From:	Dominika Phillips
To:	Hornsea Project Three; KJ Johansson; Kay Sully
Cc:	Andrew Guyton; Stuart Livesey
Subject:	Hornsea Project Three (UK) Ltd response to Deadline 4 (Part 15)
Date:	15 January 2019 23:24:05
Attachments:	image001.png D4_HOW03_Appendix 69_NV_Ornithology.pdf D4_HOW03_Appendix 70_Inch Cape_Ornithology.pdf D4_HOW03_Appendix 71_NF_HOW02_DL5.pdf D4_HOW03_Appendix 72_Aviation Team.pdf D4_HOW03_Appendix 73_O2.2.30_O2.2.39.pdf

Dear Kay, K-J

Please find attached the 15th instalment of documents.

Best regards,
Dr Dominika Chalder PIEMA
Environment and Consent Manager

[redacted]

Environmental Management UK | Wind Power
5 Howick Place | London | SW1P 1WG

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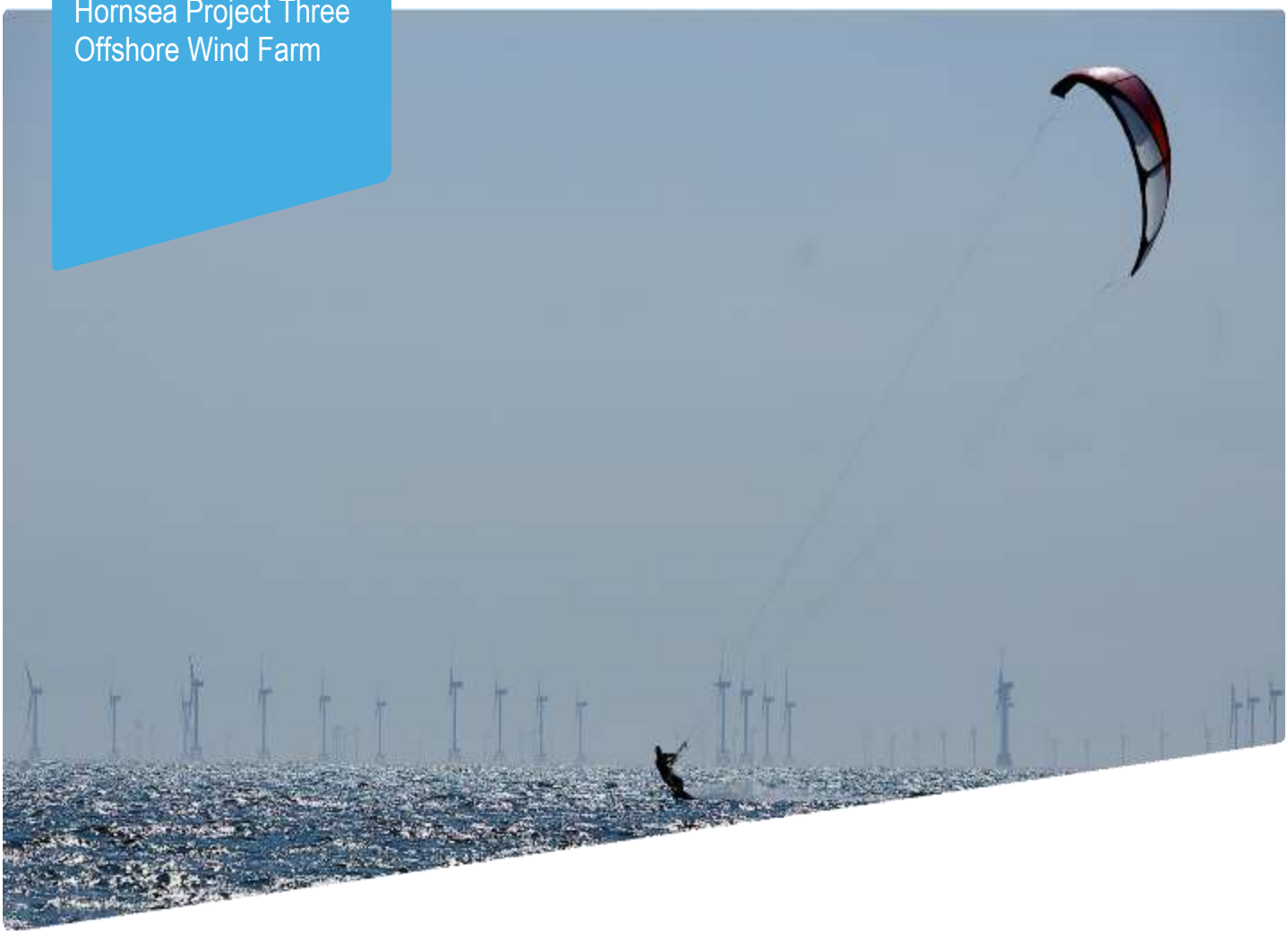
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Appendix 71 to Deadline 4 Submission – Natural England Response to Hornsea Two Deadline 5 (2015)

Date: 15th January 2019

Hornsea 3
Offshore Wind Farm

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Document Control			
Document Properties			
Organisation	Ørsted Hornsea Project Three		
Author	Natural England		
Checked by	n/a		
Approved by	n/a		
Title	Appendix 71 to Deadline 4 Submission – Natural England Response to Hornsea Two Deadline 5 (2015)		
PINS Document Number	n/a		
Version History			
Date	Version	Status	Description / Changes
15/01/2019	A	Final	Submitted at Deadline 4 (15/01/2019)

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

THE PLANNING ACT 2008

THE INFRASTRUCTURE PLANNING (EXAMINATION PROCEDURE) RULES 2010

HORNSEA OFFSHORE WIND FARM - PROJECT TWO APPLICATION

International Mainstream Renewable Power Limited and Siemens Project Ventures for:

The construction and operation of Hornsea Offshore Wind Farm Project Two, a 1,800 MW with up to 360 turbines wind farm located approximately 89km off the East Riding of Yorkshire coast, and 50km from the median line between UK and Dutch waters.

Planning Inspectorate Reference: EN010053

WRITTEN SUBMISSION FOR DEADLINE 5

Dated 12th November 2015

Contents

INTRODUCTION

1.1 This submission follows the third set of Issue Specific Hearing (ISH) for the Hornsea Project Two, which took place in the Ashbourne Hotel, North Killingholme, Immingham, between 27th and 28th October 2015.

1.2 This report consists of 3 parts

a. Section A – Written submission of Natural England's oral case given at the issue specific hearings on 27th and 28th October 2015

b. Section B – Comments on the Offshore Ornithology Clarification Notes submitted by the Applicant

c. Section C – Comments to Addendum to the HRA: Consideration of the Southern North Sea dSAC submitted by the Applicant

SECTION A – SUMMARY OF NATURAL ENGLAND'S CASE AT THE ISSUE SPECIFIC HEARING ON 27 AND 28 OCTOBER 2015

Day 1 Agenda

Tuesday 27th October 2015

Agenda Item 3 - CL: Construction Onshore and Inter-tidal

Update on the Intertidal Access Management Plan (IAMP).

2.1 The ExA asked Natural England about intertidal access & roadway construction issues raised.

2.2 Natural England confirmed that the detail of the IAMP had been agreed with the Applicant. Ms Burton advised that the previous concern was around the feasibility of placing an aluminium track over sand dunes to minimise impacts to an acceptable level. The Applicant has carried out a site visit, observing the site from the sea defence to establish the feasibility of the IAMP. Natural England subsequently received a technical note from the Applicant and confirmed that it is happy that what has been assessed in the EIA is fit for purpose. Natural England reaffirmed that it is in agreement with the Applicant on this point.

2.3 In response to a question from the ExA about overwintering birds, Natural England outlined that it is in agreement with the Applicant's proposal specifically regarding overwintering access for no more than five people no more than two days. It was noted that any residual intertidal concerns will be covered in the IAMP prior to construction.

Agenda 4 - CS: Construction Offshore

Update on the progress on the 'In Principle Monitoring Plan', including inclusion in the draft DCO.

2.4 The Applicant understands that the IPMP has been agreed with Natural England and MMO pending further ornithological discussion. Natural England confirmed that it had agreed the IPMP with the Applicant pending further ornithological discussion. Natural England also highlighted that the IPMP will remain a useful live document to capture agreed monitoring needs as and when they arise through the project lifecycle.

Agenda Item 8 - EOO: Ecology Offshore-Ornithology

Update on HRA matrices, including for a) Flamborough Head and Bempton Cliffs (FHBC) SPA; and b) for the Greater Wash dSPA

2.5 Natural England stated it is happy that the correct sites are in the matrices, including the Flamborough Head and Bempton Cliffs (FHBC) SPA, but differs with the opinion of the Applicant on some of the detail as set out in our written submissions.

2.6 Natural England confirmed that the screening document was received for the Greater Wash potential SPA at Deadline 4 and that Natural England will produce a response for

Deadline 5 (please see the Offshore Ornithology SoCG [paragraph 3.3.5] between the Applicant and Natural England for an update on this matter).

2.7 In response to a discussion about the data being used to put the site forward, and the relative density and distribution of birds within the site, Natural England advised that an analysis had been undertaken by JNCC[1] to inform the draft boundary for the site. The analysis undertaken by JNCC was cited as 'An assessment of wintering red-throated diver, little gull, common scoter in the Greater Wash.' The report has been completed by JNCC and will be provided on their website. Natural England confirmed it shared the JNCC report with the Applicant on 15th of October 2015 in an email from Martin Kerby and committed to sharing it with the RSPB following the hearing which was completed on 29th October 2015.

Clarification of final position agreed between Natural England and the Applicant on the effects of Hornsea Project 2 on Special Protection Areas (SPA and pSPA) populations of gannet, guillemot, razorbill and puffin, for the project alone and in combination.

2.8 Natural England, noted that for Flamborough & Filey Coast pSPA Natural England's position was submitted in tabular form at Deadline 3. Natural England's conclusion has not changed for gannet, guillemot, puffin and razorbill alone, or in combination with other projects. In terms of a final position Natural England advised that all these positions were final except for the in-combination assessment for gannet. This is because there are still some ongoing issues for Natural England to resolve regarding the publication of the Cleasby et al (2015) paper on gannet flight heights. However, despite these ongoing discussions, Natural England has reviewed this paper and currently the advice submitted at Deadline 3 has not changed. Natural England still advises there is no adverse effect on site integrity for gannet alone or in-combination with other plans and projects (see paragraphs 2.16 – 2.22 for more detailed submission on Cleasby et al. (2015)**.**

Update on latest position agreed between Natural England and the Applicant on the effects of Hornsea Project 2 on the Special Protection Areas (SPA and pSPA) population of kittiwake, and assemblage features, with particular reference to recent areas of disagreement.

2.9 Natural England highlighted that it had only seen the Kittiwake Collision Risk Technical Note after Deadline 4 and, therefore, had not had a chance to review the full document.

