion with the relevant SNCBs and the MMO to reflect actual build-out scenarios and current best practice to ensure the potential cumulative impacts of construction noise, including piling, are not significant.
Onshore	
Geology and Ground conditions	On the basis that cumulative effects have been scoped out, or where CEA has not identified any significant cumulative effects – it is agreed that no further consideration of these effects is necessary at this time.
Hydrology and Flood Risk	
Ecology and Nature Conservation	
Landscape and Visual	
Historic Environment	For Hornsea Three, potential significant cumulative effects from construction works could result in cumulative permanent loss of or damage to, buried archaeological remains and result in temporary cumulative effects on the historic landscape, settings of heritage assets including Scheduled Monuments, listed buildings, Conservation Areas and Registered Parks and Gardens. These cumulative effects are primarily as a result of Hornsea Three effects as opposed to the in-combination effects of Hornsea Three, NV and NB. This is due to limited land take at the point of cross over and geographical separation of the above ground infrastructure. It is agreed that no further consideration of these effects is necessary at this time.
Land Use and Recreation	On the basis that CEA has not identified any significant cumulative effects – it is agreed that no further consideration of these effects is necessary at this time.
Traffic and Transport	Both parties have undertaken a cumulative impact assessment and concluded that, with the design-in mitigation proposed (including those set out within the relevant traffic management plans), no significant cumulative effects relating to traffic and transport would occur. There has been extensive consultation with Norfolk County Council and other relevant stakeholders (including Cawston Parish Council) in regard to a highways mitigation scheme to address cumulative impacts along The Street, Oulton and the B1145, Cawston. An outline scheme for both locations has been agreed in principle with Norfolk County Council. Both projects have committed to the implementation of the outline scheme at The Street, Oulton, which would be sufficient to mitigate impacts for either Hornsea Three alone, Norfolk Vanguard alone, or for both projects together. Norfolk Vanguard are undertaking a review of the proposed scheme at the B1145, Cawston to also confirm it is sufficient to mitigate impacts for either Hornsea Three alone, Norfolk Vanguard alone, or for both projects together, with a view to also adopting those measures. All of the identified measures to mitigate cumulative construction traffic impacts on shared road links will be captured in each projects Outline (Construction) Traffic Management Plan. In addition to the outline mitigation schemes, it has been agreed for three specific links, the cumulative traffic effects from Hornsea Three and Norfolk Vanguard should be monitored to ensure construction traffic levels are not exceeded in the event of the two projects running simultaneously. The links and maximum cumulative traffic levels not to be exceeded without a full IEMA Transport Environmental Link Assessment and agreement with the HAs and incorporated into the detailed CTMPs are defined below; - Link ID 89: B1145 through Cawston - 668 two way movements per day, of which up to 271 can be HGVs; - Link ID 59: B1149 Edgefield to Heydon - 515 two-way total movements per day, of which up to 337 can be HGVs; and - Link ID 208: The Street, Oulton 424 two way movements per day, of which up to 214 can be HGVs. The relevant management plan for each project (e.g. Outline CoCP, Annex A: Framework Communication Plan, and Outline CTMP for Hornsea Three and Outline CoCP and Outline TMP for Norfolk Vanguard) will set out the process of continued engagement between both parties and the Local Highway Authority. This will ensure that as construction programmes are refined post-consent, this information is regularly shared between parties, particularly traffic demand on shared road links. This will ensure that commitments to manage cumulative construction traffic demand are fully delivered; for example, on a given road the two projects may have committed to programme works that ensure each scheme's peak traffic does not overlap. Regularly programmed sharing of information will ensure that the final approved (C)TMPs for both projects accurately reflect the expected construction traffic demand of both projects, and provide certainty to the Local Highway Authority that commitments remain feasible and deliverable.
Noise and Vibration	On the basis that CEA has not identified any significant cumulative effects – it is agreed that no further consideration of these effects necessary at this time. Traffic related cumulative air quality and noise and vibration considered above.
Air Quality	
Socio economics	

