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Norfolk Vanguard Offshore Wind Farm

DCO Non- Material Change

Supporting Statement for the removal of the capacity limit

Applicant: Norfolk Vanguard Limited
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Glossary

BEIS	Business, Energy and Industrial Strategy
CRM	Collision Risk Modelling
DCLG	Department for Communities and Local Government
DCO	Development Consent Order
DML	Deemed Marine Licence
EIA	Environmental Impact Assessment
ES	Environmental Statement
EIA	Environmental Impact Assessment
GW	Gigawatts
HAT	Highest Astronomical Tide
HRA	Habitats Regulations Assessment
LoS	Line of Sight
MMO	Marine Management Organisation
MW	Megawatt
NMC	Non-Material Change
NRA	Navigation Risk Assessment
OWF	Offshore Wind Farm
SoS	Secretary of State
WTG	Wind Turbine Generator

1 INTRODUCTION

1. Norfolk Vanguard Limited submitted an application for development consent for the Norfolk Vanguard Offshore Wind Farm on 26 June 2018, with a Development Consent Order (DCO) granted by the Secretary of State (SoS) for the Department for Business, Energy and Industrial Strategy (BEIS) on 11 February 2022 (Order). The Order granted consent for the development of an offshore wind farm with a gross output of 1,800 Megawatt (MW) (1.8 Gigawatt (GW)), across two offshore sites located approximately 47 and 70 km off the coast of Norfolk.

2. The Norfolk Vanguard offshore wind farm (OWF) comprises two distinct areas, Norfolk Vanguard East and Norfolk Vanguard West ('the OWF sites'). The OWF 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 approximately 60km to the onshore project substation at Necton, Norfolk.

3. Since the submission of the application for the Norfolk Vanguard DCO, a detailed review of the supply chain has shown that there have been advancements in technology making Wind Turbine Generators (WTGs) more efficient and cost effective. These advances have allowed the generation capacity of a wind turbine to increase whilst remaining within the same parameters for scale. Therefore, Norfolk Vanguard Limited and Norfolk Vanguard East Limited (the **Applicant**) is making an application for a non-material change to remove the 1,800MW limit of electrical capacity stated in the Norfolk Vanguard DCO. For the avoidance of doubt, no other parameters secured within the DCO would be amended, save for a reduction in total turbine numbers. No changes to any onshore elements of the Project are proposed. A parallel application to the Marine Management Organisation (MMO) is also being made to vary the associated Deemed Marine Licences (DMLs) in accordance with the changes sought in the Non-Material Change (NMC) application.

4. This statement which is provided in support of the NMC application, and a related application to vary the associated DMLs, demonstrates that a change to the overall capacity limit of the wind farm would not result in any change to conclusions of the Environmental Impact Assessment (EIA) and the Habitats Regulations Assessment (HRA) and that the NMC application can properly be considered as being non-material.

1.1 Approach

5. The upper limit of many design parameters (for example WTG tip height, rotor diameter and minimum draught height) have been secured within the Norfolk

Vanguard DCO. This document provides a summary of the relevant parameters which have been secured in the Order and confirms whether a change is proposed to them.

6. This document reviews the topics assessed within the Norfolk Vanguard Environmental Statement (ES) and considers whether there will be any changes in impact to those topics described within the ES in the context of the removal of the limit on export capacity. Furthermore, it also considers whether the proposed changes would alter the conclusions of the HRA undertaken in respect of the Order.

7. This document follows the advice and guidance outlined in the Planning Act 2008: Guidance on Changes to Development Consent Orders from the Department for Communities and Local Government (DCLG). The changes proposed are considered in light of the guidance at section 2.2 below.

1.2 What this Non-material Change enables

8. On 27 June 2019, following advice from the Committee on Climate Change, the UK Government announced a new carbon reduction 'net zero' target for 2050 which resulted in an amendment to the Climate Change Act 2008 (the target for the net UK carbon account for 2050 changed from 80% to 100% below the 1990 baseline). Furthermore, the Energy White Paper, Powering our Net Zero Future, was published on 14 December 2020. The white paper puts net zero and the UK governments effort to fight climate change at its core, following the Prime Minister's Ten Point Plan for a Green Industrial Revolution. Allowing an increase in the capacity of the Norfolk Vanguard Wind Farm furthers the contribution of the project to the government's climate goals. This has been enabled by innovation in the sector, which is bringing forward more advanced WTGs and enhancing load factors while remaining within the design envelope. Moreover, this non-material change hastens the deployment of renewables, enhancing our security of supply, as well as making a contribution to stabilising and ultimately bringing down the cost of energy[1].

[1] At times of high energy prices, like today, our renewable energy, supported and enabled through the Contracts for Difference regime, pay back to the consumer, protecting the consumer from even higher wholesale costs. The current wholesale price of electricity is about £210 /MWh. The last strike price agreed with offshore wind developers for new projects was in the range £50-39 /MWh, and in the next Allocation Round, the strike price for fixed bottom offshore wind will be similar or lower.
In the last quarter of 2021, wind and solar energy on the grid paid back £157M to consumers, and renewables are forecast to pay back nearly £650M to consumers in the first half of 2022. Installing additional capacity enhances the cost efficiency of energy provided to UK consumers.

2 DESIGN ENVELOPE

2.1 Comparison of consented and proposed envelope parameters

9. A comparison of consented and proposed parameters relevant to the proposed amendment is provided in

10. Table 1 below. It is important to note that neither maximum generating capacity nor maximum WTG capacity are, in themselves, parameters that are used to inform the EIA. Rather, these maximum capacity assumptions informed the specific parameters required to establish the worst case envelope required to undertake the assessment (i.e. number of WTGs, height of WTGs, size of WTG foundations etc). Aside from the removal of the limit on capacity, the only change which is being proposed to the parameters within the DCO is a reduction in the maximum number of WTGs. The maximum number of WTGs will decrease from 158 to 145 as advancements in technology are such that the increase in individual WTG capacity means that fewer WTGs are required. This would decrease the parameters which are directly linked to the number of WTGs such as seabed footprint and volume of scour protection. However, as these will remain within the consented enveloped that was assessed within the ES no change to these parameters is proposed as part of the NMC application or associated DML variations.

11. It should be noted that the proposed non-material change only has the potential to affect parameters associated with the WTGs and does not affect any other parameters associated with other structures within the wind farms, offshore cable corridor, onshore cable route, onshore project substation or National Grid Substation extension (and associated works).

