

East Anglia ONE

DCO Non-Material Change

Supporting Statement

August 2021

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Revision 2

Prepared by:	Checked by:	Approved by:

REVISION CONTROL

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1	March 2021	For Issue	GoBe Consultants	Marc Browne	Catherine Sibley
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ABBREVIATIONS AND DEFINITIONS

AC	Alternating Current
BEIS	Department for Business, Energy and Industrial Strategy
CFD	Contract for Difference
DCLG	Department for Communities and Local Government
DCO	Development Consent Order
DML	Deemed Marine Licence
EA	Environment Agency
EA ONE	East Anglia ONE Offshore Wind Farm
EAOL	East Anglia ONE Limited
EIA	Environmental Impact Assessment
EPS	European Protected Species
ES	Environmental Statement
GW	Gigawatt
HRA	Habitats Regulations Assessment
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
LAT	Lowest Astronomical Tide
MHWS	Mean High Water Spring
MMO	Marine Management Organisation
MoD	Ministry of Defence
MW	Megawatt
NATS	National Air Traffic Services
NMC	Non Material Change
NFFO	National Federation of Fishermen's Organisations
RSPB	Royal Society for the Protection of Birds
SSC	Suffolk County Council
SPA	Special Protection Area
SoS	Secretary of State
SPR	ScottishPower Renewables
TCE	The Crown Estate
TH	Trinity House
WDC	Whale and Dolphin Conservation
WTG	Wind Turbine Generator

1. Introduction and scope

- 1 East Anglia ONE Ltd (EAOL) submitted an application for development consent and associated Deemed Marine Licences (DMLs) for the East Anglia ONE Offshore Wind Farm (EA ONE) in November 2012, with consent granted by the Secretary of State (SoS) for the Department of Energy and Climate Change (which subsequently became part of the Department for Business, Energy and Industrial Strategy (BEIS)) in June 2014. The 2014 Development Consent Order (DCO) granted consent for the development of an Offshore Wind Farm with a gross output of 1,200 Megawatt (MW) (1.2 Gigawatt (GW)), located approximately 43.4 km off the coast of Suffolk. The 2014 Order consented up to 240 Wind Turbine Generators (WTG) and associated offshore infrastructure.
- 2 It is worth noting that shortly after the consent was given for EA ONE, the UK Government announced the first new Contract for Difference (CfD) budget which was restricted below expectations and the competitive nature of the auction meant that ScottishPower Renewables (SPR) had to reassess the design of EA ONE to ensure that it could compete successfully in the auction. The optimisation of the design resulted in a new 714 MW offshore windfarm connecting with 'Alternating Current' (AC) technology. This was the most economic and efficient grid connection design for this export capacity.
- 3 A non-material change request was subsequently submitted in 2015. This sought consent for a change to the DCO to allow the option to construct either a wind farm of up to 750 MW with a High Voltage Alternating Current (HVAC) transmission system or a wind farm of 1,200 MW with a High Voltage Direct Current (HVDC) transmission system. The HVAC option for 750 MW included an allowance over the anticipated export capacity of 714 MW to account for transmission losses.
- 4 The East Anglia ONE Offshore Wind Farm (Corrections and Amendments) Order 2016 was granted in March 2016. The DCO (as amended) grants consent for *"240 wind turbine generators for the HVDC option, or if the HVAC option is selected, an offshore wind turbine generating station with a gross electrical output capacity of up to 750 MW comprising up to 150 wind turbine generators"*.
- 5 Requirement 35 of the DCO requires written notice to be given to the SoS which confirms whether the HVDC option or the HVAC option has been selected. EAOL selected the HVAC offshore substation option and confirmation of this was given to the SoS in a letter dated 16th September 2016.
- 6 The construction of the offshore works for EA ONE was completed in October 2020. All 102 WTGs are installed and operating, generating power which is transmitted to the associated onshore substation at Bramford, near Ipswich in Suffolk. The installed capacity has not been reduced and therefore there is no reduction in the renewable energy benefits.
- 7 EA ONE seeks a non-material change to reduce the maximum number of WTGs in the consent to 102, which is reflective of the number of WTGs installed under the DCO and their associated parameters (See Section 2 and Table 2-1). This document provides justification for the requested amendments and explains why the changes are considered to amount to a non-material change.
- 8 This document has been prepared to support the application for a non-material change (NMC) to the DCO (as amended). A parallel application will be made to the Marine Management Organisation (MMO) to seek the corresponding variation to the DMLs. This document explains the proposed amendments to the DCO and DMLs, with associated justification and supporting information to evidence the conclusion that the proposed changes represent a NMC.
- 9 This document follows the advice and guidance outlined in the Planning Act 2008: Guidance on Changes to Development Consent Orders published by the Department for Communities and Local Government (DCLG). The changes proposed are considered in light of the guidance in Section 3.

2. Proposed amendments

- 10 EA ONE wish to secure 102 WTGs as the maximum number of WTGs authorised in the DCO, reflecting the total number of WTGs installed and their parameters comprising their height (when measured from Lowest Astronomical Tide (LAT) to the tip of the vertical blade), their hub height (when measured from LAT to the centreline), their rotor diameter and their clearance height (from Mean High Water Springs (MHWS) to the lowest point of the rotating blade). No other changes to the WTG parameters within the DCO and/or DMLs are sought.
- 11 The increase in clearance height from the minimum of 22 m MHWS as stated in the DCO is due to the adoption of jacket foundations as opposed to monopile foundations, coupled with relatively shallow water depths across the EA1 site of 31 m below sea level. These two parameters allowed for an increase in hub height which in turn allowed the larger air draught. Conversely, a project in deeper waters would likely be unable to increase the wind turbine hub height to this extent.