2.10 Natural England highlighted that while progress on some issues is possible, it is unlikely we will be able to reach agreement on all of the issues presented in the technical note submitted by the Applicant at Deadline 4. Natural England assured the ExA that it will review the document and a meeting is scheduled with the Applicant on 5th November 2015, so a submission will be made at Deadline 5, recognising the urgency of this matter.[2]

[1] Lawson, J., O'Brien, S.H., Win, I., Kober, K., Allcock, Z., and Reid, J.B. 2015a. An assessment of the numbers and distributions of wintering red-throated diver, little gull and common scoter in the Greater Wash. JNCC Report No. 574.

[2] Please refer to Section B of this submission for more details on Natural England's position regarding the kittiwake feature of the Flamborough Head and Bempton Cliffs SPA and Flamborough and Filey Coast pSPA.

Update on progress and extent of agreed positions, between RSPB and the Applicant, on the effects of Hornsea Project 2 on Special Protection Areas (SPA and pSPA) populations of gannet, kittiwake, guillemot, razorbill and puffin, for the project alone and in combination. RSPB differences from Natural England analysis and conclusions should also be clarified.

2.11 In response to a question from the ExA about how the MacArthur Green (2015) study, a 400 page document referred to by the Applicant, was commissioned, Natural England advised that without the full reference it was not aware who commissioned the report.

2.12 The ExA noted that table 15.1 in the MacArthur Green Report (2015) relating to kittiwake, shows whether populations are growing, declining, or stable. MacArthur Green (2015) does not fill in population trend column in Table 15.1 for kittiwake at Flamborough Head and Bempton Cliffs SPA. The ExA posed the question of whether the kittiwake population is stable or declining.

2.13 Natural England's stated that its position is the same as outlined previously in our written submission and in response to question EOO16 (submitted at Deadline 4). Natural England believes there is good evidence that the population has declined, and either still is declining, or is at best stable. Natural England thinks that the count produced in 1987 is correct at around 83,000 pairs of kittiwake. Natural England and JNCC (who maintain records for Seabird Monitoring Programme) have checked the raw data for these counts on the recording forms that were used at the time of the survey. These clearly state that pairs of birds are recorded. Natural England thinks that the number of birds at the site has therefore fallen by roughly half and that these declines mirror similar changes in other UK colonies over the time period.

2.14 Following the hearing Natural England believes the MacArthur Green Report (2015) referred to by the ExA actually relates to the Furness (2015) "Non-breeding season populations of seabirds in UK waters: population scales for Biologically Defined Minimum Population Scales (BDMPS)" report which was an evidence report commissioned by Natural England. As part of this project the authors undertook a review of the UK population size of selected seabird species (including kittiwake) and what proportion of these birds were from UK breeding seabird SPAs. The authors considered information on recent population trends for individual SPAs to inform whether the proportion of UK birds occurring in SPAs has changed over time. For kittiwake this information is summarised in Table 15.1.

2.15 One source of information on the status of birds at SPAs comes from Site Condition Monitoring data from the Scottish Natural Heritage Sitelink web entries for each SPA in Scotland. These data indicate the most recent formal assessment of the status of the designated feature but only for Scottish SPAs. This information is entered in Table 15.1 in the column headed "Site Condition Monitoring" as "declined", "maintained", "no-change" etc. This condition assessment is only available for Scottish SPAs as there is no equivalent information for English and therefore there is no entry in that column for Flamborough Head and Bempton Cliff SPA. Instead, information on the population trend for Flamborough and Bempton Cliffs SPA is given in the recent count column which contains the most recent counts for the site from the JNCC Seabird Monitoring Programme website. Natural England refers the ExA to our Deadline 4 submission (Section B, response to ExA question EOO16) where we have provided a more detailed assessment of kittiwake population trends at Flamborough Head and Bempton Cliff SPA and FFC pSPA.

2.16 In response to a discussion about the preferred Population Viability Analysis (PVA) metrics to be used in assessment of impacts, Natural England noted that it doesn't focus on just one metric when determining AEOI, but uses all available evidence to be able to form that opinion. In this case, the two preferred PVA metrics (the change in growth rate and change in final population size in the presence of additional mortality) are being used alongside all the other information discussed and presented.

2.17 Natural England noted that the current PVA used in the application is not markedly different from those published previously. Natural England advised that previous decisions used different metrics in their assessments, for example the increased risk of a windfarm poses of a population going into decline. There are a number of reasons why the focus is now on the two preferred metrics, not least the fact that the population is already believed to be in decline. These are:

- Ongoing litigation in the Scotland;
- An unpublished BTO report[3], commissioned by JNCC, which highlights the two metrics as the most robust; and,
- Our improved understanding of how to apply these metrics to declining and unfavourable populations.

Views of Applicant, Natural England and RSPB on recent research study on potential impacts of offshore wind farms on gannet populations (Journal of Applied Ecology, 2015, DOI: 1111/1365-2664.12529).

2.18 Natural England summarised a written statement prepared by Natural England's Senior Specialist for Offshore Ornithology. Currently the SNCBs are reviewing the paper with the aim of coming to a joint position.

2.19 Natural England welcomes this piece of work, and notes that a key finding of the report is that when foraging, gannets fly considerably higher (median height 27m) than when commuting or migrating (median height 12m).

2.20 These results suggest that gannet would be at potential risk of collision with OWF turbines when foraging and that when this information on flight behaviour is used to calculate the proportion of birds predicted to fly at collision risk height this could be higher than published generic flight heights for gannet (e.g. Johnston et al. 2014) where only 12.5% of birds are predicted to be flying above 20m – i.e. information on the % birds at collision height from generic data could be underestimating collisions.

2.21 Although Natural England accepts that the key message that foraging gannets fly higher than when commuting or migrating is a valid one, we would question the validity of the claim that the predicted collision mortality for Bass Rock gannets is up to 12 times greater than the potential mortality predicted using published, generic flight-height estimates for the project areas considered in the report.

2.22 We note that this study is reliant on deriving flight height statistics for use with CRM from a small sample of birds – less than 20 - (n=16, but n=11 in relation to OWF areas)

[3] The unpublished BTO report was commissioned by JNNC and co-funded by Natural England and Scottish Natural Heritage. Natural England is working with members of the project steering group to determine a date for its publication. Natural England is also working to determine if it will be possible to share information in the report prior to publication.

fitted with altimeters and high-resolution GPS loggers, as compared with vastly larger, albeit snapshot samples used in the review of flight height derived from boat based observers (Cook *et al.,* 2012; Johnston *et al.,* 2014).

2.23 Further we have concerns over the robustness of calculating density of birds at sea from a small number of tracked individuals given that bird density, in addition to flight height distribution, is a key component in calculating collision mortality.

2.24 Therefore there are a number of points in relation to the methodology used that need to be addressed in order to validate conclusions about the extent to which use of generic flight height data might be underestimating collision mortality.

Update on the positions reached in SoCG on the effects of Hornsea Project 2 on EIA species.

2.25 Natural England advised the panel it had received the updated EIA note at Deadline 4 and is aiming to respond at Deadline 5 (please see the Offshore Ornithology SoCG [paragraph 3.3.4] between the Applicant and Natural England for an update on this matter).

Update on migratory bird collision risk

2.26 The ExA noted that Natural England has no concerns about the significance of migratory collision risk outputs, but that Natural England will provide the applicant with updated population figures to use in the assessment.

2.27 Natural England noted that the numbers coming out of the migratory bird assessment pose no ecological concern. However, the applicant's assessment presents a new technique to assess the impacts to migratory birds and Natural England needs to review this, especially in relation to the correct population scales to use. While this is unlikely to have material impact on the environmental assessment for this case it is an important consideration for future cases. Natural England will aim to do this by Deadline 5.

Nature and inclusion in the DCO/Deemed Marine Licences (DMLs) of the details for the monitoring of offshore ornithological impacts.

2.28 The ExA noted the essential nature of the monitoring and asked Natural England and the RSPB if they were content with provisions provided for in the DCO.

2.29 Natural England advised it is content that there is sufficient security in the DML for ornithological monitoring. Natural England also noted there is further detail in the IPMP which is a live document that can be updated beyond the consent of the project. The IPMP doesn't mention during construction monitoring at all but equally, doesn't preclude it should it become necessary to answer a very specific question.

Agenda Item 9 - EL: Ecology Onshore and Inter-tidal

Update on inter-tidal issues related to: the applicable tide height above chart datum (CD) at Grimsby and working tide height at the cable landfall area; the length of the summer construction working window; the tailpiece on Condition 20(3) of DML A2/B2, which allows winter working with the agreement from the Marine Management Organisation (MMO) and Natural England; and assessment of the effects on the intertidal zone from carrying out ducting over three years.

2.30 ExA asked for an update on tide height from the Applicant and Natural England.

2.31 The Applicant advised that significant progress has been made and proposed wording for the DML: *The undertaker must not construct or install those licensable activities comprised in Work Nos. [4A/4B] and [5A/5B] in the intertidal area within 500 metres seaward of the seawall during the period of time commencing two hours before a high tide predicted to be greater than 6.5 metres Chart Datum and ending two hours after a high tide predicted to be greater than 6.5 metres Chart Datum between 1 April and 31 May (inclusive) and 1 August to 30 September (inclusive), unless provided for in the construction and monitoring programme submitted and approved under Condition 10(2)(a) or the construction method statement submitted and approved under Condition 10(2)(b) or unless otherwise agreed in writing by the MMO, in consultation with Natural England."*

2.32 Natural England agreed that this wording was discussed with the Applicant prior to the hearing and that Natural England is in agreement that this is sufficient protection in the DML to rule out AEOI for the Humber Estuary SPA and Ramsar site.

2.33 With regards to winter working agreements Natural England confirmed it had agreed with the Applicant that Condition 20(6) and (7) of the DMLs, which restricts the numbers of days and personnel who can access the intertidal period to undertake scheduled inspections during the overwintering period, is sufficient and reduces the risk of any disturbance effects on any SPA/Ramsar bird features during the operational phase of the project. Natural England feels this issue has now been resolved.

Update on Natural England/Applicant position on the effects of Hornsea Project 2, (i) alone and (ii) in combination, on features of: a) the Humber Estuary SPA; b) the Humber Estuary Ramsar site; and c) the Humber Estuary SAC.

2.34 Natural England confirmed that there were no AEOI for the Humber Estuary SAC alone, or in-combination with other plans and projects.

2.35 Natural England also confirmed that there were no AEOI for the Humber Estuary SPA and Ramsar site, pending the amendment to the DCO to agreed wording for the tidal restriction (as set out in paragraph 2.29).

Agenda Item 10 - EOMM: Ecology Offshore - Marine Mammals

Update on whether formal consultation has commenced on the possible designation of a SAC for harbour porpoise.

2.36 Natural England advised that there is no further update on Harbour Porpoise dSAC since the last ISH.

2.37 In response to the information submitted at deadline 4 regarding the draft harbour porpoise dSAC by the Applicant Natural England advised that they were still reviewing the information provided in the submission. See Section C of this submission for Natural England's position regarding the HRA Addendum on the Harbour Porpoise dSAC submitted by the Applicant at deadline 4.