Table 1: Maximum parameters for the consented envelope compared with the proposed envelope

Row no.	Relevant parameter	Consented envelope		DCO/ DML reference	Proposed change
		ES	2022 DCO/DML		
	General				
1	Area of Norfolk Vanguard sites (offshore)	NV West 295km^2 NV East 297km^2	Secured through the Order Limits	Schedule 9 and 10, Part 2 (6).	No change
2	Project Generating capacity	1,800MW	1,800MW	Schedule 1, Part 1, Authorised Development	Removal
3	Maximum number of offshore electrical platforms	2	2	Schedule 1, Part 3, Requirement 3 (2)	No change
4	Maximum number of accommodation platforms	2	2	Schedule 1, Part 3, Requirement 3 (3)	No change
5	Maximum number of meteorological masts	2	2	Schedule 1, Part 3, Requirement 3 (4)	No change
6	Maximum number of LIDAR measurement buoys	2	2	Schedule 1, Part 3, Requirement 3 (5)	No change
7	Maximum length of array cables	600km	600km	Schedule 1, Part 3, Requirement 5	No change
8	Maximum length of export cables	400km	400km	Schedule 1, Part 3, Requirement 5	No change
9	Maximum length of interconnector cables	150km	150km	Schedule 1, Part 3, Requirement 5	No change
	Wind Turbine Generators				
10	Maximum number of WTGs	200	158	Schedule 1 Requirement 3 (1)	145
11	No more than two-thirds of the total number of wind turbine generators* must be located in Norfolk Vanguard West			Schedule 1, Requirement 3 (1) (a)	No change
12	No more than one-half of the total number of wind turbine generators* must be located in Norfolk Vanguard East.			Schedule 1, Requirement 3 (1) (b)	No change

Row no.	Relevant parameter	Consented envelope		DCO/ DML reference	Proposed change
		ES	2022 DCO/DML		
13	Maximum rotor diameter	303m	303m	Schedule 1, Requirement 2(c)	No change
14	Maximum tip height	350m	350m	Schedule 1, Requirement 2 (1) (a)	No change
15	Minimum draught height	22m	35m for WTG below and including 14.6MW and 30m for WTG 14.7MW and above	Schedule 1, Requirement 2 (1) (e)	No change
	Foundations				
16	Maximum seabed footprint area of a wind turbine foundation (excluding scour protection)	1,963m^2	1,963m^2	Schedule 1, Requirement 6 (2)	No change
17	The total maximum amount of scour protection for the wind turbine generators, accommodation platform, meteorological masts, offshore electrical platforms and LIDAR measurement buoys	7,170,530m^2 and 35,852,650m^3.	5,196,703m^2 and 25,983,515m^3.	Schedule 1 Requirement 11	No change
18	Maximum amount of disposal material allowed that is associated with WTGs	3,807,566m^3	1,648,824m^3	Schedules 9 and 10, Part 3 (1) (d) (ii)	No change
19	Total maximum amount of disposal material allowed within the windfarm sites	39,895,132m^3	37,736,390m^3	Schedules 9 and 10, Part 3 (1) (d)	No change
20	Maximum total amount of drill arisings allowed to be disposed of.	400,624m^3	400,624m^3	Schedules 9 and 10, Part 3 (1) (f)	No change
21	Maximum total amount of scour protection for the offshore electrical platforms	20,000m^2 and 100,000m^3	20,000m^2 and 100,000m^3	Schedules 11 and 12, Part 4, Condition 3 (1) (b)	No change
22	Maximum Hammer energy for monopiles	5,000kJ	5,000kJ	Schedules 9 and 10, Part 4, Condition 14 (3)	No change

* rounded to the nearest whole number

2.2 Background

12. There is no statutory definition of what constitutes a material or non-material amendment for the purposes of Schedule 6 of the Planning Act 2008 and Part 1 of the Infrastructure Planning (Changes to, and Revocation of, Development Consent Orders) Regulations 2011 (2011 Regulations). However, the Government has issued guidance on this point. Criteria for determining whether an amendment should be material or non-material is outlined in the Department for Communities and Local Government "Planning Act 2008: Guidance on Changes to Development Consent Orders" (December 2015). Paragraphs 9 -16 of this document sets out the four characteristics which act to provide an indication on whether a proposed change to a DCO is material or non-material. The following characteristics are stated to indicate that an amendment is more likely to be considered 'material'.

- *A change should be treated as material if it would require an updated Environmental Statement (from that at the time the original DCO was made) to take account of new, or materially different, likely significant effects on the environment).*
- *A change is likely to be material if it would invoke a need for a Habitats Regulations Assessment. Similarly, the need for a new or additional licence in respect of European Protected Species is also likely to be indicative of a material change.*
- *A change should be treated as material that would authorise the compulsory acquisition of any land, or an interest in or rights over land that was not authorised through the existing DCO.*
- *The potential impact of the proposed changes on local people will also be a consideration in determining whether a change is material.*

13. Consideration or each of these four points is provided in sections 2.3 to 2.6 below.

2.3 Consideration of the effects of the change on the Environmental Statement

14. This section considers the potential implications of removing the limit on export capacity in relation to all topics assessed within the ES. Removal of the limit on export capacity could have the potential to increase collision risk numbers, however a reduced number of WTGs is proposed as part of the NMC to account for the increase in individual WTG capacity. Collision risk modelling has been undertaken for the reduced number of WTGs proposed and is presented in Appendix A Collision Risk Modelling. This demonstrates that there is no increase in potential collision risk to that previously presented.

15. Table 2 considers the effects of the proposed NMC and whether it is likely to result in new or materially different significant effects to those assessed in the ES which

would trigger the need for an update to the ES. It should be noted that any impacts relating to cable installation have not been considered as, due to the decrease in the maximum number of WTGs from that secured in the Order there is no change in the maximum parameters relating to the cable array.

Table 2: Assessment of effects of changes in context of the ES

ES Topic	Impacts described in ES Chapter	Change in impact significance
Marine Geology, Oceanography and Physical Processes (Chapter 8)	Impacts assessed within Chapter 8 which are of relevance to the NMC and DML variation are: 1. Changes in suspended sediment concentrations due to seabed preparation and drilling; 2. Changes in seabed level due to seabed levelling and drilling; 3. Interruptions to bedload sediment transport due to sand wave Levelling; 4. Indentations on the seabed due to installation vessels; 5. Changes to the tidal and wave regime due to the Presence of wind turbine structures; 6. Changes to the sediment transport regime due to the Presence of wind turbine foundation structure; and 7. Loss of seabed morphology due to the footprint of wind turbine foundation structures. The worst case scenario assessed within the ES included the use of floating foundations with large gravity anchors. At the time of the assessment this represented the worst case scenario for impacts to the seabed as the gravity anchors were the largest of all foundation types considered and required the greatest amount of seabed preparation. For the assessment gravity anchors used for 20MW (of which there would be 90) WTGs formed the greatest area of impact and required the greatest amount of sediment disposal therefore represented the worst case scenario for changes to suspended sediment and seabed level of 3,807,566m^3. The worst case scenario for changes to wave, tide and sediment transport regimes were gravity base foundations (which are a different foundation type to gravity anchors for floating foundations) as these would occupy the greatest volume within the water column. For this assessment the worst case scenario was represented by gravity base foundations	The assessment for Marine Geology, Oceanography and Physical Processes is informed by parameters associated with the number of, physical footprint and seabed material displaced or disposed of as a result of foundation installation, not the capacity of either the wind farm or individual WTGs. During the Norfolk Vanguard examination and intervening period the maximum number of WTGs was reduced from 200 to 158, and the use of gravity anchors for floating foundations was removed from the design envelope which resulted in a reduction of associated parameters which could impact physical processes such as maximum amount of scour protection and maximum amount of disposed material (see Table 1 for further information on the reductions). The parameters which inform the assessment (or reduced values where the design envelope was refined during examination) are specifically secured in the Order through the requirements and conditions detailed in the following rows of Table 1: 10, 16, 17, 18, 19, 20 and 21. In reference to the proposed NMC and DML variation, and as shown Table 1 there will be no increase to any of these parameters, only a small decrease in the maximum number of WTGs from 158 to 145. There will also be no change in the installation methods from those previously assessed within the ES. **Therefore, the proposed NMC and DML variation will not change the impact conclusions stated in the ES.**