2.1. Comparison of consented and proposed WTG parameters

- 12 A comparison of the consented and proposed maximum number of WTGs and the WTG parameters relevant to the amendment of both the 2014 Order (as amended) and also separately the DML for the generation assets is provided in Table 2-1 below.

Table 2-1 Summary of the proposed amendments for the non-material change sought by EAOL to the EA ONE 2014 Order (as amended).

DCO/ dML condition(s)	2014 DCO	2016 Amendment	Proposed 2021 Amendment	Proposed change from consented parameters
Maximum number of WTGs				
<ul style="list-style-type: none"> Part 1, Paragraph 2(1) Interpretation "HVAC offshore wind farm" Schedule 1, Part 1 Authorised development, Paragraph (1) Work No.1 (a); and Schedule 10 DML, Part 1, Paragraph 2(2)(a). 	-	150 WTG (HVAC)	102 WTG (HVAC)	32% reduction
Maximum number of WTGs with gravity base foundations				
<ul style="list-style-type: none"> Schedule 1, Part 3 Requirements, Paragraph 7(5); and Schedule 10 DML, Part 2, Paragraph 5(5). 	-	-	102 (HVAC) 240 (HVDC)	32% reduction for the HVAC option.
Maximum height of WTGs when measured from LAT to the tip of the vertical blade				
<ul style="list-style-type: none"> Schedule 1, Part 3 Requirements, Paragraph 3(1)(a); and Schedule 10 DML, Part 2, Paragraph 1(1)(a). 	200 m	-	188 m	6% reduction
Maximum hub height of WTGs (when measured from LAT to the centreline of the generator shaft forming part of the hub)				
<ul style="list-style-type: none"> Schedule 1, Part 3 Requirements, Paragraph 3(1)(b); and Schedule 10 DML, Part 2, Paragraph 1(1)(b). 	120 m	-	111 m	8% reduction
Maximum rotor diameter of WTGs				
<ul style="list-style-type: none"> Schedule 1, Part 3 Requirements, Paragraph 3(1)(c); and Schedule 10 DML, Part 2, Paragraph 1(1)(c). 	170 m	-	154 m	9% reduction
Minimum clearance height (from MHWS to the lowest point of the rotating blade of the WTGs)				
<ul style="list-style-type: none"> Schedule 1, Part 3 Requirements, Paragraph 3(1)(e); and Schedule 10 DML, Part 2, Paragraph 1(1)(e). 	22 m	-	28 m	27% increase

3. Materiality of Changes

3.1. Background

- 13 There is no statutory definition of what constitutes a material or non-material change 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 DCLGs “*Planning Act 2008: Guidance on Changes to Development Consent Orders*” (December 2015¹).
- 14 This document sets out the four characteristics which assist in establishing whether a proposed change to a DCO should be considered as material or non-material. The following characteristics are set out as examples of where an amendment is more likely to be considered 'material'.
- A change should be treated as material if it would require an updated Environmental Statement (ES) (from that at the time the original DCO was made) to take account of new, or materially different, likely significant effects on the environment as a result of the change.
 - A change is likely to be material if it would invoke a need for a Habitats Regulations Assessment (HRA). Similarly, the need for a new or additional licence in respect of European Protected Species (EPS) is also likely to be indicative of a material change.
 - A change should be treated as material if it 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.
- 15 The proposed amendments to the DCO (as amended) have been considered in light of these four characteristics in the following Section 3.2.1 to Section 3.2.4.

3.2. Materiality of Change

- 16 The characteristics of a 'material' change are set out within this Section of the report, and each criterion is considered against the proposed amendments to the DCO (as amended).

3.2.1. EIA Consideration

“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.”

- 17 Within this section EAOL has considered the potential implications of the proposed amendments in relation to all of the offshore topics assessed during the original Environmental Impact Assessment (EIA) process (the proposed amendments relate only to the offshore WTG infrastructure installed in the offshore part of the Order Limits below MHWS, with no proposed changes that have the potential to affect the onshore receptors originally considered within the application).
- 18 As the as-built parameters are fully within the consented Rochdale Envelope the adverse impacts will be no worse than those assessed in the EIA.
- 19 Consequently, all proposed amendments fall within the worst-case scenarios as assessed in the EIA. It can therefore be concluded that the proposed amendments will not result in any additional or increased likely significant effects from those described within the ES. The resultant Collision Risk Modelling update is provided in Appendix A.

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https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/485064/Making_changes_guidance_to_Development_Consent_Orders.pdf

3.2.2. Habitats Regulations Assessment Consideration

“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.”

- 20 Following a review of the HRA and the associated receptors, primarily birds and marine mammals, it can be concluded that the proposed WTG parameter amendments will not give rise to any impacts beyond those that were assessed in the original development consent application for the DCO (as amended) (see Section 3.2.1). Accordingly, an HRA is not required as a result of the proposed reductions to the WTG parameters.
- 21 Since the DCO (as amended) was made, the Outer Thames Special Protection Area² (SPA) has been extended. This site (and the previous boundary) was considered within the original HRA and it was concluded that EA ONE would not have an adverse effect on the SPA. Despite the extension to the SPA, the impacts upon the site and its conservation objectives remain the same and therefore given the reduction to the WTG parameters, this will not give rise to any change to the conclusions of the original HRA.
- 22 In addition, given that the proposed amendments to the WTG parameters will not give rise to any new or additional works and that the WTGs have been installed already, EA ONE will not need to apply for a new EPS licence.