Day 2 Agenda

Wednesday 28th October 2015

Agenda Item5: DCO and Requirements

2.38 Natural England highlighted that following a meeting with the Applicant on Monday 26th October 2015, it was agreed that the outline Ecological Management Plan (EMP) will be updated to include intertidal monitoring over the lifetime of the project. This is important to show impacts are not greater than those assessed in the ES and HRA.

2.39 The ExA questioned whether further consultation was needed at this time regarding access. Natural England noted that should the project get consent the Applicant would become a Section 28G authority, under the Wildlife and Countryside Act 1981 (as amended), and would be able to undertake work that relates to their assets; therefore they do not need to consult with anyone else. However, an understanding and agreements will need to be reached with landowners and the Applicant. At this time discussions have only been related to SSSI interest features of which Natural England is the regulator.

2.40 Natural England highlighted it was satisfied with the wording of Requirement 27 on the Intertidal Access Management Plan (IAMP) but highlighted it was concerned 28 days may not be a sufficient amount of time to resolve all technical issues and potential impacts on the Annex 1 habitats, and therefore agree the IAMP with the applicant and LPA in time. Therefore we recommended that this period could be extended.

Agenda Item 6: Deemed Marine Licences and conditions

2.41 Natural England highlighted it was satisfied with the wording regarding the in-principle monitoring plan (IPMP) within the DMLs and highlighted this should be included as a requirement in the DCO.[4]

2.42 As an outstanding matter Natural England highlighted that condition 20 in the DMLs, regarding the tidal height restriction, will need to be updated to reflect the wording agreed between the Applicant and Natural England on 26th October 2015.

[4] Following the hearing Natural England would like to highlight it is content with the wording of the IPMP in the DMLs and does not feel an additional requirement is needed in the DCO as stated in the ISH.

SECTION B – COMMENTS ON THE OFFSHORE ORNITHOLOGY CLARIFICATION NOTES

3.1 This note sets out Natural England's response to the Applicant's paper: **Kittiwake Collision risk: review of core assumptions. Appendix DD.,** submitted at deadline IV. The note covers the following key areas:

1) Collision Models;
2) Avoidance Rates;
3) Flight heights and determination of PCH values;
4) Phenology - Definition of the breeding and non-breeding season months for kittiwake at FFC pSPA;
5) Assessment of the proportion of birds in project areas that are adult birds and apportioning to FFC pSPA in the breeding season;

3.2 The note also covers Natural England's current position on the project alone and in-combination impacts on the FFC pSPA kittiwake population, and the effect of mitigation proposed by the Applicant (see SoCG submitted at Deadline 5 section 3.2.19).

3.3 The Applicant's Appendix DD sets out the key assumptions that underpin assessment of the impact of predicted collision mortality on the kittiwake population at FFC pSPA, for both the project alone and in-combination with other plans and projects. This forms part of the ongoing discussions between the Applicant and Natural England to explore and where possible resolve the differences in our respective positions on the predicted magnitude of potential impacts.

Overview of Natural England's position at Deadline 3 and 4

3.4 Natural England provided details of our position regarding impacts on kittiwake at the first ISH and in Natural England's response at Deadline III. These were that project alone figures were **134 adult** collisions per annum, with lower and upper 95%CLs based on the variability in the baseline survey kittiwake density data of 73-231 adults per annum, and **503 adults** in-combination. Natural England consider that the range 73 - 231 predicted collisions for the project alone is not unduly precautionary since it does not account for uncertainty in the predictions due to flight height and avoidance rate assumptions. For the in-combination predicted collisions the uncertainty in the figures is much greater since the in-combination figure is generated from individual project figures each of which have unquantified variability. Natural England therefore consider there is significant uncertainty around the 503 in-combination figure and the real value could be considerably lower or higher than this value.

Accounting for variability

3.5 In forming a view about the potential collision impacts for kittiwake from Hornsea Project 2, Natural England has considered a number of factors that relate to the uncertainty and variability around the input variables and assumptions. As a result we do not consider that it is appropriate to consider the assumptions in isolation from one another and without reference to the variability, as the applicant has done with Natural England's figures in

Appendix DD. In particular, statements by the Applicant that some of Natural England's individual assumptions are very precautionary or "likely to be a gross overestimate" do not reflect the overall uncertainty and variability in input parameters, including those resulting from limitations and issues with the baseline survey data as highlighted in Natural England's Relevant Representations (e.g. see Appendix 1, paragraphs 10-19), Written Representations (see sections 6.512 – 6.5.29) and our response to the ExA question EOO2 at Deadline I. Nonetheless, we have considered the Applicant's assessment of our assumptions and have set this out below along with our current position on the potential collision impact for kittiwake at FFC pSPA both from the project alone, and in-combination with other plans and projects.

3.6 The Band Model guidance (Band 2012) sets out an approach for considering the uncertainty around the various input parameters in the collision risk modelling process, however, the Applicant has not considered this in their own assessment and their position is based on a single collision figure which does not reflect the complexity of the situation or the sensitivity of the outputs to variability in the input parameters. Species density, PCH, flight speed and AR have been shown to be input parameters which are likely to result in the greatest variability in collision risk predictions (Masden 2015) and Natural England's position attempts to reflect some of the uncertainty around three of these (species density, flight height and AR) (Table 1).

Table 1. Summary of Natural England's position at Deadline III in relation to predicted kittiwake collisions at FFC pSPA for the project alone. Collisions are adult birds.

	Lower CL	**Mean**	**Upper CL**
Collisions accounting for variability in density	73	134	231
Collisions accounting for variability in AR	111	134	160
Collisions accounting for variability in flight height	99	134	164

3.7 As there is not a statistically valid method of combining the confidence limits for the estimates in Table 1, Natural England based our assessment on the variability around the estimates using the 95% CLs for the baseline density data (i.e. 73 – 231 annual collisions of adult kittiwake from FFC pSPA), noting that this is not a precautionary assessment as it does not incorporate additional variability arising from uncertainty in ARs and flight heights.

3.8 These figures contrast with the Applicant's position which is **6.2** adult collisions for the project alone and **146** in-combination.

Natural England's assessment of collision risk.

3.9 Our assessment of potential collision risk from Hornsea P2 for kittiwake is based on the following assumptions and it is alternative views on these that account for the majority of the difference between Natural England's and the Applicant's figures:

1) Collision Models. Basic versus Extended Band Model for CRM;
2) Avoidance rates applied to CRM collision predictions;
3) Assumptions about flight heights and determination of PCH values;
4) Phenology - definition of the breeding and non-breeding season months for kittiwake at FFC pSPA;
5) Assessment of the proportion of birds in project areas that are adult birds and apportioning to FFC pSPA in the breeding season;

Collision Models. Basic versus Extended Band Model for CRM (Applicant's Stage 5 in Appendix DD).

3.10 Natural England set out its position regarding use of the Basic Band model rather than the Extended Band model (Applicant's position) to generate collision predictions for kittiwake in Appendix 1 of our relevant representations, as well as our written representations where we stated:

> *6.5.63. One of the main areas of disagreement regards use of the Extended Band Model outputs for gannet and kittiwake. Following a review of the Cook et al (2014) avoidance rate report for Marine Science Scotland, the SNCBs published a joint position statement which states that* ***"it is not appropriate to use the Extended Band Model in predicting collisions for northern gannet or black-legged kittiwake, at the current time"*** *(JNCC et al. 2014).The Applicant has based their assessment of population impacts from the Extended band model for kittiwake and gannet.*

3.11 This position represents the Joint Nature Conservation Committee, Natural England, Natural Resource Wales, Northern Ireland Environment Agency and Scottish Natural Heritage's recommended methodology for Collision Risk Modelling (CRM) for use by the Offshore Wind Farm (OWF) industry. The rationale for the recommendations are set out in the paper "*Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review*", JNCC et al. (2014).

3.12 The Applicant has not followed this recommendation and has based their assessment of potential collisions of kittiwake from Hornsea Project 2 on the Extended Band Model (Option 4).

3.13 The following table gives an indication of the effect that using the Extended versus Basic Band model has on the calculation of kittiwake collisions. The relevant comparisons are Basic Band Model Option 1 with Extended Band Model Option 4 as these use the site specific flight height data and Basic Band Model Option 2 with Extended Band Model Option 3 as these use generic flight height data e.g. from Johnston et al (2014) corrigendum.

Table 2. Comparison of Basic and Extended Model collision predictions using the site specific flight height data for Hornsea P2 as modelled by the Applicant to reflect a lower turbine height of 24.08m. Figures are collision predictions with no avoidance rate applied. All kittiwake collisions, no apportioning to SPAs.

	Basic Band Model	Extended Band Model
	Option 1	Option 4
Annual kittiwake collisions	8,122	1,406

Table 3. Comparison of Basic and Extended Model collision predictions using the generic flight height data from Johnston et al (2014) corrigendum as modelled by the Applicant to reflect a lower turbine height of 24.08m. Figures are with no AR. All kittiwake collisions, no apportioning to SPAs.

	Basic Band Model	Extended Band Model
	Option 2	Option 3
Annual kittiwake collisions	20,892	6,398

3.14 The use of the Extended Band model over the Basic Band model results in collision estimates that are around 70-80% lower before applying an avoidance rate, and although the application of different avoidance rates to the Basic versus Extended outputs reduces this differential to approximately 40-70% (see Tables 4 & 5), the Applicant's use of the Extended over the Basic Band model accounts for a significant proportion of the difference between the Applicant's and Natural England's collision risk figures.

Table 4. Annual Kittiwake collisions from Hornsea P2, no apportioning to colonies. AR 98.9% applied to Basic Model as per SNCB position, AR 98% applied to Extended Band Model as per Applicant's position.

	Basic Band Model	Extended Band Model
	Option 1	Option 4
Annual kittiwake collisions	89	28

Table 5. Annual Kittiwake collisions from Hornsea P2, no apportioning to colonies. AR 98.9% applied to Basic Model as per SNCB position, AR 98% applied to Extended Band Model as per Applicant's position.

	Basic Band Model	Extended Band Model
	Option 2	Option 3
Annual kittiwake collisions	230	128

Avoidance rates applied to CRM collision predictions (Applicant's Stage 4 in Appendix DD).

3.15 Choice of avoidance rate represents another area where Natural England's position differs from the Applicant. Regarding the application of an avoidance rate to the predicted collision figures, the SNCB position is that for kittiwake the appropriate AR is 98.9% for use with Option 1 and Option 2 of the Basic Band Model (JNCC et al. 2014). The SNCBs also consider that it is good practice to present a range of collision estimates using ±2SD around the mean AR of 98.9% to reflect variability and uncertainty around this figure which based on the analysis presented in Cook et al (2014). Using the SNCBs recommended AR for kittiwake, gives an AR range of 98.7-99.1%.