ES Topic	Impacts described in ES Chapter	Change in impact significance
	required for 9MW WTGs (of which there would be 200).	
Marine water and sediment quality (Chapter 9)	Impacts assessed within Chapter 9 which are of relevance to the NMC and DML variation are: 1. Deterioration in water quality due to increased suspended sediment concentrations; and 2. Deterioration in water quality due to re-suspension of sediment bound contaminants As detailed in the row above the worst case scenario assessed in the ES was associated with the largest gravity anchor foundations resulting in an assessment of a volume for seabed preparation of 3,807,566m^3. However, with the removal of this option from the design envelope, this reduced the volume of seabed preparation material to 1,648,824m^3, and this figure was secured within the Order (see Table 1).	The assessment for marine water and sediment quality is informed by parameters associated with the number, installation methods and amount of seabed material displaced by the WTGs and their foundations, not the capacity of either the wind farm or individual WTGs. During the Norfolk Vanguard examination and intervening period the maximum number of WTGs was reduced from 200 to 158 which resulted in a reduction of associated parameters such as maximum amount of disposed material (see Table 1 for further information on the reductions) and therefore reducing impacts to water quality. The reduction in these parameters did not alter the conclusions stated within the ES. The parameters which inform the assessment (or reduced values where the design envelope was refined during examination) are specifically secured in the Order through the requirements and conditions detailed in the following rows of Table 1: 10, 16, 17, 18, 19, 20 and 21. In reference to the proposed NMC and DML variation, and as shown in Table 1 there will be no increase to the parameters that relate to the foundations' sizes, total possible number or maximum quantities of disposal as secured through the Order, and only a small decrease in the maximum number of WTGs from 158 to 145. There will also be no change in the installation methods from those previously assessed within the ES. **Therefore, the proposed NMC and DML variation will not change the impact conclusions stated in the ES.**
Benthic and Intertidal Ecology (Chapter 10)	Impacts assessed within Chapter 10 which are of relevance to the NMC and DML variation are: 1. Temporary habitat loss/disturbance 2. Temporary increase in suspended sediment concentrations and associated sediment deposition 3. Underwater noise and vibration 4. Permanent loss of seabed habitat through the presence of seabed infrastructure 5. Temporary seabed disturbances from maintenance	The assessment for Benthic and Intertidal Ecology is informed by parameters associated with the number, installation methods and amount of seabed material displaced by the WTGs and their foundations, not the capacity of either the wind farm or individual WTGs. During the Norfolk Vanguard examination and intervening period the maximum number of WTGs was reduced from 200 to 158 and the gravity anchor foundation option was removed, which resulted in a reduction of associated parameters which could impact benthic ecology such as maximum seabed footprint and maximum amount of disposed material (see Table 1 for further information on the reductions). These reductions did not alter the

ES Topic	Impacts described in ES Chapter	Change in impact significance
	operations 6. Colonisation of WTG/cable protection/scour protection 7. Electromagnetic Fields (EMF) from installed array and export cables As detailed in the row above the worst case scenario assessed in the ES was associated with the largest gravity anchor foundations resulting in an assessment of a volume for seabed preparation of 3,807,566m³. However, with the removal of this option from the design envelope, this reduced the volume of seabed preparation material to 1,648,824m³, and this figure was secured within the Order (see Table 1). In reference to noise impacts, the worst case spatial scenario assessed for pilling was as a result of 5,000kJ hammer energy for monopile foundations. As no layout was available for the ES it was assumed that the maximum spatial impact could include the entire wind farm site and a buffer around the site for the furthest extent to which the noise could travel. The worst case temporal impact resulted from the installation of pin piles for jacket foundations of which there would be 800 in total. In reference to EMF, the assessment noted that impacts were mitigated by the commitment to bury cables where possible and, where not possible, to apply cable protection, such that EMF would be minimised to very low levels.	conclusions stated in the ES. The parameters which inform the assessment are specifically secured in the Order through the requirements and conditions detailed in the following rows of Table 1: 7, 8, 9, 10, 11, 16, 17, 18, 19, 20, 21 and 22. In reference to the proposed NMC and DML variation, and as shown in Table 1, there will be no increase to the parameters that relate to the foundations' sizes, scour protection or total or maximum quantities of disposal as secured through the Order. Furthermore, the conditions that control the levels of underwater noise namely maximum number of and therefore duration of piling activity and the maximum hammer energies will not be exceeded. There will be a reduction in the maximum number of WTGs from 158 to 145 which would reduce the overall area, number of piling events and duration of impacts however, this would not be a significant enough decrease to change the magnitude of related impacts. There will also be no change in the installation methods from those previously assessed within the ES. This includes the commitment to bury cables wherever possible and at the limited number of locations where this may not be possible to place cable protection over the cable which would reduce any EMF to very low levels. There will be no increase in the nominal operating voltage (approximately +/-320kV) of the export cables and since the application was made the amount of export cable crossings has been reduced from 22 to 4 (see submission ExA; Mit; 11.D10.2.App1 on the Norfolk Vanguard Planning Inspectorate page; a link is provided in the Reference section of this document) therefore reducing further the amount of unburied cable and potential for EMF. **Therefore, the proposed NMC and DML variation will not change the impact conclusions stated in the ES.**
Fish and Shellfish Ecology (Chapter 11)	Impacts assessed within Chapter 11 of relevance to the NMC and DML variation are: 1. Physical disturbance and temporary loss of seabed habitat 2. Increased SSCs and sediment re-deposition 3. Underwater noise from piling 4. Underwater noise from other construction activities	The assessment for Fish and Shellfish Ecology is informed by parameters associated with the number, installation methods and amount of seabed material displaced by the WTGs and their foundations, not the capacity of either the wind farm or individual WTGs. During the Norfolk Vanguard examination the maximum number of WTGs was reduced from 200 to 158 and the gravity anchor foundation option was removed, which resulted in a reduction of associated parameters which could impact fish and shellfish such as the maximum amount of disposed material (see Table 1 for further