3.2.3. Compulsory Acquisition

“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.”

- 23 The proposed WTG amendments will only apply to the activities being undertaken within the existing offshore Order Limits which have been leased to EAOL by The Crown Estate (TCE). As such, compulsory acquisition of additional land or interests in or rights over land are not relevant to the proposed amendments.

3.2.4. Local Population

“The potential impact of the proposed changes on local people will also be a consideration in determining whether a change is material.”

- 24 As discussed above in Section 3.2.1, the reduction in WTGs and their relevant parameters will not change the impact significance for any receptors or topic areas relating to the local population. There will be no additional or increased impacts in relation to commercial fisheries, shipping and navigation, seascape landscape and visual or the local economy and therefore the proposed amendments to the DCO (as amended) will not affect any local onshore or offshore stakeholders.

² <https://incc.gov.uk/our-work/outer-thames-estuary-spa/>

4. Pre-Submission Stakeholder Consultation

- 25 EAOL will submit a statement setting out the details of the steps EAOL has taken to comply with the requirements of Regulations 6 and 7 of the 2011 Regulations (Consultation and Publicity Statement) in due course.
- 26 In the meantime, this section outlines the consultation that has been or will be undertaken as part of the application for a NMC.

4.1. Pre-Application Consultation

- 27 EAOL has undertaken informal pre-application consultation with BEIS, the MMO, the Suffolk County Council (SSC), Mid Suffolk Council, East Suffolk Council, TCE, Natural England, Royal Society for the Protection of Birds (RSPB), the Wildlife Trust, the Marine Coastguard Agency (MCA), the National Air Traffic Services (NATS), Trinity House, Environment Agency (EA), the Civil Aviation Authority (CAA), the Ministry of Defence (MoD), the Whale and Dolphin Conservation (WDC), Historic England and the National Federation of Fishermen's Organisations (NFFO) in order to brief consultees on the nature of the proposed amendments. An overview of this is presented in Table 4-1. Initially, each consultee was contacted to inform them of the NMC to reduce the maximum consented number of WTGs and request if they would like to be consulted with on the proposed amendments. Following this, EAOL made the decision to include not only a reduction in the number of WTGs but also their relevant parameters within the NMC process, and subsequently all consultees were re-contacted in order to confirm their position on the need to be consulted.
- 28 In addition, EAOL intend to publicise the intention to submit an application for a NMC in advance of the formal application via the SPR website and e-mail all interested parties, as collated from registered users of the website. This pre-consultation process will allow potentially interested parties to register to receive a copy of the NMC application directly upon formal application (either electronic or hard copy).

Table 4-1 List of confirmed consultees as per Regulation 7 of the 2011 Regulations

Consultee	Date of Consultation	Consultation Format	Summary of Consultation	Confirmed Consultee
BEIS	14/01/2021	Teams meeting	Notice of the NMC and agreement on the consultation and submission process.	N/A
MMO	18/01/2021	Email	Confirmation that the MMO would like to be consulted with and are happy to receive the documents electronically.	✓
SSC	18/01/2021	Email	Confirmation that SSC would like to be consulted with and are happy to receive the documents electronically.	✓
Mid Suffolk Council	18/01/2021	Email	Confirmation that Mid Suffolk Council would like to be consulted with and are happy to receive the documents electronically.	✓
East Suffolk Council	18/01/2021	Email	Confirmation that East Suffolk Council would like to be consulted with and are happy to receive the documents electronically.	✓
TCE	15/01/2021	Email	Confirmation that TCE would like to be consulted with and are happy to receive the documents electronically.	✓
Natural England	15/01/2021	Email	Confirmation that Natural England would like to be consulted with and are happy to receive the documents electronically.	✓
RSPB	15/01/2021	Email	Confirmation that the RSPB would like to be consulted with and are happy to receive the documents electronically.	✓
Wildlife Trusts	15/01/2021	Email	Confirmation that the Wildlife Trust would like to be consulted with and are happy to receive the documents electronically.	✓
MCA	15/01/2021	Email	Confirmation that the MCA would like to be consulted with and are happy to receive the documents electronically.	✓
NATS	15/01/2021	Email	Confirmation that the NATS would like to be consulted with and are happy to receive the documents electronically.	✓
Trinity House	15/01/2021	Email	Confirmation that Trinity House would like to be consulted with and are happy to receive the documents electronically.	✓
EA	15/01/2021	Email	Confirmation that the EA do not need to be consulted with.	X
	09/03/2021	Email	Confirmation that the EA have been updated and do not wish to be consulted with.	
CAA	15/01/2021	Email	Confirmation that the CAA do not need to be consulted with.	X
	09/03/2021	Email	Confirmation that the CAA have been updated and do not wish to be consulted with.	
MoD	15/01/2021	Email	Confirmation that the MoD do not need to be consulted with.	X
	11/03/2021	Email	Confirmation that the MoD have been updated and do not wish to be consulted with.	
WDC	15/01/2021	Email	Confirmation that the WDC do not need to be consulted with.	X
	09/03/2021	Email	Confirmation that the WDC have been updated and do not wish to be consulted with.	
Historic England	15/01/2021	Email	Confirmation that Historic England do not need to be consulted with.	X
	11/03/2021	Email	Confirmation that HE have been updated and do not wish to be consulted with.	
NFFO	15/01/2021	Email	Confirmation that the NFFO do not need to be consulted with.	X
	15/03/2021	Email	Confirmation that the NFFO have been updated and do not wish to be consulted with.	