3.16 Cook et al (2014) only provides a suggested avoidance rate for the Basic model. The SNCB position on an AR for kittiwake for use with the Basic band model does not follow the suggestion from Cook et al (2014) to use the "small gull" category (99.2% AR) for kittiwake, which was derived from predominantly common gull and black-headed gull data. Cook et al (2014) were only able to derive species level ARs for Herring gull and lesser black-backed gull. Additionally, they derived three different ARs from grouping data for "large gulls" (Herring gull, lesser black-backed gull, great black-backed gull, Caspian gull); "small gulls" (black-headed gull, common gull, little gull) and an "all gull" AR which included all the data from large gull and small gull groupings plus a large amount of data relating to "unidentified gulls" (where it wasn't specified which species or whether they were large or small gulls).

3.17 The rationale provided in Cook et al. (2014) for suggesting an AR for kittiwake that follows the "small gull" AR, in particular using wing morphology, flight speeds and altitudes, is logical, particularly for micro avoidance behaviour. However, while morphologically similar to both black–headed gull and common gull, kittiwake flight speed (13.1±0.4; Alerstam et al. 2007) is similar to both lesser black-backed gull (13.1±1.9) and great black-backed gull (13.7±1.2) as well as to common gull (13.4±1.9). It is reasonable to consider that both morphology and at-sea ecology affect a species' ability to avoid turbines: the former is more likely to influence the ability of the bird to take evasive action (micro avoidance), while the latter is more likely to influence macro and meso avoidance responses.

3.18 Kittiwake are more marine in their ecology and behaviour than both black-headed and common gulls, and without species-specific observations, we lack information on whether kittiwake are likely to show behaviour similar to the small or larger gull species, or responses that differ from both groups. This uncertainty results in the need for a judgement on which grouping, and subsequent avoidance rate, is most appropriate for kittiwake.

3.19 The SNCB's agreed with Cooke et al (2014) that there is a lack of evidence for kittiwake to calculate an avoidance rate for the species, but consider that given the issues outlined, that the "all gulls" rate which includes data from all gull species, and the largest sample size of data available, should be applied to kittiwake, rather than the "small gulls" AR which only includes the common, black-headed and little gull data. The "all gulls" grouping includes both coastal and marine species and species with similar morphology and flight behaviour. It also provides consistency in the approach taken for gannet, where lack of species-specific data prevented calculation of a species-specific avoidance rate and where Cook et al (2014) suggest that the "all gulls" AR is used with the Basic Band Model.

3.20 Therefore, the SNCBs recommend that, until such time as it is possible to calculate a species-specific avoidance rate for kittiwakes, they are classed under the more generic (and precautionary) 'all gull' category – i.e. 98.9% AR.

3.21 In the Applicant's Appendix DD report, they state at Stage 4 that Natural England's collision figure for kittiwake would be reduced by 27.27% if we had used an AR of 99.2% rather than the 98.9% AR recommended by the SNCBs. Natural England notes that apart from 99.2% not being the SNCB position on an AR to use for kittiwake with the Basic Band model, Natural England did consider a range of AR's from 99.1% to 98.7% around the recommended mean value to reflect uncertainty and variability in the ARs (see Table 1). Further, the use of different ARs within the Basic Band model is not relevant to the discussion of the difference between the Applicant's and Natural England's collision figures for kittiwake because the Applicant has used the Extended Band model with an AR of 98%. The Cook et al (2014) report, which is the most comprehensive review of avoidance rates for seabirds available and has been subject to peer review, states that "*It was not possible to recommend an avoidance rate for use with the extended Band (2012) collision risk model based on the evidence available at present.".* The Applicant has used an AR of 98% applied to Option 4 of the Extended Band model on the basis of an analysis presented in a joint Forewind/SMartWind report (SMartWind 2014) which uses a subset of the project data included in the Cook et al (2014) analysis.

Assumptions about flight heights and determination of PCH values (Applicant's stage 2 in Appendix DD).

3.22 The current SNCB position on collision risk modelling for kittiwake is that it is only appropriate to use the Basic Band model collision outputs (JNCC et al. 2014). Within the Basic Band model there are two options which can be applied – Option 1 which requires a percentage of birds at collision height (PCH) derived from site specific data as a model input; and Option 2 which generates a PCH value for the specified project turbine height profile from a generic dataset of flight height data e.g. Johnston et al (2014) corrigendum.

3.23 Natural England's position on collision risk predictions for Hornsea Project 2 as set out at Deadline III is based on outputs from Option 2 of the Basic Band Model that use generic data on kittiwake flight behaviour rather than the site specific data from Hornsea P2. The reasons that Natural England has based its assessment on the Option 2 rather than Option 1 outputs are set out in our relevant representation (Appendix 1, paragraphs 24-30) and written representations (paragraph 6.5.34 – 6.5.37) and can be summarised as:

- *Concerns about the accuracy of boat based observers at recording birds in flight to the nearest 5m height level;*
- *Concerns about the false precision resulting from assignment of birds in flight to height bands (0-2.5m, 2.5-7.5m, 7.5-12.5m, 12.5-17.5, 17.5-22.5, 22.5-27.5, 27.5-32.5 etc);*
- *Post collection processing of birds in flight data to calculate PCH values coincident with the rotor height (24.08m above mean sea level);*
- *Site specific PCH data for Hornsea P2 that are low compared to data collected at other offshore project areas, without any clear ecological explanation for differences, and which additionally fall outside the 95% CLs of the Johnston et al (2014) corrected generic data; and*
- *No consideration of variability and uncertainty in flight height data factored into subsequent collision risk modelling.*

3.24 These concerns relate to the site specific data collected at Hornsea Project 2. As a result of our concerns about the site specific data, Natural England based its assessment of impacts on generic data on kittiwake flight heights that were generated by modelling flight height data across a range of offshore windfarm project areas. Natural England considers that this gives a better representation of likely kittiwake flight behaviour, and allows consideration of variability in flight heights in the collision risk modelling. This approach is consistent with Natural England's approach to other projects where there have been concerns about the accuracy of the site specific flight height data, for example at Dogger Bank Creyke Beck (A&B) and Dogger Bank Teesside (A&B) where Option 2 outputs were used due to methodological issues with the flight height data and concerns about whether the PCH data were representative of bird behaviour at the site. In the case of Dogger Bank the PCH value was 20% and fell above the CLs of the generic data.

3.25 The Table below summarises the difference between the PCH flight height figures that the Applicant presented based on the Hornsea P2 site specific data and the equivalent PCH values based on the Johnston et al 2014 (corrigendum) data (supplementary spreadsheet).

Table 6. Comparison of PCH values applied to Option 1 and Option 2 Band Models for kittiwake at Hornsea P2.

	Applicant PCH based on above 24.08	Johnston et al* for 24-152 turbine spec	95% LCL	95% UCL
Kittiwake	3.79%	10.2%	7.52%	12.4%

*Note the Table in the Johnston et al (2014) corrigendum paper gives PCH values of 15%, 11.7-17.3% based on a 20-150m turbine.

3.26 Natural England does not consider that an observer on a boat, in an offshore environment can accurately assign individual birds in flight into 5m height bands. As stated in our Relevant Representations:

> *"Natural England does not consider that boat based observers can accurately assign flying birds into five metre height categories. Preliminary data from a project undertaken for the Marine Renewables Ornithology Group (MROG, comprising the Joint Nature Conservation Committee (JNCC), Natural England (NE), Natural Resource Wales (NRW), Northern Ireland Environment Agency (NIEA), Scottish Natural Heritage (SNH), Marine Scotland Science (MSS) and the Royal Society for the Protection of Birds (RSPB)) involving a field trial using a hexocopter at known height, showed that boat based observers were only able to place the hexocopter in the correct 5m height band on 19% of occasions and that 59% of the incorrect flight band allocations were underestimates (i.e. observers placed the hexocopter in a lower 5m height band than the hexocopter was actually in). These were preliminary trials and a further trial is planned to confirm the results …."*

3.27 Natural England acknowledges the Applicant's review of flight height data collection methodologies by a range of projects presented in Table 1.3. Of the 23 projects in the table, the Applicant identified eight projects that used a survey methodology whereby some of the flight height data were recorded using a 5m or smaller height band coincident with the rotor swept area.

3.28 Natural England maintain that the typical methodology for collecting flight height data from boat based surveys is to use broad flight height bands that equate to below, at and above rotor height (Camphuysen et al. 2004, Cook et al. 2012, Johnston et al. 2014). While it would be desirable to have data at a finer height resolution, attempting to collect boat data in fine scale height categories (e.g. 5m bands) will result in a higher likelihood that birds are assigned to incorrect flight bands than if broader flight height bands are used.

3.29 While there are clearly cases where data from boat surveys have been collected at height bands that are finer scale than "below", "at" and "above" turbine height, Natural England does not agree with the Applicant's view that this validates the Applicant's use of the Hornsea Project 2 boat data to derive a PCH that can be used with Option 1 or to derive metre by metre flight height data for use with Option 4.

3.30 Additionally, Natural England notes that at some of the projects in Table 1.3, the flight height data collected on baseline surveys either wasn't used to undertake any collision risk modelling (e.g. Gwynt y Mor); or collision risk modelling was not an important component of the project impact assessment as the focal species were ones with low sensitivity to collision impacts (e.g. London Array where the species of interest was red-throated diver and where boat based surveys are generally considered unsuitable as birds are sensitive to disturbance from boats); or survey data were collected using a range of platforms (e.g. aerial surveys and shore-based vantage point surveys) and flight height data derived from these surveys used to characterise or validate flight behaviour in addition to the boat surveys.

3.31 Natural England also note that for the English projects (except for Hornsea), where fine scale bands were used to derive PCH data for CRM, the PCH values for kittiwake were within the 95% CLs of the generic datasets and so collision outputs would have been similar to those obtained with the generic data (e.g. Cook et al. 2012).

3.32 Regarding the surveys at Hornsea Project 2, Natural England consider that in designing a boat based survey protocol it would be unusual to instruct surveyors on a boat to collect and record data in height bands that include 0.5m boundary categories (such as to record birds in a 17.5 – 22.5 m height band). Natural England has requested further details from the Applicant on how the surveyors collected and recorded data, however these have not been provided. The Ornithology Technical report (SMartWind 2015) states that "*A snapshot method was used for flying birds, which takes the ship's speed into account and prevents overestimation of seabird densities. In addition, the estimated height of flying birds was also recorded, to the nearest 5 m. The count interval for surveys was one minute, and synchronised GPS recorders were used to record the vessel position every minute*". It is not clear from this description of methods whether observers on the boat were recording birds in the five metre bands listed by the Applicant (e.g. 0-2.5, 2.5-7.5m, 7.5-12.5m, 12.5-17.5m, 17.5-22.5m, 22.5-27.5m etc.) or alternatively were recording birds to the nearest 5 m (e.g. 5m, 10m 15m 20m etc.) and these were then subsequently post-processed such that, for example, birds recorded as flying at 20m were assigned to a 17.5-22.5m category.