Construction Management and Community Liaison

2.21 All projects are committed to community liaison through the construction phase.

2.22 Hornsea Three has submitted an Outline Code of Construction (Outline CoCP) [APP-179]. Appendix A (Communication Plan Framework) of the Outline CoCP notes that a Communication Plan will be developed, managed and implemented by the Stakeholder Manager for Hornsea Three. During the construction phase, a Community Liaison Officer (CLO) will be appointed prior to the commencement of onshore works. The CLO will attend public meetings including liaison with community groups and will manage all contacts with local resident groups, schools, emergency services and local businesses with regard to general construction works issues in accordance with the parameters established in the Communications Plan.

2.23 Similarly, NV has submitted an Outline Code of Construction. Section 2.4 of NV Outline CoCP notes that Norfolk Vanguard Limited will ensure effective and open communication with local residents and businesses that may be affected by noise or other amenity aspects caused by the construction works. A designated Norfolk Vanguard Limited local community liaison officer will respond to any public concerns, queries or complaints in a professional and diligent manner as set out by a project community and public relations procedure which will be submitted for comment to the Local Authorities. Parish Councils in the relevant area will be contacted (in writing) in advance of the proposed works and ahead of key milestones, with these measures being captured in a communications plan as part of the final CoCP.

Update: 10th January 2019

2.24 The respective Outline Code of Construction Practice (OCoCP) as submitted for both Norfolk Vanguard (document reference 8.01) and Hornsea Project Three (submitted at Deadline 4) (which supersedes document reference REP1-142 and APP-179) both include commitments to developing project specific Communication Plans post-consent, and include a framework to set out the key points of how communications will be delivered. The Communication Plans will ensure effective and open communication with local residents and businesses that may be affected by the construction works. In order to ensure communication between the respective projects, it is proposed that the Communication Plans will also set out the process of continued engagement between the Norfolk Vanguard, Hornsea Project Three and the Local Highway Authority. This will ensure that as construction programmes are refined post-consent that this information is regularly shared between parties, particularly traffic demand on shared road links and that commitments to manage cumulative construction traffic demand are fully delivered; for example on a given road the two projects may have committed to programme works that ensure each scheme's peak traffic does not overlap.

2.25 Furthermore, the final Traffic Management Plans (TMP) for each project will confirm cumulative traffic impacts and set out the measures to ensure that the cumulative environmental impacts are managed to levels such that they are acceptable by Norfolk County Council as the local highway authority. Regularly programmed sharing of information will ensure that the final approved TMPs accurately reflect the expected construction traffic demand of both projects, and provide certainty to the Local Highway Authority that commitments remain feasible and deliverable.

Update 13 March 2019

2.26 As noted in Table 2, mitigation schemes for each project alone and both projects cumulatively are currently being discussed with Norfolk County Council to inform the scale and extent of the mitigation schemes. The agreed mitigation will be captured within updated versions of the outline TMPs.

Update 26th March 2019

2.27 As noted in Table 2, outline mitigation schemes for each project alone and both projects cumulatively have been agreed in principle with Norfolk County Council. These outline schemes will be included within updated versions of the outline (C)TMPs for each project.

2.28 Both parties have committed to a process of continued engagement between them and the Local Highway Authority. This will ensure that as construction programmes are refined post-consent, this information is regularly shared between parties, particularly traffic demand on shared road links. This will ensure that commitments to manage cumulative construction traffic demand are fully delivered.

3. Electro-Magnetic Fields

Hornsea Three

3.1 Hornsea Three Electro-Magnetic Fields compliance is documented in Environmental Statement Annex 3.3 – Electro-Magnetic Fields (EMF) Compliance Statement [APP-087].

3.2 For Hornsea Three, the EMF compliance statements confirms:-

- The maximum calculated power-frequency magnetic field from the HVAC underground cables is 55 microtesla (μT), well below (15% of) the Code of Practice 360 μT public exposure guideline limit set to protect health.
- The maximum calculated static magnetic field from the HVDC underground cables is 27 μT, well below (5% of) the 500 μT International Commission on Non-Ionizing Radiation Protection (ICNIRP) DC guideline exposure level[1].
- For Hornsea Three, on the basis of the guidance for EMFs from electricity infrastructure adopted in the UK and the published evidence to support that, it is considered that the levels of EMFs from the proposed development would be well below the guideline public exposure reference levels set to protect health.