4.2. Post-Application Process

- 29 The 2011 Regulations (as amended by the Infrastructure Planning (Publication and Notification of Applications etc) (Amendment) Regulations 2020) set out, in Regulations 6 and 7, the prescribed process for the publication and consultation of the Application. Regulation 6 requires a notice of the 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 Application is given in the vicinity of the land.
- 30 In accordance with Regulation 6 of the 2011 Regulations, EAOL intend to publish the Regulation 6 Notice in the following newspapers:
- Eastern Daily Press;
 - Norwich Evening News;
 - The Lowestoft Journal/ Beccles & Bungay Journal;
 - The Great Yarmouth Mercury;
 - The Yarmouth Advertiser;
 - The Waveney Advertiser;
 - East Anglian Daily Times;
 - Ipswich Star;
 - West Suffolk Mercury;
 - East Suffolk Extra; and
 - Fishing News.
- 31 In light of the restrictions imposed as a result of the COVID-19 pandemic, the limitations concerning access for interested parties to the Application are recognised and as such, in addition to the standard consultation approaches, EAOL intend to publicise the Application by the following additional means:
- Publication of notices on local Parish websites and online platforms (the Parish contacts will also be provided with an electronic copy of the application directly, with confirmation that a hard copy can be provided upon request) including:
 - Akenham Parish Council, <https://aldenham-pc.gov.uk/>
 - Alderton Parish Council, <https://www.aldertonparishcouncil.org.uk/>
 - Bawdsey Parish Council, <http://www.bawdsey.onesuffolk.net/>
 - Bromeswell Parish Council, <http://bromeswell.onesuffolk.net/>
 - Burstall, <https://www.burstall.suffolk.cloud/>
 - Claydon and Whitton Parish Council, <http://claydonandbarham.onesuffolk.net/>
 - Copdock and Washbrook Parish Council, <https://copdockwashbrook.onesuffolk.net/>
 - Flowton Parish Council (Facebook, Twitter)
 - Great Bealings, www.greatbealings.co.uk
 - Grundisburgh & Culpho Parish Council, <https://grundisburgh.suffolk.cloud/>
 - Hintlesham & Chattisham, <http://hintleshamandchattisham.onesuffolk.net/parish-council/>
 - Kirton and Falkenham Parish Council, <http://kirtonandfalkenham.suffolk.cloud/>
 - Little Bealings, <https://littlebealings.onesuffolk.net/parish-council/>
 - Little Blakenham Parish Council, <https://littleblakenham.suffolk.cloud/>
 - Martlesham Parish Council, <https://martlesham.onesuffolk.net/>
 - Newbourne Parish Council, <http://newbourne.onesuffolk.net/>
 - Playford Parish Council, <http://www.playford.org.uk/Information.htm>
 - Ramsholt Parish Council
 - Shottisham, <http://shottisham.suffolk.cloud/shottisham-parish-council/>
 - Somersham Parish Council, https://www.somersham-pc.gov.uk/Home_13721.aspx
 - Sroughton Parish Council, <http://sroughton.onesuffolk.net/parish-council/>
 - Swilland and Winesham, <http://swillandandwinesham.onesuffolk.net/>
 - Tuddenham St Martin, <http://tuddenhamstmartin.onesuffolk.net/>
 - Waldringfield, <http://waldringfield.onesuffolk.net/parish-council/>
 - Westerfield Parish Council, <http://westerfield.onesuffolk.net/>
 - Woodbridge (Facebook, Twitter)

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- Publication of the Application notice on the SPR website, and provision of access to electronic copies of the Application documents (a contact email address and contact number will be provided, and hard copies will be made available on request);
 - Placement of a hard copy at the OrbisEnergy Building in Lowestoft for public review upon appointment only (and subject to appropriate COVID-19 restrictions);
 - Distribution of the Application notice to the list of interested parties, as collated from registered users of the SPR website; and
 - Provision of the application to the SPR nominated Fisheries Liaison Officer for communication to the fishing community.
- 32 In accordance with the 2011 Regulations, the Application documents will also be available for inspection on a website maintained by or on behalf of the Secretary of State.

5. Conclusion

- 33 EAOL is seeking to amend the DCO (as amended) for EA ONE to reduce the maximum number of WTGs and their relevant parameters to reflect those installed for the project. Taking into account the four criteria outlined within the DCLG Guidance on Changes to Development Consent Orders (2015) (in Section 3.2), it has been demonstrated that the proposed WTG parameter amendments should be considered as non-material in nature on the basis that there is:
- No exceedance in the maximum consented parameters;
 - No change to land requirements; and
 - No change to the impacts on local communities.
- 34 Therefore, the amendments are fully within the consented Rochdale Envelope and the adverse impacts will be no worse than those assessed in the original ES and HRA for EA ONE.