3.33 Natural England considers that this highlights the issue of applying a false level of precision to the data. For example, if the boat observers recorded birds at "20m" and "25m", and the birds at 25 m were then assigned to a height band 22.5-27.5m, the Applicant has assumed that birds were distributed equally across this band. The Applicant then calculated that a proportion of these birds would not be at rotor height because the lower rotor was at 24.08m not 22.5m, and so excluded a proportion of birds from the collision risk modelling on this basis. In reality it is possible that no birds had been recorded by the observers as being between 22.5 and 24m during the at sea surveys and the post collection processing of the data is applying a level of precision that is not supported by the underlying data.

3.34 Further post collection processing of the data to generate a metre by metre flight height distribution, whereby 5 metre bands were combined to create 10m bands and the number of birds divided by 10 to give a per metre number for the band introduces additional, unquantified, biases to the data.

3.35 In paragraph 1.6.4 of Appendix DD the Applicant points out that "*Any deemed inaccuracies associated with bird flight heights are only significant at heights associated with the lower rotor height of a turbine. At this height incorrect assignment of a bird to a flight height band above or below the lower rotor height would affect the resulting PCH value*." Natural England notes that this statement only applies to generation of PCH values for the Basic Band model, and that incorrect assignment of a bird to any flight height band could affect the metre by metre flight height data generated by the Applicant and used in their Option 4 Extended Band Model outputs. However, in relation to generating a single PCH value for use with Option 1 of the Basic Band Model the Applicant goes on to state that "*The use of five metre bands does, however, in the Applicant's view increase confidence in the PCH values obtained. For those birds recorded at lower flight heights (eg <20m) there is a higher degree of confidence that these birds are outside of the rotor swept area. Such*

confidence cannot be obtained by using flight height bands representing below, within or above rotor height as there is no indication as to what height within these bands a bird was flying". Natural England does not agree with this argument, as the Applicant had not attempted to use the finer scale flight height data to generate any confidence levels around the PCH data, or explore the sensitivity of assigning birds to different 5 m bands, e.g. for those birds recorded in the bands immediately below and above the lower rotor height. The Applicant calculated a PCH value using flight height data from bands 22.5m and above (additionally excluding a proportion of birds assumed to be between 22.5 and 24.08m) and has treated any birds in the band below 22.5m as being below rotor height. This gives the same result as if the Applicant had collected the flight height data in coarse bands 0-22.5m, and 22.5-152.4m and above 152.4m (apart from excluding 15.8% of birds in the 22.5-32.5% band on the assumption that these were between 22.5 and 24.08m, which as explained above, Natural England considers to be applying a false level of precision to the data).

3.36 In order to increase the confidence in the PCH values derived from 5 m bands the Applicant would need to have undertaken some form of sensitivity analysis using the flight height data from 5 m bands below, at and above the lower rotor height to calculate a range of PCH values.

3.37 Natural England suggested this to the Applicant in our Relevant Representations and in subsequent discussions about the site specific flight height data:

> *"Therefore, Natural England advises that in calculating PCH values using the site specific data, the Applicant needs to consider an appropriate way to account for the uncertainty in the flight height data, for example by considering the effect of including birds recorded at 17.5-22.5 m as potentially being at collision height."*

And

> *"Band (2012) guidance on collision risk modelling for offshore windfarms states that "Confidence intervals on flight height data should be used where these are available from the survey information. Otherwise, a realistic view should be taken of the potential for miss-estimation and error in flight height observations by field observers."*

Following discussion on 14 October 2015 the Applicant agreed to look at calculating PCH values that included birds recorded as flying at 17.5-22.5 and the birds assigned to 22.5-24.08m. Their analysis is presented in Table 1.4 of Appendix DD, however the Applicant has only presented information on PCH that includes birds in the 22.5-27.7m band and birds calculated as flying above 20m, which is an arbitrary division of the 17.5-22.5m band. The Applicant concludes "*Based on the information presented this Section (Section 1.6) which discusses the flight height bands used for previous projects, the Applicant considers, that the PCH value calculated assuming all birds above 22.5 m are at risk of collision allows for consideration of uncertainty in PCH values*". Natural England does not agree with this conclusion and considers that a realistic view of the potential for mis-estimating the proportion of birds at collision height would need to consider the possibility that all birds assigned to the 17.5-22.5m height band could be at collision risk.

3.38 For Hornsea Project 2 the site specific data on the percentage of birds at collision risk (PCH) for kittiwake (and several other species) are low compared to a range of other offshore projects, and fall below the lower 95% CL of the generic dataset of Johnston et al (2014) corrigendum. There could be an ecological reason why kittiwake at Hornsea P2 fly at lower heights compared to at other project areas – for example, birds might fly at lower altitudes when foraging or commuting between sites, compared to when migrating (e.g. Garthe & Huppop 2004; Krijgsveld et al. 2011; Wright et al. 2012), and conversely Cleasby et al. 2015 have shown that foraging gannets fly at higher altitudes when foraging compared to when commuting (they estimated that gannets flew at a median height of 12 m whilst commuting compared to 27 m during foraging bouts). However, the variability in flight heights recorded at different project areas could also be a function of methodological or sampling variability.

3.39 In Appendix DD the Applicant has presented a review of kittiwake PCH values for a range of UK windfarms (Table 1.5 and Figure 1.3) which show that the majority of PCH values lie outside of the 95%CLs of the generic data presented in Johnston et al (2014). Natural England notes that several windfarms are not included in the Table e.g. East Anglia One (PCH 21.3%, Seagreen Alpha 10.6% and Seagreen Bravo 16.1%). Hornsea Project 2 along with Hornsea Project 1 ranks among the sites with the lowest PCH values across all 21 sites included in Table 1.5. Only two sites have lower PCH values – Inch Cape and Kentish Flats Extension. At Inch Cape it is only a PCH value for the breeding season that is lower, which does not represent an equivalent comparison as all the other values are annual figures. At Kentish Flats Extension kittiwake were not the focus of the impact assessment (red-throated diver were the key species and surveys were designed around this species) – the 2% PCH for 2005-07 was based on a population estimate of 0.15 kittiwake and the 3% PCH figure for 2009/10 was based on a population estimate of 0.6 kittiwake at the site).

3.40 The review highlights a large variation in PCH values measured at different project areas – ranging from 2.8% birds (ignoring non-annual estimates, and those derived from <1 bird) up to 33% birds at collision height. There is no clear ecological reason why the PCH values vary across the different sites (for example that birds at a site are largely commuting/migrating versus foraging). Some of the projects with the highest PCH values are as far offshore as Hornsea e.g. Dogger Bank (20% PCH) and East Anglia 1 (PCH of 21.3% not included in Applicant's analysis) while others are closer to the coast e.g. Aberdeen (18.56% PCH), Walney 1 & 2 (15.5%) and Walney Extension (33%). Some of the lowest PCH values are for projects within foraging range of kittiwake colonies (e.g. Neart na Goithe 6% and Inch Cape, where breeding season PCH was 0.4% compared to 9.2% in the non-breeding season), but conversely Aberdeen (18.56% PCH) and Westermost Rough (14% PCH) are close to the coast and within foraging range of colonies.

3.41 Information provided by the Applicant in their S42 Ornithology Technical report showed that across the whole Hornsea zone, the monthly PCH values (birds flying above 22.5m) varied considerably between surveys from 0.3% (April 2011) to 15.2% in December 2012. At Hornsea Project 1 where a breakdown of month PCH values were presented (SMartWind 2014) values ranged from 0% (April 2010, April 2011, May 2011) to 16.63% (June 2010) based on flights at 22.5m and above.

3.42 Therefore it seems reasonable to conclude that there is considerable variability in kittiwake flight height behaviour within sites and that the variability in flight height behaviour recorded across a range of different projects could also apply within individual sites. For this reason Natural England does not consider that use of the generic PCH data from Johnston et al (2014) is precautionary. Based on a turbine with a lower rotor height of 24m, Johnston et al (2014) gives a PCH value of 10.2% with upper and lower CLs 7.52-12.4%. Although the Applicant has not presented PCH data that includes the 17.5-22.5m band, given that Table 1.4 of Appendix DD indicates that 7.31% of birds were "above 20m", Natural England considers that the PCH value that included flight heights in the 17.5-22.5m band and above would be within the CLs of the Johnston et al (2014) data.

3.43 Johnston et al. (2014) is a synthesis of data on the flight heights of birds from surveys of 32 potential offshore wind farm development sites which were combined to model flight height distributions for 25 marine bird species. The analysis provides data on the typical flight height behaviour of species in the offshore environment, and the flight height distributions provide measures of uncertainty around flight heights that can be incorporated in the assessments of collision. The flight height values calculated for kittiwake were derived from 62,939 kittiwake at 23 offshore windfarm sites and included a number of the projects considered in the in-combination assessment for kittiwake e.g. Dogger Bank, Dudgeon, Humber Gateway, Lincs, Nearte na Goithe, Race Bank, Moray Firth, Westermost Rough.

3.44 Our position on the site specific flight height data versus generic data for Hornsea P2 was summarised in our Relevant Representations:

> *"While Natural England considers that the use of site specific flight height data over the generic flight height data for CRM is the preferred approach where robust site-specific data are available, where site specific flight height data are significantly different from the generic data, then ecological or methodological reasons that might explain the difference between the generic and site specific data need to be explored. Where survey information at a site may be insufficient to provide a reasonably precise figure for the proportion of birds flying at risk height, Natural England advises that it is better to use a generic view of flight height behaviour, obtained by combining flight height information gathered from surveys at different sites (e.g. Johnston et al., 2014a,b; Band 2012).*
>
> *The CRM undertaken by the Applicant uses averaged PCH values calculated across the whole annual cycle but this hides a large amount of variation in the percentage of birds flying at collision height. The Applicant has not provided information on the monthly breakdown of PCH in the submission documents but this information was provided in the Section 42 draft ES and HRA consultation (although note it has been since modified/corrected). For example, in the Section 42 documents …. for kittiwake the annual PCH figure was calculated as 3.1% but the monthly range was 0.3% to 15.2%. This highlights the need to include consideration of both the natural variability in the data as well as uncertainty resulting from measurement errors.*
>
> *Natural England considers that the variability in PCH needs to be accounted for in CRM, in particular given the concerns about the ability of boat based observers to accurately assign birds in flight to 5m flight height bands as well as other*

uncertainties and variability in the data. Further the kittiwake and large gull data fall outside the confidence limits of the generic flight height data and while this might reflect a genuine site specific difference in flight height behaviour between the Hornsea site and other offshore areas we consider that the Applicant should undertake an assessment of collision risk and subsequent population impacts that uses the generic flight height data as well as site specific data."