Norfolk Vanguard

3.3 NV EMF compliance is documented in Environmental Statement Chapter 27 Human Health.

3.4 For NV, the ES confirms the maximum calculated static magnetic field from the HVDC underground cables is 33.7 μT; well below (<1%) the ICNIRP DC public exposure limit of 40,000 μT at a 25m perpendicular distance from the centreline of the onshore cable route), this value falls to 1.27 μT.

[1] ICNIRP public exposure limit for AC = 360 μT; ICNIRP public exposure limit for DC = 40,000 μT. ICNIRP advisory level for DC for protection of people with implanted medical devices = 500 μT. For DC fields, although the ICNIRP guideline level for magnetic field exposure is 40 mT (1994) or 400 mT (2009), ICNIRP discusses the need for "*practical policies… to prevent inadvertent harmful exposure of people with implanted electronic medical devices and implants containing ferromagnetic materials, and injuries due to flying ferromagnetic objects*" (ICNIRP, 2009) (page 511) and in that context makes reference to a lower restriction level of 0.5 mT suggested by the International Electrotechnical Commission (IEC) in 2002 (IEC, 2002).

3.5 For NV, on the basis of the Public Health England recommended limits for exposure to EMFs, based on those from the ICNIRP, and the published evidence to support that, it is considered that the levels of EMFs from the proposed development would be well below the guideline public exposure reference levels set to protect health against EMF exposure.

Cumulative Impact of Electro-Magnetic Fields at the crossing point of Hornsea Three and NV / NB

3.6 When considered cumulatively, as magnetic field strength decreases rapidly with distance from the source combined with the vector nature of electric and magnetic fields, the cumulative field strength from multiple sources would not typically be as great as the scalar sum of their maximum strength. In practice, this means that magnetic field strength at a given location tends to be dominated by one source (the largest and/or nearest) where several sources in the area are present.

3.7 As such, and considering the large margin of compliance with the public exposure guidelines, no significant cumulative impacts from other existing or proposed sources are anticipated.

3.8 In response to local concerns, Ørsted and Vattenfall jointly commissioned an independent study and resulting report which explores the 'worst case' EMFs which may result where it is proposed the power cables from Offshore wind farm projects will cross. The Vattenfall and Ørsted Circuit Crossings- EMF Information Sheet is attached to this SoCG at **Appendix A**.

3.9 These assessments represent the worst-case scenario for two crossing points, one where both transmission systems use HVAC technology and the other where both use HVDC technology. It should be noted that this worst case scenario was correct at the time of writing, however NV and NB have subsequently made the decision to deploy HVDC technology. The parameters modelled are included in the tables below and are conservative as maximum rating, minimum burial depth and most acute crossing angle (45°) were taken and the most highly loaded circuits were located on top which produced the highest magnetic fields.

3.10 Summary of the cumulative impact of Hornsea Three, NV and NB found:-

- The study found that the maximum calculated AC magnetic fields were 50.7 µT, which is 14% of the UK exposure limit values; the maximum calculated DC magnetic fields were 60.8 µT which is less than 1% of the UK exposure limit.
- All of the cable crossing scenarios irrespective of whether DC or AC cable connections are used will be compliant with the UK exposure limits set to protect the health of members of the public against electric and magnetic field exposure.
- As the magnetic field is mainly dependant on cable rating, burial depth and phase separation, all cable crossings with similar or less onerous design parameters will also be compliant.

3.11 The study advises that if both cable routes that cross use the same power transmission technology, i.e. AC and AC or DC and DC, the fields can combine to add or subtract from one another. However, if different technologies are used, i.e. AC and DC, the magnetic fields do not interact with one another. In that scenario, the installations of the HVAC and HVDC cables can be considered separately.