ES Topic	Impacts described in ES Chapter	Change in impact significance
	5. Permanent loss of seabed habitat 6. Introduction of hard substrate 7. Underwater noise during operation 8. Indirect impacts on fish species as a result of behavioural disturbance to prey species associated with construction noise 9. EMFs and 10. Changes in fishing activity. As detailed above the worst case scenario assessed in the ES was associated with the largest gravity anchor foundations, resulting in a worst case total disturbance footprint of 16.1km². However, with the removal of this option from the design envelope, this footprint will be reduced. In reference to noise impacts, the worst case spatial scenario assessed for pilling was as a result of 5,000kJ hammer energy for monopile foundations and 2,700kJ hammer energy for offshore electrical platform pin pile foundations. As no layout was available for the ES it was assumed that the maximum spatial impact could include the entire wind farm site and a buffer around the site for the furthest extent to which the noise could travel. The worst case temporal impact resulted from the installation of pin piles for jacket foundations which would result in 1,260 hours of piling activity (for WTG and offshore electrical platform foundations) occurring over a 20 month period. In reference to EMF, the assessment noted that impacts were mitigated by the commitment to bury cables where possible and, where not possible, to apply cable protection, such that EMF would be minimised to very low levels.	information on the reductions). The reduction in these parameters did not alter the conclusions stated within the ES. The parameters which inform the assessment are specifically secured in the Order through the requirements and conditions detailed in the following rows of Table 1: 7, 8, 9, 10, 11, 16, 17, 18, 19, 20, 21 and 22. In reference to the proposed NMC and DML variation, and as shown in Table 1, there will be no increase to the parameters that relate to the foundations' sizes, scour protection or total or maximum quantities of disposal as secured through the Order. Furthermore, the conditions that control the levels of underwater noise namely maximum duration of piling activity and the maximum hammer energies will not change. There will be a reduction in the maximum number of WTGs from 158 to 145 which would reduce the overall duration of impacts however, this would not be a significant enough decrease to change the magnitude of related impacts. There will also be no change in the installation methods from those previously assessed within the ES. This includes the commitment to bury cables wherever possible and at the limited number of locations where this may not be possible, to place cable protection over the cable which would reduce any EMF to very low levels. There will be no increase in the nominal operating voltage (approximately +/-320kV) of the export cables and since the application was made the amount of export cable crossings has been reduced from 22 to 4 (see submission ExA; Mit; 11.D10.2.App1 on the Norfolk Vanguard Planning Inspectorate page; a link is provided in the Reference section of this document) therefore reducing further the amount of unburied cable and potential for EMF. **Therefore, the proposed NMC and DML variation will not change the impact conclusions stated in the ES.**
Marine Mammal Ecology (Chapter 12)	Impacts assessed within Chapter 12 which are of relevance to the NMC and DML variation are: 1. Physical and auditory injury resulting from underwater	The assessment for Marine Mammal Ecology is informed by parameters associated with the number and installation methods of the WTGs, not the capacity of either the wind farm or individual WTGs. During the Norfolk Vanguard examination the maximum number of WTGs was reduced from

ES Topic	Impacts described in ES Chapter	Change in impact significance
	noise during piling 2. Behavioural impacts resulting from underwater noise during piling 3. Behavioural impacts resulting from underwater noise during construction activities, other than piling 4. Behavioural impacts resulting from underwater noise and presence of vessels 5. Barrier effects as a result of behavioural impacts resulting from underwater noise associated with piling, construction activities and vessels 6. Vessel interaction As detailed above the worst case scenario assessed in the ES was associated with the largest gravity anchor foundations resulting in worst case total disturbance footprint of 16.1km². However, with the removal of this option from the design envelope, this footprint will be reduced. In reference to noise impacts, the worst case spatial scenario assessed for pilling was as a result of 5,000kJ hammer energy for monopile foundations and 2,700kJ hammer energy for offshore electrical platform pin pile foundations. As no layout was available for the ES it was assumed that the maximum spatial impact could include the entire wind farm site and a buffer around the site for the furthest extent to which the noise could travel. The worst case temporal impact resulted from the installation of pin piles for jacket foundations which would result in 1,260 hours of piling activity (for WTG and offshore electrical platform foundations) occurring over a 20 month period.	200 to 158 and the gravity anchor foundation option was removed, which resulted in a reduction of associated parameters which could impact marine mammals such as maximum amount of piling events and maximum amount of disposed material (see Table 1 for further information on the reductions). The reduction in these parameters did not alter the conclusions stated within the ES. The parameters which inform the assessment are specifically secured in the Order through the requirements and conditions detailed in the following rows of Table 1: 18, 19 and 22. In reference to the proposed NMC and DML variation, and as shown in Table 1, there will be no increase to the parameters that relate to the foundations' sizes, scour protection or total or maximum quantities of disposal as secured through the Order. Furthermore, the conditions that control the levels of underwater noise, namely maximum duration of piling activity and the maximum hammer energies will not change. There will be a reduction in the maximum number of WTGs from 158 to 145 which would reduce the overall duration of impacts however, this decrease would not be significant enough to change the magnitude of related impacts. Furthermore, the maximum number of vessel movements and numbers of vessels on site during construction and operation assessed within the ES will not increase as a result of the NMC and DML variation. In addition, mitigation to reduce adverse effects on marine mammals is secured within the Order (Schedules 9-10, Condition 14(f) and Schedules 11-12 9(f)) and will not change. **Therefore, the proposed NMC and DML variation will not change the impact conclusions stated in the ES.**
Offshore Ornithology (Chapter 13)	Impacts assessed within Chapter 13 which are of relevance to the NMC and DML variation are: 1. Disturbance and displacement;	The assessment for Offshore Ornithology is informed by parameters associated with the specification, number and installation methods of the WTGs, not the capacity of either the wind farm or individual WTGs. During the Norfolk Vanguard examination the turbine draught height was increased

ES Topic	Impacts described in ES Chapter	Change in impact significance
	2. Indirect effects due to prey species displacement; 3. Collision risk; and 4. Barrier effects. The assessment is based upon a maximum of 200 x 9MW WTGs separated at a minimum distance of 680m, a maximum rotor diameter of 303m, maximum hub height of 198.5m, maximum tip height of 350m and a minimum draught height of 22m.	to 30m above MHWS for turbines with a capacity of 14.7MW and above, and 35m for turbines with a capacity up to and including 14.6MW. This reduced the magnitude of predicted affects, as demonstrated in ExA; Mit; 11.D10.2.App1 on the Norfolk Vanguard Planning Inspectorate web page (a link is provided in the Reference section of this document) however it did not alter the overall impact conclusions of significance as stated within the ES. The parameters which inform the assessment are specifically secured in the Order through the requirements and conditions detailed in the following rows of Table 1: 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and 21. In reference to the proposed NMC and DML variation, there will be no exceedance of the specifications of the WTGs as secured in the Order, the proposed WTGs remain within the consented envelope. There will be a reduction in the maximum number of WTGs from 158 to 145 which will be secured through Schedule 1 Requirement 3 (1) of the amended Norfolk Vanguard Order. In regard to Collision Risk Modelling (CRM), updated modelling is detailed in Appendix A of this document. In summary, the updated WTGs parameters and layout (which remain within the maximum parameters secured within the Order) result in reductions (by up to 28%) in annual collision risk for all species except lesser black-backed gull, for which the predictions are very slightly lower, when compared to modelling conducted for the consented worst-case WTG parameters for the ES. The differences in collision reductions among species reflects their respective densities in the east and west sites, with all species except lesser black-backed gull present in higher densities in the east site (which will have fewer installed turbines). **Therefore, the proposed NMC and DML variation will not change the impact conclusions stated in the ES.**
Commercial Fisheries (Chapter 14)	Impacts assessed within Chapter 14 which are of relevance to the NMC and DML variation are: 1. Adverse impacts on commercially exploited fish and shellfish populations 2. Temporary loss or restricted access to traditional grounds	The assessment for Commercial Fisheries is informed by parameters associated with the number, installation methods, amount of seabed material displaced by the WTGs and their foundations, and interactions with project vessels and not the capacity of either the wind farm or individual WTGs. The parameters which inform the assessment are specifically secured in the Order through the requirements and conditions detailed in the following rows of Table 1: 7, 8, 9, 10, 17, 18, 19, 20 and 21.