3.45 As a result of our concerns about the site specific methodology Natural England advised in our written representation:

Where site specific data on flight height is used in the collision risk modelling the Applicant should consider an appropriate way to account for the uncertainty in the flight height data, for example by considering the effect of including birds recorded at 17.5-22.5 m as potentially being at collision height;

3.46 We also advised that:

Due to the uncertainty in the flight height data collected for the Hornsea Project, Band Model Options (such as Option 2) which use generic flight height distribution data, and allow incorporation of upper and lower confidence limits around the flight height data, should be used for assessing collision risk for the project

Natural England advised that collision risk outputs based on the site specific flight height data needed to include consideration of the variability in the data, including the uncertainty resulting from measurement errors. Without any consideration of this uncertainty in the site specific flight height data, Natural England will focus its assessment of collision impacts on outputs generated from Band Model options that use the generic flight height data (Basic Band Model Option 2 for gannet and kittiwake…. Natural England do not consider that it is valid to use collision outputs generated from "Option 4" of the Extended Band Model because a) there are currently no agreed avoidance rates that can be used with the Extended Band Model "Option 4" where site specific flight height curves have been generated, and b) because of the unquantified uncertainties associated with the one metre flight height distributions generated by the Applicant.

Summary of Natural England's position on collision risk modelling for kittiwake:

With respect to the current turbine specification with a lower rotor height of 24.08m above mean sea level, Natural England's position is:

- **Use of Basic Band Model outputs. This follows the SNCB position for kittiwake (JNCC et al. 2014);**
- **Use of Option 2 outputs that use generic information on kittiwake flight height behaviour collated across a large number of offshore windfarms, due to concerns about the site specific data for Hornsea;**
- **Use of an AR of 98.9% (with a range 98.7-99.1%). This is an agreed SNCB position on ARs (JNCC et al. 2014);**

Phenology - Definition of the breeding and non-breeding season months for kittiwake at FFC pSPA (Applicant's Stage 3 in Appendix DD);

3.47 Natural England does not agree with the Applicant's definition of a May to July breeding season for kittiwake at FFC pSPA. Natural England considers that the appropriate breeding season months are April to July. The Applicant has defined the breeding season for kittiwake as May to July based on the migration free breeding season for kittiwake in North Sea waters given in Furness (2015). Furness (2015) defines the breeding season for kittiwake as from March to August in the context of UK breeding colonies. Breeding seasons were defined on the basis of the modal return and departure of birds from colonies. Furness (2015) also identifies autumn and spring migration periods based on periods where substantial migration of birds through UK water occurs. Given that the timing of migrations of birds from high latitude regions can vary from that of UK birds, the migration periods can overlap with the UK breeding season i.e. while it is expected that the majority of UK birds will be back at their colonies by March, birds from colonies further north (e.g. in Arctic regions) may not return to their colonies until April and therefore may still be migrating in March and April. For this reason Furness (2015) also identified a migration free "core" breeding season of May to July for kittiwake which reflects the period where no birds are predicted to be migrating through UK waters.

3.48 The purpose of identifying different seasons in the context of the Hornsea P2 assessment is to determine the likely origin of birds within the Project area so that they can be apportioned to the relevant colony or population. In the breeding season birds in the Project area are assumed to be from the only SPA colony with foraging connectivity to the project – FFC pSPA. Outside of the breeding season, it is assumed that birds are more widely distributed and are mixing with birds from a wider range of colonies. Apportioning then needs to take account of the fact that birds in the Project area will be from a range of different breeding colonies.

3.49 Information provided by colony managers at RSPB Bempton Cliffs Reserve, is that kittiwake start to return to the colony in mid-March and that large numbers are present from April. Therefore as set out in our Deadline IV submission Natural England consider that the breeding season for FFC pSPA should be April to July as a minimum. This is consistent with the published literature that indicates that birds re-occupy UK colonies from February, with modal return in March (Pennington et al. 2004; Brown and Grice 2005; Forrester et al. 2007).

3.50 Although birds from Arctic colonies that migrate through UK waters may not return to their colonies until April (Coulson 2011), a study of geolocator data from individuals from 18 colonies across the North Atlantic range of kittiwake showed that most birds were back **in the vicinity** of their colonies by the equinox period in April (Fredericksen et al. 2012). So although Furness (2015) defines the migration free breeding season for UK waters as May to July it is clear that the majority of UK breeding birds will be back at their colonies or at least in the vicinity of their colonies by April. As Hornsea Project 2 lies at the southern end of the kittiwake breeding range, it is likely that by April the majority of kittiwake encountered in the Project area will be from the nearest large colony – i.e. FFC pSPA and at this time there

are unlikely to be significant numbers of kittiwake from Arctic colonies as far south in the North Sea as Hornsea Project 2.

3.51 In paragraph 1.7.3 of Appendix DD, the Applicant makes reference to their apportioning approach undertaken for kittiwake for the period January to April whereby 8.4% of birds in the Hornsea Project area are predicted to be FFC pSPA adults. The Applicant argues that this is precautionary as it is assuming that 60% of the FFC pSPA adults are in the project area during this period. However the method also assumes that these 60% of FFC pSPA adults are mixing equally in the Hornsea project area with 60% of adult birds from colonies from Hermaness southwards down the east coast of the UK as well as 5% of adults from Russia, Norway, Faroes and France, 15% of adults from German colonies, as well as some adult birds from Iceland and the west coast colonies of the UK and immature birds from all these countries. Natural England maintain that we do not agree with this assessment being applied to April for the Hornsea P2 site – that is we do not agree that only 8.4% of birds in the Hornsea Project area in April will be FFC pSPA birds.

Summary of Natural England's position: Breeding season for FFC pSPA should be defined as April-July.

Assessment of the proportion of birds in project areas that are adult birds and apportioning to FFC pSPA in the breeding season (Applicant's Stage 1 in Appendix DD);

3.52 As set out in our Deadline 4 submission, Natural England consider that there is a high probability that kittiwake present in the Hornsea Project 2 area during April to July will have connectivity with the FFC pSPA colony. The Applicant does not agree with this position, citing data from Birdlife's Seabird Foraging Database which suggest that only 5% of foraging trips would be beyond 60km of the colony. The Applicant asserts that less than 5% of foraging trips are predicted to interact with the Hornsea Project 2 area.

3.53 Natural England do not know whether any data from FFC pSPA contribute to Figure 1.1, but note that for a colony with 44,520 pairs, 5% of foraging trips equates to a significant number of individual birds. Additionally, the key question is not what proportion of foraging trips might extend into the project area, but what is the likelihood that a kittiwake encountered in the project area is a bird from FFC pSPA. Given that FFC pSPA is the largest kittiwake colony in England (and one of the largest in the UK), and is the closest kittiwake colony to Hornsea Project 2, Natural England considers that during the breeding season there will be a high probability that kittiwake present in Hornsea Project 2 will be birds from FFC pSPA.

3.54 Further, RSPB tracking data for 86 adult kittiwake from Flamborough Head and Filey, over the period 2010-2013 show that maximum foraging ranges were greater than the distance between Hornsea P2 and FFC pSPA (~100km) in all years. Two of the tracking years coincided with the baseline surveys of Hornsea Project 2, and the mean max foraging range from Flamborough Head in one of these years (2012) also exceeded 100km. Kittiwake numbers at the project site in the breeding season in 2012 were almost 3 times higher than

numbers recorded in 2011 when the mean max foraging range calculated from the tracking data was only 58km. Natural England considers that evidence on bird movements that relates specifically to FFC pSPA birds should be given significantly greater weight in comparison to information on foraging ranges derived from other colonies.

3.55 Although the tracking data only involves a small number of birds from the colony, the tracking data provides clear evidence of connectivity with the Hornsea Project 2 area with tracked birds from Flamborough Head and Filey interacting with the Hornsea project area in all four years. On this basis Natural England considers that kittiwake present in the Hornsea Project 2 area during the breeding season should be apportioned to FFC pSPA.

3.56 The population models that the Applicant has constructed for FFC pSPA are based on defining the adult population size of the colony, and predicted mortalities are applied to the adult component of the population with the assumption that a level of mortality proportional to their contribution to colony size will be experienced by the other age classes. Therefore, a measure of predicted mortality for the adult component of the colony is required for the population modelling.

3.57 The Applicant's data shows that 94.6[5]% of birds present in the breeding season were adult birds, based on a sample of 22,870 birds that were aged and, therefore, Natural England assumed that 95% of the birds recorded in the Project area during the breeding season are FFC pSPA adults. Natural England accepts that this assessment may overestimate the proportion of adult birds on the project site, since it is difficult to distinguish older immature birds from adults in the field.

3.58 In Appendix DD the Applicant has considered their data on the proportion of adults recorded on baseline surveys and has calculated an adjustment based on the assumption that birds recorded as "adults" on baseline surveys could include adult birds plus 2nd and 3rd summer birds. Using data on juvenile survival from Robinson (2005) and Frederikson et al. (2004) the Applicant has estimated what proportion of the "adult-type" birds might have been adult birds (rather than 2nd or 3rd summer immatures). The Applicant has calculated that 83% of birds are predicted to be true adults. Natural England accepts this modification to the proportion of adults predicted to be in the Project site during the breeding season, noting that the most recent review of demographic rates for seabirds in the UK concluded that juvenile and immature survival rates for kittiwake were poorly resolved and only recommended a survival rate for juveniles (0-1 years) and a survival rate for adult birds (Robinson and Horswill 2015).

Summary of Natural England's Position:

Apportioning of birds to FFC pSPA in the breeding season (April-July) updated from 94.6% to 83%.

[5] 94.6% was based on figures that relate to May-July. The Applicant provided updated figures at Deadline IV which indicated that when April data were also considered, the percentage of adult birds present in the Project area in the breeding season (April-July) was 93.5%.

Updated Natural England position on predicted collisions for kittiwake from FFC pSPA for Hornsea Project 2 alone.

3.59 Following agreement with the Applicant on the revised apportioning of birds to FFC pSPA, Natural England has updated its position on the project alone mortality figures and these are presented in Table 7. These figures are based on using the Basic Band Model Option 2, with 83% of birds apportioned to FFC pSPA for the breeding season months April to July. The non-breeding season apportioning remains the same as in our position at Deadline III and IV and follows the figures from Furness (2015), namely 5.4% apportioning during the post breeding season and 7.2% apportioning in the pre-breeding season.

Table 7. Updated position for project alone collisions for kittiwake on the basis of assuming that 83% of birds within the Project area during the breeding season are adult birds from FFC pSPA (rather than 94.6% used by Natural England at Deadline III). Per annum Kittiwake collisions (adults) at FFC pSPA.

	Lower CL	**Mean**	**Upper CL**
Baseline density variability.	64	118	204
AR variability (98.7-99.1%)	93	118	141
Flight height variability (upper and lower 95% CLs of Johnston et al (2014) supplementary data.	83	118	138

Table 8. Predicted impacts on kittiwake population of FFC pSPA

Additional adult mortality	Ratio of Impacted to unimpacted GR	Change in the per annum population GR (based on a modelled 3.9% GR)	Ratio of impacted to unimpacted population size at 25 years	% change in population size at 25 years between impacted and unimpacted populations (based on modelled 3.9% GR)
50	0.999	-0.116	0.980	-2.01%
100	0.998	-0.166	0.967	-3.31%
150	0.998	-0.192	0.958	-4.18%
200	0.997	-0.286	0.944	-5.64%
250	0.997	-0.339	0.934	-6.58%

3.60 Based on a predicted level of additional mortality in the range 64 – 204 adult kittiwake from FFC pSPA per annum (which represent collision predictions for the lower and upper 95%CLs of the kittiwake density data for the project area), Natural England has considered PVA model outputs from a density independent model of up to 200 additional adult mortalities (the closest output provided by the Applicant to the 204 figure in Table 7). Natural England do not consider this range of potential collisions to be precautionary as it does not factor in additional uncertainty around the avoidance rate (AR) and flight height data, incorporation of which could increase the range of predicted collisions.