Appendix A

East Anglia ONE

DCO Non-Material Change

Collision Risk Modelling Update

Prepared by:	Checked by:	Approved by:

REVISION CONTROL

Revision and Approvals					
Rev	Date	Reason for Issue	Prepared by	Checked by	Approved by
1	25/03/2021	First draft	Mark Trinder	Nicola Goodship	Marc Browne
2	10/06/2021	Revisions	Mark Trinder	Ross McGregor (PCH calculations)	Marc Browne

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ABBREVIATIONS AND DEFINITIONS

CRM	Collision Risk Model
EA ONE	East Anglia ONE Offshore Wind Farm
MSL	Mean Sea Level
PCH	Proportion of birds at Collision Height
SPA	Special Protection Area

1. Introduction and scope

- 1 This document provides updated collision risk model (CRM) predictions for seabirds at the East Anglia ONE (EA ONE) wind farm. The current and most recent collision estimates for EA ONE were estimated for a design comprising 150 turbines, as this was the maximum number which could be installed under the HVAC option following the grant of a non-material amendment in March 2016, with a minimum draught height of 22 m (from Mean Sea Level, (MSL))³. The HVAC option was selected in September 2016.
- 2 However, EA ONE seeks a non-material change to reduce the maximum number of turbines in the consent to 102, which is reflective of the number turbines installed under the DCO and their associated parameters. This document therefore demonstrates and explains why the changes in turbine numbers and other as built parameters are considered to amount to a non-material change.
- 3 The built wind farm is now fully operational and comprises 102 turbines (of the same design) but with a mean draught height of 30.8 m from MSL (range 29.4 - 32.5 m MSL; use of the mean hub height is considered appropriate as this corresponds to the use of mean estimates for other parameters in the model). This document provides revised collision estimates which correspond to the as-built (and operational) wind farm parameters to support the non-material change application.
- 4 Although collision estimates for EA ONE for a 102 turbine wind farm design were presented during the East Anglia THREE wind farm examination⁴, these were calculated for a rotor draught height of 22 m from MSL. Therefore, these estimates have been recalculated using the increased draught height of 30.8 m from MSL, which changes the estimated proportion of birds at collision height (PCH) which is an important parameter in the Band (2012⁵) CRM.

2. Methods

- 5 To estimate revised PCH values for each species the original seabird flight height data, collected during the boat surveys which were used in the site characterisation, were reanalysed for the key species of interest; gannet, kittiwake, lesser black-backed gull, great black-backed gull and herring gull.
- 6 On review of the seabird flight height data for birds recorded within the 20 m to 35 m height range it was found that heights had been assigned to 5m intervals (i.e. 20, 25, 30 or 35 m). Hence, in the previous collision risk modelling, the estimate of birds below rotor height for the lower tip height of 22 m were derived from the data for birds assigned to heights up to and including 20 m. For the updated site specific PCH for the lower rotor tip of 30.8 m, the same approach was used. So, birds below rotor height were defined as those assigned to heights up to and including 30 m.
- 7 A summary of the flight height data is provided in Annex 1. The number of individuals recorded at or below 20 m (corresponding to the 22 m lower rotor tip height used in the original application CRM) and at or below 30 m (corresponding to the 30.8 m mean lower rotor tip height for the built wind farm), all with respect to MSL, are provided in Table 2-1, along with the PCH calculated from these data.
- 8 Natural England advise that site-based estimates of PCH should be treated with caution for sample sizes of ≤ 100 individuals (e.g. SPR 2015⁶) as this limits confidence in the results. This minimum sample size was exceeded for all species except great black-backed gull (Table 2-1), for which only 24 height estimates were recorded. Therefore, although a site-based estimate is presented in Table 2-1, the original and

³ <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010056/EN010056-001876-East%20Anglia%20Three%20limited%2020.pdf>

⁴ <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010056/EN010056-001644-EA3%20-%20Revised%20CRM.pdf>

⁵ Band, B. (2012). Using a Collision Risk Model to Assess Bird Collision Risks for Offshore Windfarms.

⁶ [https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010056/EN010056-000301-6.3.13%20\(3\)%20Volume%203%20Chapter%2013%20Offshore%20Ornithology%20Appendix%2013.3.pdf](https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010056/EN010056-000301-6.3.13%20(3)%20Volume%203%20Chapter%2013%20Offshore%20Ornithology%20Appendix%2013.3.pdf)

revised CRM uses the generic flight height data (Johnston *et al.* 2014a,b⁷) for this species (i.e. Band Option 2).

- 9 Natural England reviewed an earlier version of this report and requested additional collision risk modelling using Option 2 be provided for all species, and these are now included in Annex 2. This update also corrects an error subsequently detected in the original flight height data; a subset of the height data were recorded in the Excel spreadsheet as text rather than numerical and were thus inadvertently omitted from calculations. This error has been corrected in the current version of this report.
- 10 The reductions in the proportion of birds estimated to be at risk of collision following revision for the draught height change are substantial, for example:
 - 66% for gannet (from 25.7% to 8.8%); and,
 - 78% for kittiwake (from 21.3% to 4.6%).
- 11 The other input parameters used in the CRM are provided in Table 2-2, Table 2-3, Table 2-4 and Table 2-5. The bird parameter values are the same as used in the original CRM, while the turbine parameters correspond to the original, HVAC option and final designs respectively.

Table 2-1 Flight height sample sizes and PCH for the original and built wind farm designs.