ES Topic	Impacts described in ES Chapter	Change in impact significance
	3. Displacement of fishing activity into other areas 4. Increased steaming times to fishing grounds 5. Interference with fishing activities 6. Safety issues for fishing vessels 7. Obstacles on the seabed The assessment is based upon a maximum of 200 WTGs separated at a minimum distance of 680m and with temporary transitory 500m safety zones around installed or partially installed infrastructure leading to a period of total exclusion of all fishing activities from the entire Norfolk Vanguard site.	In reference to the proposed NMC and DML variation, the maximum number of WTGs will decrease, and there will be no change to the minimum spacing requirements and maximum area of offshore development as secured in the Order. Furthermore, the maximum number of vessel movements and numbers of vessels on site during construction and operation assessed within the ES will not increase as a result of the NMC and DML variation. **Therefore, the proposed NMC and DML variation will not change the impact conclusions stated in the ES.**
Shipping and Navigation (Chapter 15)	Impacts assessed within Chapter 15 which are of relevance to the NMC and DML variation are: 1. Vessel displacement 2. Restriction of adverse routeing 3. Increased vessel to vessel collision risk 4. Vessel to structure allision risk 5. Anchor interaction and snagging risk 6. Effects on emergency response resources This assessment was informed by a Navigational Risk Assessment (NRA) model which was based upon the worst case layout for the Project. This included 200 WTGs with a minimum separation distance of 680m. The maximum WTG foundation size considered within these layouts was the tensioned leg floating platform, the foundation with largest surface area at sea level.	The assessment for Shipping and Navigation is informed by parameters associated with the number and installation methods of WTGs and their foundations in addition to interactions with project vessels, not the capacity of either the wind farm or individual WTGs. During the Norfolk Vanguard examination the maximum number of WTGs was reduced from 200 to 158 which reduced the collision and allision risk for vessels navigating in and around the wind farm site, the tension leg floating foundations were also removed reducing the surface area at sea level. These reductions however did not alter the overall conclusions stated within the ES. The parameters which inform the assessment are specifically secured in the Order through the requirements and conditions detailed in the following rows of Table 1: 1, 3, 4, 5, 6, 11, 12 and 15. In reference to the proposed NMC and DML variation, the maximum number of WTGs will not decrease, and there will be no change to the minimum spacing requirements and maximum area of offshore development as secured in the Order. Furthermore, maximum number of vessel movements and numbers of vessels on site during construction and operation assessed within the ES will not increase as a result of the NMC. No parameters that are used to inform the NRA model will increase from what was assessed in the EIA and secured in the Order. **Therefore, the proposed NMC and DML variation will not change the impact conclusions stated in the ES.**

ES Topic	Impacts described in ES Chapter	Change in impact significance
Aviation and Radar (Chapter 16)	Impacts assessed within Chapter 16 which are of relevance to the NMC and DML variation are: 1. Creation of an aviation obstacle 2. WTGs causing permanent interference to civil and military radar 3. Increased air traffic in the area related to wind farm activities. This assessment was based upon a maximum blade tip height of 350m above Highest Astronomical Tide (HAT).	The assessment for Aviation and Radar is informed by parameters associated with the number and specifications of the WTGs being installed within the site, not the capacity of either the wind farm or individual WTGs. The parameters which inform the assessment are specifically secured in the Order through the requirements and conditions detailed in the following rows of Table 1: 10, 11, 12, 13, 14 and 15. The layout was not defined for the assessment. There are no increases to any of the parameters which form the basis of the assessment and therefore there would be no increase in effect. In addition, mitigation to avoid adverse effects on air defence radar is to be agreed with the MoD and NATS and is secured within the Order by Schedule 1, Part 1, Requirement 13 and Requirement 34 respectively and this will not change. **Therefore, the proposed NMC and DML variation will not change the impact conclusions stated in the ES**
Offshore and Intertidal Archaeology and Cultural Heritage (Chapter 17)	Impacts assessed within Chapter 17 which are of relevance to the NMC and DML variation are: 1. Direct impact to known heritage assets 2. Direct impact to potential heritage assets 3. Indirect impact to heritage assets from changes to physical processes 4. Impacts to the setting of heritage assets and historic seascape character 5. Impacts to site preservation conditions from drilling fluid breakout 6. Impacts to site preservation conditions from heat loss from installed cables This assessment was based on a worst case scenario which resulted in the maximum possible disturbance to the seabed via seabed preparation works (dredging and disposal), installation of foundations and associated scour protection. This was based on 200 9MW WTGs with gravity anchor foundations.	The assessment for Offshore and Intertidal Archaeology and Cultural Heritage is informed by parameters associated with the number, installation methods and amount of seabed material displaced by the WTGs and their foundations, not the capacity of either the wind farm or individual WTGs. The parameters which inform the assessment are specifically secured in the Order through the requirements and conditions detailed in the following rows of Table 1: 7, 8, 9, 10, 16, 17, 18, 19, 20, and 21. In reference to the proposed NMC and DML variation, and as shown in Table 1, there will be no changes to the parameters that relate to the foundations' sizes, total possible number or maximum quantities of disposal as secured through the Order. There will also be no change in the installation methods from those previously assessed within the ES. **Therefore, the proposed NMC and DML variation will not change the impact conclusions stated in the ES.**

ES Topic	Impacts described in ES Chapter	Change in impact significance
Infrastructure and Other Users (Chapter 18)	Impacts assessed within Chapter 18 which are of relevance to the NMC and DML variation are: 1. Impacts on oil and gas operations 2. Impacts on oil and gas exploration 3. Physical impacts on subsea cables and pipelines This assessment was based on the worst case of installation of either 90 or 200 WTGs, but was not influenced by the maximum generating capacity of the Project or the individual capacity of WTGs.	The assessment of Infrastructure and Other Users is informed by parameters associated with the area of the Norfolk Vanguard site and number and installation methods of the WTGs and their foundations, not the capacity of either the wind farm or individual WTGs. The parameters which inform the assessment are specifically secured in the Order through the requirements and conditions detailed in the following rows of Table 1: 1, 7, 8, 9, 10, 11, 17, 18, 19, 20 and 21. In reference to the NMC and DML variation, and as shown in Table 1, there will be no changes to the parameters that relate to the foundations' sizes, scour protection or maximum quantities of disposal as secured through the Order. The number of turbines will be reduced to 145 and therefore this falls within the range assessed within the ES. There will also be no change in the installation methods from those previously assessed within the ES. **Therefore, the proposed NMC and DML variation will not change the impact conclusions stated in the ES.**

2.4 Consideration of the effects of the change on HRA

16. As stated in section 2.2 "*A change is likely to be material if it would invoke a need for a Habitats Regulations Assessment*".

17. The proposed removal of the generating capacity limit will not result in any exceedance in the parameters secured in the Order (Table 1). The removal of the capacity limit along with the reduction in the maximum number of WTGs will not lead to an increase in the potential for collision risk for any species, as demonstrated by the updated CRM provided in Appendix A, and there would also therefore be no increase in the number of collisions apportioned to SPA populations. Hence, the predicted collision risks for the kittiwake populations at the Flamborough and Filey Coast SPA and Lesser black-backed gull populations at the Alde or Estuary SPA (both populations for which compensation will be provided under Schedule 17 Part 1 and 2 of the Order) would be unaffected as a result of the change proposed.