3.61 Considering a range of impacts from 50-200 adults per annum (closest modelled outputs to the 64-204 predicted range) that factors in variability around numbers of birds in the Project area, the per annum % growth rate would fall by 0.12-0.29 and the final population size would be between 2.0% and 5.6% lower than the un-impacted population size at 25 years. A density dependent model would predict smaller declines in growth rate; however there is no clear evidence to support application of any particular form or magnitude of density dependence in the modelling.

3.62 Natural England consider that if the kittiwake population were to grow at the rate calculated in the applicant's PVA model of 3.9% over the next 25 years, then additional mortality of 204 adults or lower would not be counter to a conservation objective to restore the population, as it would still allow the population to grow (at 3.6% per annum) with minimal delay in reaching the same population level as the un-impacted population. However, in the context of a population trajectory that is currently declining and may continue to decline (or at best be stable), an additional mortality of up to 204 adults per annum over 25 years, causing a reduction in the per annum % growth rate of 0.29 would further harm the population and make it more difficult to restore the population to a favourable condition. Natural England is therefore currently unable to conclude beyond reasonable scientific doubt that this level of impact would not be an AEoSI.

Proposed mitigation

3.63 Following discussions with the Applicant regarding the level of predicted mortality on the kittiwake population of FFC pSPA the Applicant has proposed mitigation that includes modifying the Project design envelope to exclude the 5MW turbine option and raising the minimum hub height by 3.5m on a 6MW turbine as the revised worst case scenario in terms of rotor swept area and minimum lower tip height of the blade (see SoCG submitted at Deadline VI section 3.2.19).

3.64 The Applicant has provided updated collision risk figures both for Option 2 outputs of the Basic Band Model applied to a 27.5m lower rotor height (above mean sea level (MSL)) and additionally, Option 1 outputs using the site specific flight height data but including all birds that were assigned to height bands 22.5-27.5m and above. This approach to using Option 1 with site specific data follows Natural England's suggestion to include the entire 5m flight height band immediately below the lower rotor height (at MSL). This allows consideration of the variability around flight heights generated by the ability of boat based observers to accurately assign birds to five metre bands. Therefore, by incorporating this data, that modelled number addresses some of Natural England's concerns regarding the collection and use of the site specific flight height data that have been described above.

Natural England has therefore been able to base its conclusions with regard to this mitigation agreement on the collision risk figures presented by the Applicant for Option 1, whilst also considering revised Option 2 outputs factoring in the proposed mitigation (Table 9). These figures in Table 9 below include Natural England's updated, and agreed with the Applicant, position regarding breeding season apportioning of 83% adults (rather than 95[6]% applied at Deadline 3).

Table 9. Predicted adult collisions apportioned to FFC pSPA based on apportioning of 83% birds (April-July), 5.4% birds (Aug-Dec) and 7.2% birds (Jan-March). Proposed mitigation of raising hub height by 3.5m on a 6MW turbine.

Kittiwake collisions (adult birds from FFC pSPA)	**Lower CL**	**Mean collisions**	**Upper CL**
Option 1 of Basic Band Model including all birds in recording bands 22.5-27.5m and above	27	49	85
Option 2 of Basic Band Model. Lower rotor height 27.5m above msl.	42	78	134

3.65 The impact of raising the turbine height and being able to consider outputs from Option 1 of the Band model means that fewer birds are within the rotor swept area, and, therefore, for both versions of the model the number of collisions has decreased. This also allows consideration of lower modelled values from the PVA assessment (Table 8) where the lowest modelled output of 50 birds now correspond to the lower confidence limits and the mean collisions for Option 1, and the highest modelled outputs for Option 1 now fall below 100 birds. Natural England is of the view that if the number of collisions is reduced in this way (via mitigation) then it is likely that the Option 1 range of collisions represent a set of values where the impacts on the population parameters (as described in Table 8) can be considered to not be an AEoSI, when considering the likely impact of the proposal in the context of natural population variability. In order to aid our considerations of that variability, Natural England looked further into the demographic rates presented in Horswill and Robinson (2015), where based on an annual survival rate of 0.854, the baseline mortality rate for adult kittiwake would be 14.6%. Therefore, 1% of annual baseline mortality for the kittiwake population of FFC pSPA is 130 adults. The use of a 1% increase in baseline mortality has been used to indicate the significance of effects for populations of birds, for example being used as a screening tool for assessment of impacts. Whilst the focus of our assessment remains on the PVA outputs in the context of a population which has declined and is either continuing to decline or is at best stable, Natural England has also noted that

[6] 95% was based on figures supplied by Applicant which related to May-July. Applicant updated figures at Deadline IV to indicates that the adult percentage was 93.5% based on April to July.

the entire range of Option 1 collision values falls well below the 1% of annual baseline mortality for FFC pSPA.

3.66 Therefore, based on the significant reduction in collisions caused by an increase in turbine height, and the subsequent reduced impacts on growth rate and final population size, especially when considering Option 1 of the model (now that the Applicant has addressed some of the methodological issues with the site specific flight height data), Natural England concludes that the predicted additional mortality is likely to fall within a range that can be considered as not having an adverse effect on site integrity for the project alone.

In-Combination assessment.

3.67 Natural England set out its position on predicted kittiwake mortality at FFC pSPA for Hornsea Project 2 in-combination with other plans and project at Deadline 3. Natural England's position at Deadline 3 was 503 FFC pSPA adult kittiwake collisions per annum. This contrasts with the Applicant's position on in-combination impacts on the FFC pSPA kittiwake population of 146 adults.

3.68 Natural England and the Applicant have agreed on the list of projects that should be included in an in-combination assessment and these are presented in Table 10. These are all projects that are in the North Sea BDMPS for kittiwake as defined in Furness (2015). Natural England notes that this BDMPS does not encompass all offshore areas occupied by kittiwake from FFC pSPA, for example the BDMPS does not extend beyond UK waters and Furness (2015) also calculates that 20-30% of FFC pSPA adults may migrate through UK western waters. Therefore, Natural England considers that an in-combination assessment that includes only North Sea projects is not precautionary.

3.69 In undertaking an in-combination assessment there is an even greater degree of uncertainty about the predicted impact level compared to the Project alone assessment as individual projects will have unquantified variability around their respective collision figures. This is not considered when summing the impacts to generate an overall in-combination figure.

3.70 In our Deadline 2 submission, Natural England's position on in-combination figures was based on use of the Basic Band model with a 98.9% AR, apportioning in the non-breeding season based on Furness (2015) and apportioning of birds in the breeding season for projects that lie within data on foraging ranges derived from the literature (e.g. Thaxter et al. 2012) and recent RSPB tracking data for kittiwake from FFC pSPA.

3.71 Natural England has had further discussions with the Applicant regarding which projects might have potential impacts on the kittiwake population of FFC pSPA during the breeding season. In Appendix DD, the Applicant has undertaken an exercise to assess those projects that may have connectivity with FFC pSPA kittiwake in the breeding season and the level of confidence that is associated with the evidence on connectivity.

3.72 The projects considered in this assessment are Westermost Rough, Humber Gateway, Hornsea Project One, Hornsea Project 2, Lincs, Race Bank, Triton Knoll,

Dudgeon, Teesside, Blyth Demonstration Project, Dogger Bank Creyke Beck A&B and Dogger Bank Teeside A & B.

3.73 Humber Gateway and Westermost Rough both lie within the mean maximum foraging range of 60km given in Thaxter (2012). Additionally, Triton Knoll and Teesside fall within the SD of the mean (+/-23.3km) calculated by Thaxter (2012). All the projects listed above lie within foraging ranges calculated by RSPB, based on their tracking data from FFC pSPA.

3.74 The Applicant has placed projects into 4 tiers of decreasing confidence about connectivity:

> Tier 1 – Projects within Thaxter et al. (2012) mean maximum foraging range (Westermost Rough and Humber Gateway);
>
> Tier 2 – Projects with strong connectivity from FAME tracking data (Hornsea Project One and Two);
>
> Tier 3 – Projects with weak FAME connectivity Race Bank, Dogger Bank Creyke Beck A & B) ;
>
> Tier 4 - Projects outside of foraging range and no FAME connectivity (Blyth Demo, Teesside, Dudgeon, Dogger Bank Teesside A&B);

3.75 Natural England does not agree with the Applicant's assessment of connectivity between FFC pSPA and the project sites based on the tracking data. All of the projects are within foraging ranges recorded from the tracked birds (86 birds total tracked across 4 years, 2010-2013). There was additionally evidence of direct connectivity with project areas of tracked individuals, for Westermost Rough, Humber Gateway, Hornsea Project One, Hornsea Project 2, Lincs, Race Bank, Triton Knoll, Dogger Bank Creyke Beck A & B, Dogger Bank Teesside (A & B) and Dudgeon.

3.76 Therefore Natural England considers that breeding season collisions from all these projects should be apportioned to FFC pSPA. For Teesside and Blyth Demonstration Project which lie to the North of the colony, Natural England accepts that the tracking data do not show any direct evidence of connectivity between FFC pSPA birds and the Project areas. Natural England note that this could be a function of the small sample size of tracked birds, and it is not possible to say with certainty than there is no connectivity. However the existence of a number of smaller kittiwake colonies along the coast in the vicinity of these projects (e.g. Boulby Cliffs and Saltburn Cliffs to Huntcliff as well as Teesside colonies) means that it is likely that a large proportion of predicted collisions from these two projects are likely to relate to kittiwake from these closer colonies.

3.77 Regarding the proportion of birds in the different project areas that Natural England considers should be apportioned to FFC pSPA, our position is that where foraging connectivity has been established and FFC pSPA is the only colony considered to be in foraging range then 100% of collisions should be apportioned to FFC pSPA.

3.78 For Hornsea Project 2, Natural England have agreed that 83% represents the number of adult birds predicted to be in the Project area in the breeding season and so have used this to derive a collision figure that relates to adult birds from FFC pSPA.

3.79 At Hornsea Project One, 100% apportioning was agreed during examination, however the Applicant argues that using the same approach as applied to Hornsea Project 2 to calculate the proportion of birds in the project area predicted to be adult birds during the breeding season using site based data on birds of different age classes indicates that 67% of birds are predicted to be adults. Natural England has therefore accepted an updated assessment of breeding season collisions for Hornsea Project One based on 67% apportioning rather than 100% apportioning.