3.12 The Summary Report is attached at **Attachment A**. This is available for download from both Orsted and Vattenfall corporate websites[2].

4. Design Interaction and Co-Operation Agreement

4.1 Hornsea Three, NV, and NB are in advanced stages of entering into a Co-operation Agreement. Whilst the terms of that agreement are confidential – those matters pertinent to construction management and implementation extend to:-

- The Parties agree that there should be no detrimental impact for either party to execute their statutory consents.
- The Parties agree to consult one another and keep each other reasonably appraised of key decisions and changes to programme, milestones and upcoming communication with any relevant regulatory body. Further, the Parties shall provide a rolling stakeholder engagement plan to ensure that each party is aware of ongoing engagement with the wider community. This will help ensure that all parties are aware of works ongoing in the area so as to assist with each project's own community liaison initiatives.
- The Parties will share all survey works at the point of crossing and/or shared access areas – this will help reduce the number of surveys undertaken and ensure consistency in base survey data utilised by all Parties.
- Both Parties will design the cable installation works so as to ensure that the other parties can still install their cables – for example, if the first project installs the cables by way of open cut trench, that section of trenching will include enhanced thermal conductivity backfill to reduce any potential future thermal interactions with the second project.
- Parties will share design specifications when known to help facilitate the design of the other party's cables at the point of crossing.
- The Parties will work together to share information and agree mitigation, such as traffic management measures and plans, with the collective aim of minimising the cumulative environmental impact of construction on the local road network, noise management and management of neighbouring Public Rights of Way.
- Each Party will grant the other Party rights of access in an emergency.

[2] https://corporate.vattenfall.co.uk/contentassets/bf0e5e31bbab467eaf02040c7b17513a/vattenfall-orsted-emf-information-sheet.pdf

5. Compulsory Acquisition Powers

5.1 It is agreed that all parties will seek to enter into a tri-partite Option Agreement with the relevant land owner to acquire the rights necessary to construct, use and maintain for Hornsea Three, NV and NB at the crossing point., The terms of the Option Agreement will provide for, amongst other items, crop loss and severance compensation where the accumulative impact of projects in construction at the same time have increased impact to the landowner when compared to separate construction periods.

5.2 In the event that a voluntary agreement cannot be entered into with the relevant landowner, it is agreed that the compulsory acquisition of new rights and imposition of restrictive covenants can co-exist for Hornsea Three, NV and NB. The Co-operation Agreement will regulate the exercise of compulsory acquisition and temporary use powers.

6. Response to ExA First Written Questions and on-going engagement throughout the Examinations

6.1 Both the Applicant, Hornsea Three and NV have considered the ExAs first written questions and responses provided in **Table 5**.

6.2 Since this time, both parties have and will continue to monitor each other's respective examinations by reviewing examination submission documents and attending hearings where possible. Both parties also have regular meetings during the examinations.

Table 5 – Response to ExA First Written Questions

Q No.	Question	**Hornsea Three & Norfolk Vanguard Joint Response**
1.11.9	The main construction compound at Oulton Street would be located close to some construction and storage components of the proposed Norfolk Vanguard/Norfolk Boreas scheme. Please provide an assessment of the potential in-combination traffic and transport effects of the proposal in the locality of Oulton Street, including details of likely construction timetables for all projects and proposed measures to minimise any impacts.	There may be cumulative impacts on a small number of shared road links during construction of the two projects and relevant discussions between Hornsea Three and Norfolk Vanguard are ongoing. Both parties continue to work together to ensure alignment of highway threshold levels applied by each project, i.e. traffic capacity of each road link before significant impacts are expected, and alignment as to the scope of appropriate traffic management measures that may be required as thresholds are reached – i.e. confirming:- • Thresholds on each street (or part of street) where no or limited ("soft") traffic management measures would be required, such as controls on daily traffic demand, driver induction, community liaison;