18. Furthermore, given that there would be no increase in parameters secured within the Order there would be no increase in effect on any SAC. This includes for cable installation within the Haisborough, Hammond and Winterton SAC (for which compensation is provided under Part 3 of Schedule 17 of the Order); and as neither the maximum spatial extent or duration of underwater noise would increase as result of the changes, there would be no change in effect on the Southern North Sea SAC.

19. Therefore, with no increase in effect on any national site network, there is no requirement for an update to the Habitats Regulations Assessment (HRA) conducted as part of the Norfolk Vanguard DCO application, or for a new HRA to be conducted as a result of the change proposed.

2.5 Consideration of the effects of the change on land rights

20. As stated in section 2.2 "*A change should be treated as material that would authorise the compulsory acquisition of any land, or an interest in or rights over land that was not authorised through the existing DCO*."

21. The proposed change applies to activities being undertaken within the existing DCO Order limits and Order land in offshore areas that will be leased to the project by The Crown Estate. As such, the possible requirement for compulsory acquisition does not arise.

2.6 Consideration of the effects of the change on local people.

22. As stated in section 2.2 "*The potential impact of the proposed changes on local people will also be a consideration in determining whether a change is material*."

23. As discussed in section 2.1 the proposed NMC only affects parameters associated with the WTGs, and only by a reduction in the number of WTGs proposed. It does not affect the offshore cable corridor, onshore cable route, onshore project substation or National Grid Substation extension (and associated works). Therefore, onshore, local communities will not be affected by it.

24. Furthermore, as discussed in section 2.3, the NMC and associated DML variation is not likely to result in any new or materially different impacts to commercial fisheries and shipping and navigation and therefore the proposed NMC and DML variation will not affect local offshore stakeholders.

25. In summary, as there will be no change in any parameters apart from the removal of the limit on capacity and a reduction in the maximum number of WTGs, the proposed NMC and associated DML variation will not change the impact conclusions stated in the ES (section 2.3) or the HRA (section 2.4). No onshore changes to the Project are proposed, nor will any onshore changes be required, as a result of the NMC application. Therefore, there will be no change to compulsory acquisition powers (section 2.5). Given the very minor nature of the offshore changes proposed, no other impacts on local communities (either onshore or offshore) would arise (section 2.6). Therefore, the application can properly be determined as one which is non-material.

3 CONSULTATION

3.1 Pre-Application Consultation

26. Informal pre-application consultation has been undertaken with the Marine Management Organisation (MMO), Natural England (NE) and The Crown Estate in order to brief consultees on the nature of the proposed NMC application and associated DML variation. Table 3 below provides a summary of the pre-application consultation undertaken.

Table 3: Summary of pre-submission consultation responses

Consultee	Date of Consultation	Consultation Format	Summary of Consultation
Marine Management Organisation	2/02/2022	Meeting with case manager and case officer	Explanation of what the NMC would include
Natural England	17/02/2022 and 21/04/2022	Email sent to case officer, and update meeting	Informing of NMC and providing information on what the NMC would include
The Crown Estate	25/01/2022	Meeting	Informing of the intention to remove the capacity limit and timeline for achieving this.

27. Letters have also been sent (via email) inviting stakeholders to participate in the NMC consultation. Further information on these invitations and a list of recipients is provided in the Consultation and Publicity Report which will be published in due course.

28. More widely, local stakeholders have been informed of the proposed NMC application via an e-shot – a regular update to currently more than 1,700 subscribers. A first e-shot was issued on 11 April 2022 to inform stakeholders of the intention to make an NMC application. A follow up e-shot was sent on 10 June 2022 that included a link to the Planning Inspectorate's project page, where details on the application will be published. Recipients of the e-shot include parish councils located along and neighbouring the Project's onshore cable route, as well as other local groups and individuals taking an interest in Project development. The e-news is also available on the Vattenfall in Norfolk web page[2].

3.2 Post Application Consultation

29. The 2011 Regulations set out, in regulations 6 and 7, how the NMC application is to be published and consulted on. Regulation 6 requires a notice of the NMC

[2] Vattenfall's Norfolk Vanguard and Norfolk Boreas Projects - Vattenfall

application (Regulation 6 Notice) to be published for two consecutive weeks in one or more local newspapers and in any other publication necessary in order to ensure that notice of the NMC application is give in the vicinity of the land. The Regulation 6 Notice will be published in the following newspapers:

- The Eastern Daily Press; and
- Fishing news

30. Furthermore, as set out in regulation 7 of the 2011 Regulations, the Applicant is required to consult each person who has the benefit of the DCO, each person that was notified of the application for the DCO and any other person who may be directly affected by the changes proposed in the NMC application. Regulation 7(3) allows for this list of consultees to be reduced with the consent of the Secretary of State. On 11 May 2022, the SoS confirmed agreement to a reduced consultee list for the NMC application.

4 CONCLUSION

31. Norfolk Vanguard Limited and Norfolk Vanguard East Limited is seeking to amend the Order for the Norfolk Vanguard offshore wind farm to remove the maximum limit on its export capacity and reduce the maximum number of WTGs.

32. Consideration has been given to the four tests outlined in the 2015 DCLG Guidance on Changes to Development Consent Orders, and it has been demonstrated that the proposed amendment would be non-material in nature due to there being no exceedance in the maximum consented parameters and therefore no new or materially different significant effects likely to arise when compared with those described in the original ES; no changes to the HRA previously undertaken; no requirement for additional powers of compulsory acquisition; and no other impacts as a result of the proposed change on local communities, either onshore or offshore.

5 REFERENCES

Norfolk Vanguard Environmental Statement: Chapters available on the Planning Inspectorate Website: Norfolk Vanguard | National Infrastructure Planning (planninginspectorate.gov.uk)
Department for Communities and Local Government (2015) Planning Act 2008: Guidance on Changes to Development Consent Orders: Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/485064/Making_changes_guidance_to_Development_Consent_Orders.pdf
Norfolk Vanguard Offshore Wind Farm: Additional mitigation Appendix 1 - Updated Collision Risk Modelling (ExA; Mit; 11.D10.2.App1) (Post-examination CRM update that brought the mitigation for Norfolk Vanguard in-line with that proposed for the Norfolk Boreas project). Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-004215-ExA;%20Mit;%2011.D10.2.App1%20Additional%20Mitigation%20Appendix%201%20Updated%20Collision%20Risk%20Modelling.pdf
The Applicant's Response to the Request for Additional Information (ExA.PDR.D13.V1): Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-004420-Applicant's%20Response%20to%20the%20Request%20for%20Additional%20Information.pdf

Appendix A: Collision Risk Modelling For Revised Turbine Design

Norfolk Vanguard Offshore Windfarm

Collision Risk Modelling for Revised Turbine Design

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LIST OF TABLES

1 INTRODUCTION

This note provides annual collision mortality estimates for the six seabird species of primary interest identified during the assessment and examination for the Norfolk Vanguard Offshore Wind Farm: gannet, kittiwake, lesser black-backed gull, herring gull, great black-backed gull and little gull.

The estimates have been calculated using the Band (2012[1]) Collision Risk Model (CRM) for: (i) the turbine values assessed for the Development Consent Order (DCO), and (ii) the values of a proposed turbine model and layout, as discussed below. This allows the predicted changes in the collision risk to be clearly compared between the design assessed and the proposed design.