Species	Total in flight	22 m lower tip		30.8 m lower tip	
		No. at or below 20 m	PCH (%)	No. at or below 30 m	PCH (%)
Gannet	985	732	25.7	898	8.8
Kittiwake	455	358	21.3	434	4.6
Lesser black-backed gull	731	533	26.9	625	14.4
<i>Great black-backed gull</i>	24	16	33.3	19	20.8
Herring gull	157	105	33.1	138	12.1

Table 2-2 East Anglia ONE turbine specifications used in the collision risk modelling: original 2014 consented value, HVAC option in the 2016 Change Order and final as-built design.

Parameter	Original 2014 Consented value	HVAC option in the 2016 Change Order (submitted during EA3 Examination ⁴)	Built design (current application)
No. of turbines	240	150	102
RPM	11	10.3	10.3
Rotor radius (m)	67.5	77	77
Max blade width (m)	4.8	5	5
Blade pitch (degrees)	15	15	15
Latitude (deg.)	52.67	52.67	52.67
Width of wind farm (km)	12.3	12.3	12.3
Hub height (m, MSL)	90	99.65	107.8

⁷ Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. and Burton, E.H.K. 2014a. Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines. *Journal of Applied Ecology* 51: 31-41. &

Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. and Burton, N.H.K. 2014b. corrigendum. *Journal of Applied Ecology*, 51, doi: 10.1111/1365-2664.12260.

Table 2-3 Species biometrics used in the East Anglia ONE collision risk modelling (from APEM 2015⁸).

Species	Body length (m)	Wingspan (m)	Flight speed (ms-1)	Nocturnal activity factor (1 to 5)	Flight type
Gannet	0.94	1.72	14.9	2	Gliding
Kittiwake	0.39	1.08	13.1	3	Flapping
Lesser black-backed gull	0.58	1.42	13.1	3	Flapping
Herring gull	0.60	1.44	12.8	3	Flapping
Great black-backed gull	0.71	1.58	13.7	3	Flapping

Table 2-4 Seabird monthly density estimates (birds per km²) used in the East Anglia ONE collision risk modelling. Species biometrics used in the East Anglia ONE collision risk modelling (from APEM 2015⁸).

Month	Gannet	Kittiwake	Lesser black-backed gull	Herring gull	Great black-backed gull
Jan	0.0161	0.3464	0.2346	0.0424	0
Feb	0	0.2096	0.0287	0.0447	0.0220
Mar	0.0183	0.2594	0.0114	0.0264	0.0825
Apr	0	0	0	0	0
May	0	0	0.0148	0.0097	0
Jun	0	0	0	0	0.0241
Jul	0	0.0194	0.1117	0	0.0008
Aug	0.0361	0	0	0	0
Sep	0.0577	0	0.0733	0.0232	0.0186
Oct	0.2855	0.0319	0.2063	0	0.0007
Nov	1.4517	1.6283	0.3920	0.4230	1.1658
Dec	0.0545	1.2045	0.0054	0.1125	0.0275

Table 2-5 Monthly wind farm operational percentage (from APEM 2015⁸).

Month	Wind Farm Operational time (%)
Jan	95.23
Feb	93.65
Mar	92.30
Apr	91.04
May	91.78
Jun	88.86
Jul	90.00
Aug	89.60
Sep	92.20
Oct	94.29
Nov	95.40
Dec	95.03

⁸ APEM (2015). Collision Risk Modelling of the Consented East Anglia ONE OWF. APEM Scientific Report 414044 -CRM-01/B.

3. Results

- 12 Compared with the previous collision mortality estimates, submitted during the East Anglia THREE examination for the HVAC option, two parameter value changes have resulted in reduced mortality predictions:
- A reduction in turbine numbers from 150 to 102 (a 32% reduction, which confers the equivalent magnitude change in collision risk); and,
 - An increase in the lower rotor tip height from 22 m above MSL to 30.8 m above MSL, which substantially reduces each species PCH value (e.g. by 78% for kittiwake using site based data, Table 2-1).
- 13 These two factors have operated together to substantially reduce the estimated collision risks at EA ONE. The summary annual collision risks are provided in Table 3-1 and the monthly estimates are in Table 3-2 and Table 3-3. As can be seen, the collision estimates for the built windfarm are all substantially lower than the consented and HVAC estimates. Band Option 2 results are provided in Annex 2.

Table 3-1 Annual seabird collision mortality at East Anglia ONE calculated using Band Option 1 (except great black-backed gull for which Option 2 was used, see text for details) for the built windfarm, 2016 HVAC design and the Original consented design.

Species	Band option	Avoidance rate	Current annual total (102 turbines)	2016 HVAC option annual total (150 turbines)	Original consented annual total (240 turbines)
Gannet	1	98.9	33.6	141	213
Kittiwake	1	98.9	30.6	209	314
Lesser black-backed gull	1	99.5	15.0	40	61
Great black-backed gull	2	99.5	23.7	46	71
Herring gull	1	99.5	7.6	28	41

- 14 The revised monthly collision estimates, calculated using **Option 1** for gannet, kittiwake, lesser black-backed gull and herring gull and **Option 2** great black-backed gull are provided in Table 3-2 (great black-backed gull collisions were not estimated using Option 1 due to this species having too few flight height records for reliable PCH calculation).
- 15 The estimates for the as-built wind farm parameters (102 turbines) are presented alongside those for the HVAC option in the 2016 Change Order (150 turbines) and the original consented estimates (240 turbines) for comparison.
- 16 The collision estimates apportioned to the Flamborough and Filey Coast SPA (Special Protection Area; gannet and kittiwake) and Alde-Ore Estuary SPA (lesser black-backed gull) are also provided (Table 3-3).