Q No.	Question	Hornsea Three & Norfolk Vanguard Joint Response
1.11.12	The on-shore cable route would cross with the proposed Norfolk Vanguard/Norfolk Boreas cable route to the north of Reepham. Please provide an assessment of the potential traffic and highway impacts arising from the construction of both projects and outline any measures that may be required to mitigate any impacts.	• Thresholds on each street (or part of street) which would trigger further "soft" traffic management measures, such as timing of deliveries, hazard signage, restricted periods, and temporary speed restrictions; and • Thresholds on each street (or part of street) which would trigger further "harder" traffic management measures -such as flow control, pedestrian crossing points, parking restrictions and other traffic management measures, in some instances physical interventions such as localised widening or passing places. Any mitigation measures identified for these shared links would be secured through each project's final Construction Traffic Management Plans to be developed post-consent. These would be developed with, and approved by, Norfolk County Council as Highways Authority. Whilst these workstreams are ongoing, the locations which require further consideration due to the potential cumulative impact of both projects is limited to:- • The Street (linking B1149 with Oulton Street); • Along B1149, in particular through the settlement of Horsford; and • Along B1145, in particular through the settlement of Cawston. If CTMP measures are required along these stretches of road, these measures will be captured in a revised Outline CTMP to be submitted in due course into the Hornsea Three examination. Hornsea Three and Norfolk Vanguard will be looking to reach an agreement on these matters and engage with Norfolk County Council as the highways authority to reach a shared common point of agreement. This workstream is ongoing and for the purposes of this SoCG submitted at Deadline 1, the cumulative impact on traffic and transport therefore remains not agreed, but material headway has been made and both projects are confident that agreement can be reached in the short term. To date Hornsea Three and Norfolk Vanguard have held a number of meetings on these matters:- • 09/08/2018 Meeting with Norfolk Vanguard to discuss traffic and transport assessment. • 11/09/2018 Meeting with Norfolk Vanguard to discuss traffic and transport assessments. • 26/09/2018 Email correspondence from Hornsea Three to Norfolk Vanguard to advise of the updated TA, TA Clarification Note and Main construction compound traffic survey results. • 16/10/2018 Meeting with Norfolk Vanguard to discuss traffic and transport assessments. 16/10/2018 Email correspondence from Hornsea Three to Norfolk Vanguard issuing the Main Construction Compound Access Strategy.
1.12.10	Please provide a cumulative electromagnetic field assessment at the point where the onshore cable route would cross the proposed Norfolk Vanguard/Norfolk Boreas route.	Attached at **Appendix A** to this SoCG.

Q No.	Question	**Hornsea Three & Norfolk Vanguard Joint Response**
1.13.3	The onshore cable route proposed as part of the Norfolk Vanguard project would cross the Hornsea Three cable route near Reepham. What assessment has been carried out of the engineering requirements for the cable crossing, such as to demonstrate that the works could be carried out satisfactorily within the Order limits? How would the powers sought by Norfolk Vanguard Limited interact with those sought by the Applicant? Should the Order include protective provisions in respect of Norfolk Vanguard Limited?	The Applicant is currently in on-going discussions with Norfolk Vanguard Limited, the applicant for the Norfolk Vanguard project, with the aim of reaching a commercial agreement to manage the co-existence of the projects. As part of this agreement, the parties will agree a mechanism to determine the method and design at the point of crossing incorporating the principle that one project would install using open cut, and one through HDD. Should Hornsea Three install using HDD, there is a need for a corridor wider than the typical 80m width provided for along the onshore export cable corridor at this location to accommodate the works. This accords with the approach adopted at some of the other technically complex HDD crossings along the Hornsea Three onshore cable corridor route. The width at this crossing point has been determined based on professional experience drawn from previous offshore wind export cable installation campaigns by the Applicant (Hornsea Three) and is reflected in the relevant Land Plan (onshore) (Sheet 16 of 35 of APP-011) and Work Plans (Sheet 16 of 35 of APP-013). As set out in Volume 1, Chapter 3: Project Description of the Environmental Statement [APP-058], detailed ground investigations will be undertaken should HDD be proposed to determine geotechnical data and thermal resistivity properties of the soil to assist with detailed cable route design. Notwithstanding this, the Applicant is confident the works can be carried out within the Order Limits as set out in the Order Limits and Grid Coordinates Plan (Onshore) [APP-010]. The Applicant and Norfolk Vanguard Limited consider that the powers sought by the Applicant and Norfolk Vanguard Limited in their respective DCOs can co-exist. The Applicant is currently in on-going discussions with Norfolk Vanguard Limited, the applicant for the Norfolk Vanguard project, with the aim of reaching a commercial agreement to manage the co-existence of the projects. The Applicant is engaging with Norfolk Vanguard to consider the approach to protective provisions for the Hornsea Three DCO.