Only the turbine values and layout (which remain within the maximum parameters secured within the DCO) have been changed in the CRM, with all the other input values to the model (seabird density, biometrics, flight heights, avoidance rates, nocturnal activity, wind farm operational percentage, etc.) kept the same as those reported in MacArthur Green (2020[2]), which was the final version of the CRM presented for the project. In addition, the proposed design complies with the restriction on the relative proportions of turbines to be sited in the Norfolk Vanguard East and West arrays in accordance with Requirement 3(1) of the DCO (and condition 1(3) of the Deemed Marine Licences for the generation assets).

2 METHODS

The collision estimates were calculated with the Band (2012) CRM using the seabird species and turbine values presented below (Table 2-1, Table 2-2 and

Table 2-3).

Natural England guidance for wind farm collision assessments is to use option 2 for all species, irrespective of the number of height observations recorded during surveys (due to unresolved concerns regarding the methods for seabird height estimation from digital aerial imagery).

The collision risk assessment for the consented Norfolk Vanguard Offshore Wind Farm design comprised of two turbine options:

- Up to 158 turbines with a generating capacity of 11.55MW and a draught height of 35m (from mean high water springs, MHWS); and,
- Up to 124 turbines with a generating capacity of 14.7MW and draught height of 30m (from MHWS).

The proposed wind farm design modelled here will comprise a maximum of 145 turbines (94 in NV West and 51 in NV East), and as these are rated at more than 14.7MW the lower draught height of 30m from MHWS applies (draught height is the distance between the lower rotor tip and the sea surface). Following further site investigations the difference between mean sea level (MSL) and

[1] Band, B. (2012). Using a Collison Risk Model to Assess Bird Collision Risks for Offshore Windfarms.
[2] MacArthur Green (2020). Norfolk Vanguard Offshore Wind Farm Additional mitigation. Appendix 1 Updated Collision Risk Modelling. Document Reference: ExA; Mit; 11.D10.2.App1. Date: 28 February 2020

MHWS has also been slightly reduced from 0.8m to 0.75m. This adds an element of precaution to the revised assessment as this very slightly increases collision risks.

Table 2-1 Wind turbine values.

Values	DCO modelled turbine values: 11.55MW @ 35m MHWS	DCO modelled turbine values: 14.7MW @ 30m MHWS	NMC proposed turbine values
No. turbines	158	124	145
Rotation speed (RPM)	7.5	6	6.5
Rotor radius (m)	100	115	118
Draught height (m, MHWS)	35	30	31.4
Minimum hub height (m, MHWS)	135	145	149.5
Max blade width (m)	5.8	7.5	6.5
Blade pitch (°)	15	15	15
Tidal offset (m, MHWS to MSL)	0.8	0.8	0.75
Wind farm width (km)	West: 17.7, East: 22.3	West: 17.7, East: 22.3	West: 17.7, East: 22.3
Latitude (°)	West: 52.9, East: 52.2	West: 52.9, East: 52.2	West: 52.9, East: 52.2
Operational period (%)	90	90	90

Table 2-2 Seabird densities (birds in flight/km² and 95% confidence intervals) in Norfolk Vanguard West and East.

Species	Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gannet	West	0.01 (0-0.09)	0.03 (0-0.09)	0.05 (0-0.19)	0 (0-0)	0.02 (0-0.09)	0.03 (0-0.09)	0.09 (0-0.28)	0.12 (0-0.37)	0.06 (0-0.19)	0.39 (0-0.96)	0.64 (0.37-0.95)	0 (0-0)
	East	0.03 (0-0.14)	0.05 (0-0.19)	0.02 (0-0.09)	0.03 (0-0.12)	0.05 (0-0.2)	0.25 (0-0.68)	0.01 (0-0.07)	0.14 (0-0.32)	0.23 (0-0.55)	0.16 (0.02-0.46)	2.14 (0.68-5.05)	0.87 (0-1.69)
Kittiwake	West	0.11 (0-0.25)	0.08 (0-0.19)	0.19 (0.03-0.43)	0.06 (0-0.25)	0.08 (0-0.19)	0.28 (0.06-0.59)	0.11 (0-0.37)	0.1 (0-0.22)	0.07 (0-0.24)	0.12 (0-0.31)	0.42 (0.06-0.9)	0.02 (0-0.09)
	East	1.82 (0.34-4.82)	0.81 (0.19-1.65)	0.93 (0-2.83)	0.45 (0-1.49)	0.37 (0.03-0.97)	0.07 (0-0.26)	0.04 (0-0.14)	0.02 (0-0.14)	0.03 (0-0.11)	0.08 (0-0.34)	0.95 (0-1.94)	0.68 (0.14-1.61)
Lesser black-backed gull	West	0 (0-0)	0 (0-0)	0.02 (0-0.09)	0.01 (0-0.09)	0 (0-0)	0.11 (0-0.28)	0.14 (0-0.36)	0.2 (0.03-0.45)	0.06 (0-0.25)	0.11 (0-0.31)	0 (0-0)	0 (0-0)
	East	0.07 (0-0.27)	0.02 (0-0.13)	0.01 (0-0.12)	0.02 (0-0.1)	0 (0-0)	0 (0-0)	0.02 (0-0.12)	0.15 (0-0.41)	0 (0-0)	0.01 (0-0.07)	0.03 (0-0.12)	0.03 (0-0.16)
Herring gull	West	0 (0-0)	0.02 (0-0.09)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.03 (0-0.09)	0 (0-0)

Species	Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	East	0.52 (0-1.79)	0 (0-0)	0.01 (0-0.12)	0.02 (0-0.09)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.04 (0-0.22)	0.03 (0-0.21)
Great black-backed gull	West	0.05 (0-0.15)	0.11 (0-0.25)	0.02 (0-0.09)	0 (0-0)	0.02 (0-0.09)	0 (0-0)	0.03 (0-0.12)	0.05 (0-0.19)	0.14 (0-0.32)	0.03 (0-0.12)	0.07 (0-0.22)	0 (0-0)
	East	1.05 (0.03-3.38)	0.02 (0-0.13)	0.01 (0-0.09)	0.02 (0-0.13)	0 (0-0)	0 (0-0)	0 (0-0)	0.16 (0-0.51)	0 (0-0)	0 (0-0)	0.09 (0-0.43)	0.14 (0-0.39)
Little gull	West	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.03 (0-0.09)	0 (0-0)	0.06 (0-0.15)	0 (0-0)
	East	0 (0-0)	0.01 (0-0.07)	0 (0-0)	0 (0-0)	0.19 (0-0.65)	0 (0-0)	0 (0-0)	0.21 (0-0.6)	0.01 (0-0.08)	0 (0-0)	0.06 (0-0.33)	0 (0-0)

Table 2-3 Seabird biometrics.

Species	Body length (m)	Wingspan (m)	Flight speed (ms^{-1})	Flight type	Avoidance rate (%)	Nocturnal activity score (Garthe & Hüppop 2004)
Gannet	0.94	1.72	14.9	flapping	98.9	2
Kittiwake	0.39	1.08	13.1	flapping	98.9	3
Lesser black-backed gull	0.58	1.42	13.1	flapping	99.5	3
Herring gull	0.60	1.44	12.8	flapping	99.5	3
Great black-backed gull	0.71	1.58	13.7	flapping	99.5	3
Little gull	0.26	0.78	12.2	flapping	99.2	2

3 RESULTS

3.1 Total collision risk (EIA)

The annual collision mortality estimates for the worst case turbine design assessed for the DCO are presented in Table 3-1 alongside those for the proposed turbines.