4. Conclusion

- 17 Estimation of the collision risk mortality for the reduced number of turbines (102) with an increased rotor draught height (30.8 m) compared with the previous collision estimates for this wind farm for 150 turbines with a draught height of 22 m (for the HVAC option under the 2016 Change Order) has reduced the predicted collisions compared using the same model options in each case by 48% to 85%, varying across species.
- 18 The reductions in the predicted total annual collisions from the previous estimates (for the HVAC option under the 2016 Change Order) to the revised estimates reflecting the built wind farm and using **Option 1** for gannet, kittiwake, lesser black-backed gull and herring gull and **Option 2** for great black-backed gull are as follows:
- Gannet - from 141 to 33.6 (-76%),
 - Kittiwake - from 209 to 30.6 (-85%),
 - Lesser black-backed gull - from 40 to 15 (-62%), and
 - Herring gull - from 28 to 7.6 (-73%),
 - Great black-backed gull - from 46 to 24 (-48%).
- 19 The same magnitudes of reduction using **Option 1** were achieved for collisions apportioned to SPA populations:
- Gannet (FFC SPA) - from 10.1 to 2.4,
 - Kittiwake (FFC SPA) - from 12.0 to 1.8, and
 - Lesser black-backed gull (AOE SPA) - from 3.6 to 1.3.

Table 3-2 Seabird collision mortality at East Anglia ONE using **Band Option 1 for gannet, kittiwake, lesser black-backed gull and herring gull and Option 2 for great black-backed gull**. Monthly and annual values calculated for the updated wind farm design (Table 2-2) with annual totals for the original consented and 2016 HVAC option change order designs included for comparison. Bird biometrics and densities are presented in Table 2-3 and Table 2-4, monthly operation is presented in Table 2-5. The species-specific recommended avoidance rates are highlighted for each species (98.9% for gannet and kittiwake and 99.5% for the large gulls). The upper and lower confidence estimates have been greyed to help highlight the overall reductions.

Species	Avoidance rate	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Current annual total (102 turbines)	2016 HVAC option annual total (150 turbines)	Original consented annual total (240 turbines)
Gannet	98.7	0.3	0.0	0.4	0.0	0.0	0.0	0.0	0.9	1.4	6.5	29.1	1.1	39.7	166	251
	98.9	0.3	0.0	0.4	0.0	0.0	0.0	0.0	0.8	1.2	5.5	24.6	0.9	33.6	141	213
	99.1	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.7	1.0	4.5	20.1	0.7	27.5	115	174
Kittiwake	98.7	3.4	1.9	2.8	0.0	0.0	0.0	0.2	0.0	0.0	0.3	15.8	11.7	36.1	246	371
	98.9	2.9	1.6	2.3	0.0	0.0	0.0	0.2	0.0	0.0	0.3	13.4	9.9	30.6	209	314
	99.1	2.4	1.3	1.9	0.0	0.0	0.0	0.2	0.0	0.0	0.2	11.0	8.1	25.0	170	257
Lesser black-backed gull	99.4	3.8	0.4	0.2	0.0	0.3	0.0	2.1	0.0	1.3	3.6	6.2	0.1	18.0	49	73
	99.5	3.2	0.4	0.2	0.0	0.2	0.0	1.8	0.0	1.1	3.0	5.2	0.1	15.0	40	61
	99.6	2.5	0.3	0.1	0.0	0.2	0.0	1.4	0.0	0.8	2.4	4.2	0.1	12.0	33	49
Herring gull	99.4	0.6	0.6	0.4	0.0	0.2	0.0	0.0	0.0	0.3	0.0	5.6	1.5	9.1	32	49
	99.5	0.5	0.5	0.3	0.0	0.1	0.0	0.0	0.0	0.3	0.0	4.7	1.2	7.6	28	41
	99.6	0.4	0.4	0.3	0.0	0.1	0.0	0.0	0.0	0.2	0.0	3.8	1.0	6.1	21	33
Great black-backed gull	99.4	0.0	0.4	1.9	0.0	0.0	0.6	0.0	0.0	0.4	0.0	24.5	0.6	28.5	56	85
	99.5	0.0	0.4	1.6	0.0	0.0	0.5	0.0	0.0	0.4	0.0	20.4	0.5	23.7	46	71
	99.6	0.0	0.3	1.3	0.0	0.0	0.4	0.0	0.0	0.3	0.0	16.4	0.4	19.0	38	57

Table 3-3 Seasonal and annual collision risks apportioned to relevant SPAs for the revised East Anglia ONE wind farm using **Option1** and species-specific advised avoidance rates as above.

Species	SPA	Band Option	Breeding season	Autumn	Spring	Nonbreeding season	Revised annual total	Previous annual totals (for 2016 change order)
Gannet	Flamborough and Filey Coast	1	0.8	1.5	0.1	N/A	2.4	10.1
Kittiwake	Flamborough and Filey Coast	1	0	1.3	0.5	N/A	1.8	12.0
Lesser black-backed gull	Alde-Ore Estuary	1	0.8	N/A	N/A	0.5	1.3	3.6

ANNEX 1 – SEABIRD FLIGHT HEIGHT DATA

20 A summary of the seabird flight height data recorded during the boat surveys is provided below as the number of birds recorded within 5 m height bands (Table 3-4).