Appendix A Vattenfall and Ørsted Circuit Crossings- EMF Information Sheet

(Also available for download at from both Orsted and Vattenfall corporate websites)

Vattenfall and Ørsted Circuit Crossings- EMF Information

In response to local concerns, Ørsted and Vattenfall have jointly commissioned an independent study and resulting report which explores the 'worst case' electric and magnetic fields (EMFs) which may result where it is proposed the power cables from the large wind farms will cross.

Onshore, buried cables from offshore wind farms will necessarily cross other infrastructure, including other power cables. This summary report provides information on the electric and magnetic fields (EMFs) which could occur where power cable circuits cross, specifically assessing the crossing of Ørsted's Hornsea Project Three and Vattenfall's Norfolk Vanguard and Norfolk Boreas offshore wind farms, which are typical of the next generation of offshore wind projects in development by Vattenfall and Ørsted. It represents a conservative assessment of EMFs at such crossings, assessing the worse case parameters for this case study.

Summary of results

- The study found that the maximum calculated AC magnetic fields were 50.7 microtesla (µT) which is 14% of the UK exposure limit values; the maximum calculated DC magnetic fields were 60.8 µT which is less than 1% of the UK exposure limit.
- All of the cable crossing scenarios irrespective of whether DC or AC cable connections are used will be compliant with the UK exposure limits set to protect the health of members of the public against electric and magnetic field exposure.
- As the magnetic field is mainly dependant on cable rating, burial depth and phase separation, all cable crossings with similar or less onerous design parameters will also be compliant.

What are electric and magnetic fields and what policies and exposure limits apply?

EMFs are produced wherever electricity is used. Underground cables, irrespective of frequency, have an earthed metallic shield, which protects them from damage but also prevents electric fields escaping from the cable. Magnetic fields are not shielded in the same way as electric fields and will be produced outside the cables.

Electricity can be transmitted either via High Voltage Direct Current (HVDC) or High Voltage Alternating Current (HVAC) technology producing EMFs of the same frequency.

The UK has a carefully thought-out set of policies for managing EMFs, which includes numerical exposure limits to protect against established effects of EMFs. Public Health England (PHE), formerly the Health Protection Agency, (HPA) recommends limits for exposure to EMFs based on those from the International Commission on Non-Ionizing Radiation Protection (ICNIRP – 1994 & 1998)[1,2]. These guidelines are based on reviews of all the science regarding potential health effects of EMFs and provide limits for continuous public and occupational exposures. DC and AC EMFs have different effects on humans; therefore, each has a separate and distinct set of exposure limits to protect against exposure. PHE issued guidance on the application of exposure limits, which stated that the public exposure limit is 360 µT for 50 Hz AC magnetic fields, and 40,000 µT for DC magnetic fields[3]. In the UK the Earth's DC magnetic field measures around 50 µT, and the background AC magnetic field in a home ranges between 0.01- 0.2 µT.

More information on the science, exposure limits and policies can be found at www.emfs.info.

[1] https://www.icnirp.org/cms/upload/publications/ICNIRPstatic.pdf
[2] http://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf
[3] http://webarchive.nationalarchives.gov.uk/20140713082604/http://www.hpa.org.uk/Publications/Radiation/NPRBArchive/DocumentsOfTheNRPB/Absd1502/

National Grid has been engaged by Vattenfall and Ørsted to assess the EMF aspects of this case study, as described in this summary report. The projects as a whole and all other aspects of them remain the responsibility solely of Vattenfall and Ørsted.