Table 3-1 Comparison of annual collision mortality estimates (and 95% confidence intervals) for the worst case Norfolk Vanguard assessed design (124 turbines; note although the consent permits up to 158 turbines, these relate to the smaller model at a higher draught height which gave lower collisions risks) and the proposed design (145 turbines).

Species	Collisions for the worst case DCO modelled turbine values (14.7MW @ 30m MHWS)	Collisions for the NMC proposed turbine values	Reduction in collisions (%)
Gannet	32.1 (5.9-77.6)	27 (5.1-65.1)	15.8
Kittiwake	57.5 (6.1-149.7)	45.6 (4.8-118)	20.6

Species	Collisions for the worst case DCO modelled turbine values (14.7MW @ 30m MHWS)	Collisions for the NMC proposed turbine values	Reduction in collisions (%)
Lesser black-backed gull	12.0 (0.5-36.5)	11.9 (0.4-36.7)	0.01
Herring gull	7.5 (0-29.1)	5.7 (0-22.1)	23.9
Great black-backed gull	26.0 (0.4-86.1)	22.9 (0.3-75.1)	11.8
Little gull	2.5 (0-8.6)	1.8 (0-6.2)	28.2

Annual collision mortality predictions for the proposed turbine design and layout (145 turbines), compared with the assessed design, are reduced (by up to 28%) for all species except lesser black-backed gull, for which the collision predictions are very slightly lower. The differences in collision reductions among species reflects their respective densities in the east and west sites (Table 2 2), with all species except lesser black-backed gull present in higher densities in the east site.

Monthly collision mortality predictions are presented in Table 3-2 for the proposed design.

Table 3-2 Monthly collision mortality predictions (and 95% confidence intervals) for the Norfolk Vanguard proposed turbine design.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Gannet	0.22 (0-1.14)	0.38 (0-1.32)	0.51 (0-1.98)	0.15 (0-0.6)	0.43 (0-2.01)	1.65 (0-4.63)	1 (0-3.26)	1.86 (0-5.19)	1.55 (0-4.09)	3.76 (0.1-9.52)	12.31 (5.04-25.24)	3.14 (0-6.1)	27 (5.1-65.1)
Kittiwake	9.43 (1.6-24.65)	4.24 (0.85-8.8)	6.57 (0.3-18.84)	3.04 (0-10.4)	2.98 (0.19-7.56)	3.33 (0.66-7.72)	1.38 (0-4.83)	1.15 (0-3.01)	0.76 (0-2.85)	1.55 (0-4.57)	7.89 (0.52-16.52)	3.28 (0.64-8.22)	45.6 (4.8-118)
Lesser black-backed gull	0.48 (0-1.78)	0.13 (0-0.78)	0.3 (0-2.11)	0.36 (0-2)	0 (0-0)	1.65 (0-4.13)	2.26 (0-6.47)	4.13 (0.45-9.79)	0.83 (0-3.29)	1.48 (0-4.53)	0.19 (0-0.79)	0.17 (0-1.02)	11.98 (0.4-36.7)
Herring gull	4.15 (0-14.27)	0.22 (0-1.29)	0.12 (0-1.05)	0.18 (0-0.84)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.75 (0-3.03)	0.27 (0-1.63)	5.7 (0-22.1)
Great black-backed gull	10.37 (0.29-33.25)	1.88 (0-4.99)	0.39 (0-2.66)	0.22 (0-1.35)	0.31 (0-1.92)	0 (0-0)	0.65 (0-2.59)	2.65 (0-9.24)	2.54 (0-5.9)	0.55 (0-2.23)	2.05 (0-7.42)	1.28 (0-3.52)	22.9 (0.3-75.1)
Little gull	0 (0-0)	0.02 (0-0.15)	0 (0-0)	0 (0-0)	0.64 (0-2.12)	0 (0-0)	0 (0-0)	0.65 (0-1.89)	0.17 (0-0.69)	0 (0-0)	0.37 (0-1.38)	0 (0-0)	1.8 (0-6.2)

3.2 Collisions apportioned to relevant SPA populations

The number of predicted collisions for those species with predicted connectivity to Special Protection Area (SPA) populations are provided for gannet in Table 3-3, for kittiwake in Table 3-4 and for lesser black-backed gull in Table 3-5. Predicted collisions have been apportioned using the seasonal values advised by Natural England.

Table 3-3 Comparison of gannet seasonal collision mortality predictions (and 95% confidence intervals) apportioned to the Flamborough and Filey Coast SPA for the worst case turbine assessed and the proposed turbine. Natural England advised apportioning percentages for each season are included in the header.

Turbine	Spring (5.6%)	Breeding (100%)	Autumn (4.2%)	Annual
Assessed	0.3 (0.0-0.6)	8.2 (0.0-24.3)	1.2 (0.4-2.6)	9.6 (0.4-27.4)
Proposed	0.03 (0.18-0.48)	7.15 (0-21.75)	0.67 (0.22-1.46)	8.04 (0.22-23.69)

Table 3-4 Comparison of kittiwake seasonal collision mortality predictions (and 95% confidence intervals) apportioned to the Flamborough and Filey Coast SPA for the assessed worst case turbine and the proposed turbine. Natural England advised apportioning percentages for each season are included in the header.

Turbine	Spring (7.2%)	Breeding (86%)	Autumn (5.4%)	Annual
Assessed	1.4 (0.3-3.4)	18.7 (0.9-54.7)	0.9 (0.1-2.1)	21.0 (1.2-60.2)
Proposed	0.98 (0.18-2.41)	15.87 (0.98-45.02)	0.73 (0.06-1.74)	17.58 (1.22-49.16)

Table 3-5 Comparison of lesser black-backed gull seasonal collision mortality predictions (and 95% confidence intervals) apportioned to the Alde-Ore Estuary SPA for the assessed worst case turbine and the proposed turbine. Natural England advised apportioning percentages for each season are included in the header.

Turbine	Spring (3.3%)	Breeding (30%)	Autumn (3.3%)	Mid-winter (5%)	Annual
Assessed	0.01 (0-0.07)	2.53 (0.14-6.73)	0.08 (0-0.26)	0.05 (0-0.2)	2.67 (0.14-7.26)
Proposed	0.01 (0-0.07)	2.52 (0.13-6.72)	0.08 (0-0.26)	0.05 (0-0.22)	2.65 (0.13-7.26)

4 CONCLUSION

Collision risk modelling has been undertaken for the Norfolk Vanguard wind farm, using the same methods and values used during the project assessment and examination, including the application of Natural England's advised rates for nocturnal activity, collision avoidance rates and apportioning to SPA populations.

As has been demonstrated above, collision predictions for all species estimated using the proposed turbine are lower than the estimates for the worst case turbine design assessed for the DCO, whether considered for the total (EIA) level mortality or for collisions apportioned to relevant SPA populations (note that for lesser black-backed gull collisions apportioned to the Alde-Ore Estuary SPA the collision outputs for the proposed turbine appear to be unchanged, however this is due to rounding and the updated estimates for the proposed turbines are, at a minimum, marginally lower in all months).