3.80 For Dogger Bank Creyke Beck and Dogger Bank Teesside, a different approach to apportion was used and during examination of these projects it was agreed that 19.3% of birds would be apportioned to FFC pSPA during the breeding season. Natural England notes that in the in-combination assessment undertaken at Dogger Bank Teesside this 19.3% apportioning in the breeding season was applied to all projects in the North Sea from Beatrice down to Navitus in the English Channel. In the absence of clear evidence regarding what an appropriate level of apportioning should be for Dogger Bank Creyke Beck and Dogger Bank Teesside, Natural England have used the 19.3% apportioning figure agreed during the project examination for Dogger Bank Teesside, noting that there is a large amount of uncertainty associated with this figure.

3.81 Natural England's position on the in-combination figures is summarised as follows:

3.82 Use of Basic Band Model Option 1 (or Option 2 outputs if these were agreed during examination for a project) with 98.9% AR: At Dogger Bank Creyke Beck and Dogger Bank Teesside Natural England agreed use of Option 2 with Forewind due to methodological queries regarding the site specific flight height data. For Hornsea Project 2, Natural England has advised use of Option 2 due to methodological issues around the site specific flight height data. Note that for Hornsea Project One, Natural England considered Option 2 outputs alongside Option 1 outputs for the same reasons, but have retained the Option 1 figures in this table as Option 1 figures were used in the in-combination assessment at Hornsea Project One.

3.83 Apportioning in the non-breeding season that follows Furness (2015) – (5.4% in the post-breeding season and 7.2% in the pre-breeding season);

3.84 Apportioning of birds to FFC pSPA in the breeding season (defined as April-July for FFC pSPA) based on evidence of connectivity with FFC pSPA. This is summarised as:

- 100% apportioning of birds from Humber Gateway and Westermost Rough. These two project are within the mean maximum foraging range for kittiwake given in Thaxter et al. (2012);
- 100% apportioning from Triton Knoll, Race Bank, Dudgeon, Lincs as projects that lie within foraging range of FFC pSPA as calculated from tracking data from breeding birds from the colony as well as evidence of tracked birds showing connectivity with project areas;

- 83% apportioning from Hornsea Project 2 and 67% apportioning from Hornsea Project 1 as projects that lie within foraging range of FFC pSPA as calculated from tracking data from breeding birds from the colony as well as evidence of tracked birds showing connectivity with project areas. Apportioning percentages updated to reflect information about the proportion of birds in the project areas during the breeding season that are predicted to be adults;
- 19.3% apportioning for Dogger Bank Teesside and Dogger Bank Creyke Beck;
- No breeding season apportioning from Teesside or Blyth Demonstration Project.

3.85 Natural England's updated position is presented in Table 4. The revised in-combination total is 418 adult kittiwake. A density independent PVA model (SMartWind 2015) predicts that with an additional annual adult mortality of 400 birds (closest modelled output to predicted 418 adults impact) the per annum % growth rate of the population at FFC pSPA would decline by 0.519. The population size after 25 years is predicted to be 10.6% lower than it would be in the absence of the windfarm.

3.86 Natural England's position on the significance of this level of impact remains the same as at Deadline III – that we cannot conclude no AEoSI for the Hornsea project 2 in-combination with other plans and projects. Natural England note that there is a large degree of uncertainty around this figure, but Natural England does not consider that this is a precautionary assessment for the following reasons:

1. The figure does not factor in any of the variability in the individual project assessments;
2. Reductions in the collisions on the basis of reductions in the consented number of turbines at several projects e.g. Triton Knoll and East Anglia 1 represent assumptions that the number of collisions will decline by the same percentage as the turbine reduction. This would need to be demonstrated by re-running the collision risk modelling to show that the consented layout does actually result in these collision reduction – for example in some cases, while consented turbine numbers are lower the overall capacity of the windfarm has not been reduced by the same proportion and turbine specifications may have changed;
3. The figure for Hornsea Project One is based on an Option 1 Band Model output. During examination of Hornsea Project One, Natural England raised concerns about the use of the site specific flight height data and based its collision assessment for kittiwake on the range of collisions predicted using both Option 1 and Option 2 outputs - the latter of which were considerably higher. In taking an overall view of the collision prediction for Hornsea Project One, Natural England considered that Option 1 figures may underestimate collisions, but 100% apportioning of birds to FFC pSPA in the breeding season is precautionary since there is no adjustment for non-adult birds. The Updated figure used here for Hornsea Project One now makes an adjustment to account for not all birds being adults, therefore Natural England considers that the overall collision estimate could be higher;

Table 10. In-combination collision totals for kittiwake population of Flamborough and Filey Coast pSPA.

Offshore wind farm	Band Model	Option	Avoidance rate (%)	Annual collisions	Breeding	% Apportioning	pSPA breeding collisions	Post-breeding	% Apportioning	pSPA post breeding collisions	Pre-breeding	% apportioning	pSPA pre breeding collisions
Aberdeen European Offshore Wind Deployment Centre	Band (2012)	2	98.9	18.70				5.8	5.4	0.31	1.1	7.2	0.08
Beatrice	Band (2012)	1	98.9	57.86				4.3	5.4	0.23	15.9	7.2	1.14
Beatrice Demonstrator	Band (2000)	1	99.2	4.95				2.1	5.4	0.11	1.7	7.2	0.12
Blyth Demonstration Project	Band (2011)	1	98.9	5.39				2.3	5.4	0.12	1.4	7.2	0.10
Dogger Bank Creyke Beck Projects A and B	Band (2012)	2	98.9	718.85	288.0	19.3	55.6	135.0	5.4	7.3	295	7.2	21.2
Dogger Bank Teesside Projects A and B	Band (2012)	2	98.9	444.40	136.9	19.3	26.4	90.7	5.4	4.9	216.9	7.2	15.6
Dudgeon	Band (2000)	1	98.9	0.00	0.0	100.0	0.0	0.0	5.4	0.0	0.0	7.2	0.0
East Anglia One	Band (2012)	1	98.9	429				295	5.4	15.9	104.6	7.2	7.53
Galloper	Band et al. (2007)	1	98.9	65.89				27.8	5.4	1.5	31.8	7.2	2.29
Greater Gabbard	Band (2000)	1	98.9	27.50				15.0	5.4	0.81	11.4	7.2	0.82
Hornsea Project One	Band (2012)	1	98.9	122.00	47.9	66.6	31.9	55.9	5.4	2.9	20.9	7.2	1.50
Hornsea Project Two	Band (2012)	2	98.9	230.00	136.0	83.0	112.9	72.0	5.4	3.9	23	7.2	1.66

Humber Gateway	Not available	1	98.9	7.70	2.55	100.0	2.55	3.19	5.4	0.17	1.9	7.2	0.14
Inch Cape	Band (2012)	1	98.9	301.42				224.8	5.4	12.1	63.5	7.2	4.57
Kentish Flats	Band (2012)	1	98.9	2.20				0.9	5.4	0.05	0.7	7.2	0.05
Lincs	Band (2000)	1	98.9	2.75	0.92	100.0	0.92	1.16	5.4	0.06	0.69	7.2	0.05
London Array	Band (2000)	1	98.9	5.50				2.3	5.4	0.12	1.8	7.2	0.13
Moray Firth Project One (MORL)	Band (2012)	1	98.9	45.4				2.0	5.4	0.11	19.3	7.2	1.39
Neart na Gaoithe	Band (2012)	1	98.9	93.39				56.1	5.4	3.0	4.4	7.2	0.32
Race Bank	Band (2000)	1	98.9	31.35	1.86	100.0	1.86	23.9	5.4	1.3	5.59	7.2	0.40
Seagreen Alpha	Band (2012)	1	98.9	371.25				171.1	5.4	9.2	133.8	7.2	9.63
Seagreen Bravo	Band (2012)	1	98.9	343.20				142.4	5.4	7.7	114.0	7.2	8.21
Teesside	Band (2000)	1	98.9	77.08				24.0	5.4	1.3	2.5	7.2	0.18
Thanet	Band (2000)	1	98.9	1.10				0.5	5.4	0.03	0.4	7.2	0.03
Triton Knoll	Band (2000)	1	98.9	209.00	24.6	100.0	24.6	139.0	5.4	7.5	45.4	7.2	3.27
Westermost Rough	Band et al. (2007)	1	98.9	0.55	0.176	100.0	0.176	0.22	5.4	0.01	0.132	7.2	0.01
TOTAL				**3616.4**			**256.9**			**80.8**			**80.5**

In-combination assessment following proposed mitigation

3.88 Following discussions with the Applicant regarding the level of predicted mortality on the kittiwake population of FFC pSPA, the Applicant has proposed mitigation that includes modifying the Project design envelope to exclude the 5MW turbine option and raising the minimum hub height by 3.5m on a 6MW turbine as the revised worst case scenario in terms of rotor swept area and minimum lower tip height of the blade (see SoCG submitted at Deadline VI section 3.2.19).

3.89 The Applicant has provided updated collision figures based on this mitigation. This would reduce the predicted annual collisions for Hornsea Project 2 to 49 adults per annum using Option 1 outputs (see Table 9). Using this figure for Hornsea Project 2 in the in-combination assessment would give a total in-combination figure of 349 adults per annum. A density independent PVA model (SMartWind 2015) predicts that with an additional annual adult mortality of 350 birds (closest modelled output to predicted 349 adults impact) the per annum % growth rate of the population at FFC pSPA would decline by 0.413. The population size after 25 years is predicted to be 9.3% lower than it would be in the absence of the windfarm.

3.90 Natural England is unable to conclude no AEoSI for Hornsea project 2 in-combination with other plans and projects. The applicant and Natural England will continue to explore various elements of the in-combination assessment and updated positions will be presented at Deadline VI.

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SECTION C – COMMENTS TO ADDENDUM TO THE HRA: CONSIDERATION OF THE SOUTHERN NORTH SEA dSAC

4.1 In its second round of written questions, issued on 29th September 2015, the Examining Authority's requested (question EOMM26) that the applicant update their HRA report to assess the effects of its application on the relevant harbour porpoise dSAC. In the absence of any formal material on the Harbour Porpoise dSACs (i.e. conservation objectives, management measures, site boundaries, etc.), Natural England agreed with the Applicant that, for the purposes of addressing the ExA's question, it would be appropriate to follow the approach taken by DECC for the Dogger Bank Teesside A and B application when compiling a shadow HRA on the relevant Harbour Porpoise dSACs. Natural England notes that it was not consulted by DECC on the shadow HRA for Harbour Porpoise undertaken for the Dogger Bank Teesside A and B application. Therefore, it is Natural England's opinion that an updated HRA will need to be undertaken if, and when, a formal consultation is launched on the proposal for the dSAC.

4.2 The shadow HRA on harbour porpoise dSACs, undertaken taken by the Applicant, has followed the HRA approach undertaken for Dogger Bank Teesside A and B. This approach does not consider the impacts on harbour porpoise at a site level but at a North Sea Management Unit level. **Natural England maintains that if possible sites for SAC designation are formally consulted upon an updated HRA will need to be undertaken which considers impacts at a site level, in consultation with the Statutory Nature Conservation Bodies (SNCBs).**