Where onshore wind farm circuits cross onshore, will these be compliant with exposure limits?

The electricity industry's policy is only to design and install equipment that is compliant with the relevant exposure limits. To ensure electricity Industry remain with the exposure limits the Government produced a Code of Practice on EMF compliance which sets out the approved calculation methodology for assessing compliance for new and existing electricity assets. This methodology takes account of maximum power flows and minimum burial depth to ensure that the calculated magnetic fields represent the maximum magnetic field that the electrical infrastructure could possibly produce.

There are multiple possibilities for cable crossing points i.e. AC or DC, which cables are on top, where they cross, the crossing angle – so the calculations in this summary report are the worst-case scenarios typical of the next generation of Vattenfall and Ørsted offshore wind projects in development in the UK.

If both cable routes that cross use the same power transmission technology, i.e. AC and AC or DC and DC, the fields can combine to add or subtract from one another. However, if different technologies are used, i.e. AC and DC, the magnetic fields do not interact with one another. In that scenario, the installations of the HVAC and HVDC cables can be considered separately.

These assessments represent the worst-case scenario for two crossing points, one where both transmission systems use HVAC technology and the other where both use HVDC technology. The parameters modelled are included in the tables below and are conservative as maximum rating, minimum burial depth and most acute crossing angle (45°) were taken and the most highly loaded circuits were located on top which produced the highest magnetic fields.

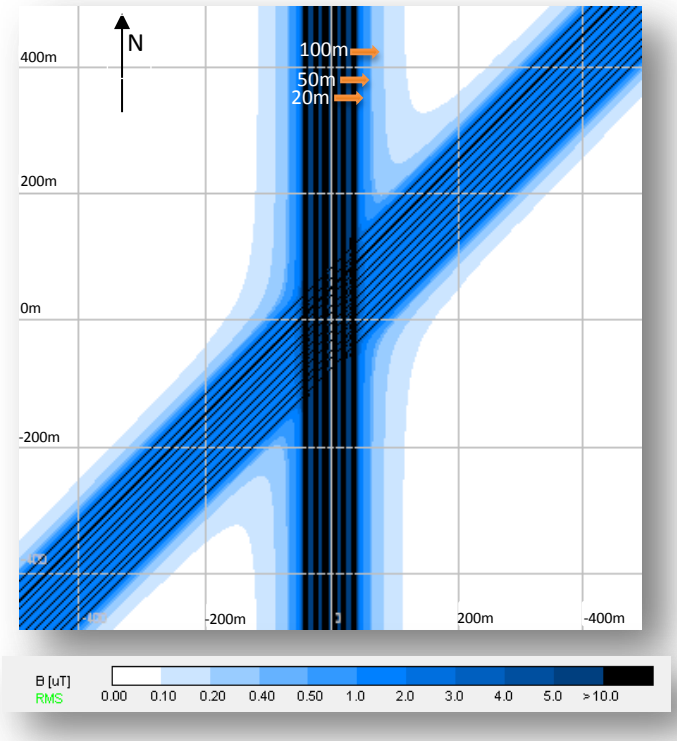
The calculated fields are shown below and are a small fraction of the AC and DC ICNIRP limits.

Cable design parameters

	2 x HVAC routes		2 x HVDC Routes	
	'On Top'	**'On Bottom'**	**'On Top'**	**'On Bottom'**
Number of circuits	6	12	2	4
Maximum load current per circuit	1620A	900A	2220A	1400A
Maximum circuit spacing at crossing	15.0m	10.0m	15.0m	10.0m
Spacing between phase centres	0.313m	0.25m	0.43m	0.25m
Cable formation in trench	Flat	Trefoil	Flat	Flat
Depth of burial, to circuit centres	0.8m	2.8m	0.8m	2.8m

National Grid has been engaged by Vattenfall and Ørsted to assess the EMF aspects of this case study, as described in this summary report. The projects as a whole and all other aspects of them remain the responsibility solely of Vattenfall and Ørsted.