Table 3-4. Summarised flight height data recorded during baseline site characterisation surveys.

Species	No. recorded at heights less than and equal to:							Total
	5 m	10 m	15 m	20 m	25 m	30 m	>35 m	
Gannet	311	472	561	732	819	898	925	985
Kittiwake	75	234	276	358	389	434	438	455
Lesser black-backed gull	112	184	245	533	587	625	639	731
Herring gull	23	66	84	105	114	138	138	157
Great black-backed gull	6	10	14	16	16	19	19	24

21 The proportions of each species at collision heights of >20 m, which correspond to the original estimate of PCH used in the ES and HVAC change Order are therefore:

- Gannet: $(985-732)/985 = 25.7\%$
- Kittiwake: $(455-358)/455 = 21.3\%$
- Lesser black-backed gull: $(731-533)/731 = 27.1\%$
- Herring gull: $(157-105)/157 = 33.1\%$
- Great black-backed gull: $(24-16)/24 = 33.3\%$

22 The proportions at collision heights of >30 m, which correspond to the as-built estimate of PCH are therefore:

- Gannet: $(985-898)/985 = 8.8\%$
- Kittiwake: $(455-434)/455 = 4.6\%$
- Lesser black-backed gull: $(731-625)/731 = 14.4\%$
- Herring gull: $(157-138)/157 = 12.1\%$
- Great black-backed gull: $(24-19)/24 = 20.8\%$

ANNEX 2 – BAND OPTION 2 RESULTS FOR GANNET, KITTIWAKE, LESSER BLACK-BACKED GULL AND HERRING GULL

- 23 Natural England guidance for more recent windfarm collision assessments is to use option 2 for all species, irrespective of the number of height observations recorded during surveys (due to concerns regarding the methods for seabird height estimation from digital aerial imagery). Thus, while the revised collision modelling provided in this note has followed the methods used in the original assessments and previous non-material change applications in order to present 'like-for-like' outputs (i.e. use of option 1 for gannet, kittiwake, lesser black-backed gull and herring gull and option 2 for great black-backed gull), in keeping with advice received from Natural England, option 2 outputs have also been calculated for the four named species for which Option 1 was previously used.
- 24 The option 2 annual collision mortality estimates for gannet, kittiwake, lesser black-backed gull and herring gull for the consented wind farm design are presented in Table 3-5.

Table 3-5 Annual seabird collision mortality at East Anglia ONE calculated using **Band Option 2** for the built windfarm.

Species	Band option	Avoidance rate	Current annual total (102 turbines)
Gannet	2	98.9	14.9
Kittiwake	2	98.9	34.0
Lesser black-backed gull	2	99.5	14.3
Herring gull	2	99.5	10.5

Table 3-6 Seabird collision mortality at East Anglia ONE using **Band Option 2** for gannet, kittiwake, lesser black-backed gull and herring gull. Monthly and annual values calculated for the updated wind farm design (Table 2-2). Bird biometrics and densities are presented in Table 2-3 and Table 2-4, monthly operation is presented in Table 2-5. The species-specific recommended avoidance rates are highlighted for each species (98.9% for gannet and kittiwake and 99.5% for the large gulls). The upper and lower confidence estimates have been greyed to help highlight the overall reductions.

Species	Avoidance rate	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Current annual total (102 turbines)
Gannet	98.7	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.4	0.6	2.9	12.9	0.5	17.7
	98.9	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.4	0.5	2.4	10.9	0.4	14.9
	99.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.4	2.0	9.0	0.3	12.2
Kittiwake	98.7	3.8	2.1	3.1	0.0	0.0	0.0	0.3	0.0	0.0	0.4	17.6	13.0	40.2
	98.9	3.2	1.8	2.6	0.0	0.0	0.0	0.2	0.0	0.0	0.3	14.9	11.0	34.0
	99.1	2.6	1.5	2.1	0.0	0.0	0.0	0.2	0.0	0.0	0.3	12.2	9.0	27.9
Lesser black-backed gull	99.4	3.6	0.4	0.2	0.0	0.3	0.0	2.0	0.0	1.2	3.4	6.0	0.1	17.1
	99.5	3.0	0.3	0.2	0.0	0.2	0.0	1.7	0.0	1.0	2.8	5.0	0.1	14.3
	99.6	2.4	0.3	0.1	0.0	0.2	0.0	1.4	0.0	0.8	2.3	4.0	0.1	11.4
Herring gull	99.4	0.8	0.8	0.5	0.0	0.2	0.0	0.0	0.0	0.5	0.0	7.8	2.1	12.7
	99.5	0.7	0.6	0.4	0.0	0.2	0.0	0.0	0.0	0.4	0.0	6.5	1.7	10.5
	99.6	0.5	0.5	0.4	0.0	0.1	0.0	0.0	0.0	0.3	0.0	5.2	1.4	8.4

Table 3-7 Seasonal and annual collision risks apportioned to relevant SPAs for the revised East Anglia ONE wind farm using **Option 2** and species-specific advised avoidance rates as above.

Species	SPA	Band Option	Breeding season	Autumn	Spring	Nonbreeding season	Revised annual total
Gannet	Flamborough and Filey Coast	2	0.4	0.7	0	N/A	1.1
Kittiwake	Flamborough and Filey Coast	2	0	1.4	0.6	N/A	2.0
Lesser black-backed gull	Alde-Ore Estuary	2	0.8	N/A	N/A	0.5	1.3

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