AC magnetic field calculations for HVAC cable crossings



Calculated worst-case AC Magnetic Fields

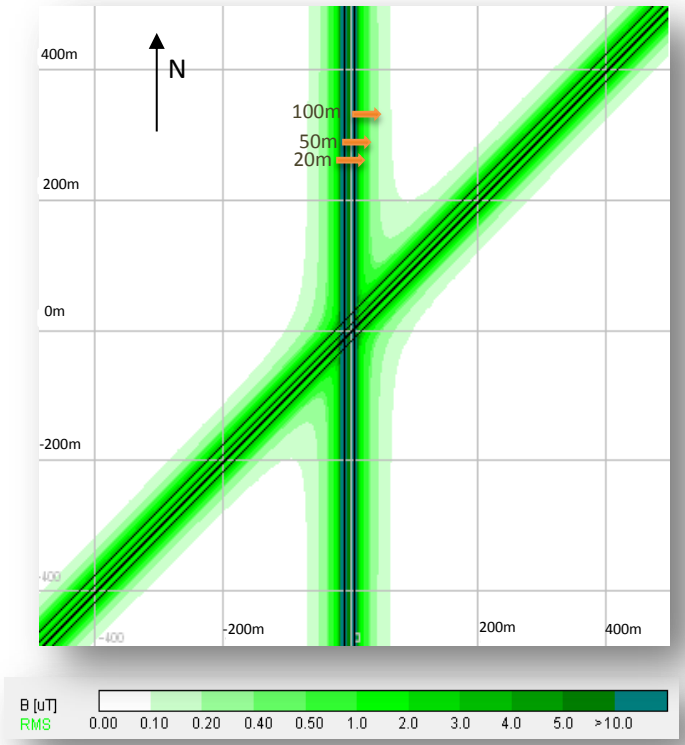
	Distance perpendicular from outer cable (m)			
	Peak	20m	50m	100m
Magnetic field (μT)	50.7	1.14	0.49	0.23
% ICNIRP exposure limit*	14%	<1%	<1%	<1%

*AC public exposure limit of 360μT

Worst-case calculated magnetic fields from AC circuits: The two cable routes modelled include 6 circuits running in a North-south direction with each circuit rated at 1620A; and 12 circuits which run underneath in a North East-South West direction with 900A rated circuits. Coloured bands represent magnetic field. Each square represents 200m distance. The orange arrows indicate the distance perpendicular from the outer cables that correspond to the table above.

The maximum calculated magnetic fields at various distances from the outer cable are included in the table and demonstrate that all AC magnetic fields are below the UK exposure limits

DC magnetic field calculations for HVDC cable crossings



Calculated worst-case DC Magnetic Fields

	Distance perpendicular from outer cable (m)			
	Peak	20m	50m	100m
Magnetic field (µT)	60.8	1.46	0.57	0.23
% ICNIRP exposure limit*	<1%	<1%	<1%	<1%

*DC public exposure limit 40,000µT

Worst-case calculated magnetic fields from DC circuits: The two cable routes modelled include 2 circuits running in a North-south direction with each circuit rated at 2220A; and 4 circuits which run underneath in a North East-South West direction with 1400A rated circuits. Coloured bands represent magnetic field. Each square represents 200m distance. The orange arrows indicate the distance perpendicular from the outer cables that correspond to the table above.

The maximum calculated magnetic fields at various distances from the outer cable are included in the table and demonstrate that all DC magnetic fields are below the UK exposure limits.

Where can I get further information?

More information is available from National Grid's website at www.emfs.info or from the EMF helpline on 0845 702 3270 or emfhelpline@nationalgrid.com.

Alternatively you can contact the Norfolk Vanguard project team directly on info@norfolkvanguard.co.uk or 01603 567995 or Hornsea Project Three on contact@hornsea-project-three.co.uk or 0800 0288 466.