THE PLANNING ACT 2008

THE INFRASTRUCTURE PLANNING (EXAMINATION PROCEDURE) RULES 2010

East Anglia TWO Offshore Wind Farm

Planning Inspectorate Reference: EN010078

Secretary of State 2nd Additional Information Request

(30 December 2021)

Appendix 3: Natural England's Comments to the Flamborough and Filey Coast (FFC) SPA PVAs and In-combination Assessments

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31st January 2022

Appendix 3 Natural England's Comments to the Flamborough and Filey Coast (FFC) SPA PVAs and In-combination assessments, submitted by the Applicant on 30 November 2021

Summary

1. This document is a technical document submitted to the Secretary of State to provide scientific justification for Natural England's advice regarding the potential impacts of East Anglia One North (EA1N) and East Anglia Two (EA2) on designated site features, as summarised within each section.

2. This advice is based on the updated in-combination totals for the Flamborough and Filey Coast (FFC) SPA features submitted by the Applicants in response to the Secretary of State (SoS) letter dated 2 November 2021 and presented in Royal Haskoning DHV et al. (2021). It is also based on the recently updated FFC SPA PVAs presented by the Norfolk Boreas Applicant in their document titled 'Updated FFC SPA PVAs and in-combination assessments updated at the request of Natural England' (MacArthur Green, 2021). Therefore, this advice updates that previously provided during the EA1N and EA2 examinations at Deadline 12 [REP12-090] regarding in-combination collision and displacement impacts for the features of the FFC SPA. Our advice considers all projects up to and including Hornsea Project 3, Norfolk Vanguard, Norfolk Boreas, EA1N and EA2, and excluding the Hornsea Project 4, and Dudgeon and Sheringham extension projects (DEP & SEP), as per the SoS request to the Applicants.

3. Our advice is based on best available evidence at the time of writing and is subject to change in the future should further evidence be presented.

Detailed Comments

1) Updated PVAs

4. Natural England welcome the updated PVAs for the gannet, guillemot and razorbill qualifying features of the FFC SPA as submitted by the Applicants in Royal Haskoning DHV et al. (2021). Our advice also takes account of the evidence presented by the Norfolk Boreas Applicant in their updated FFC PVAs and in-combination assessments updated at the request of Natural England (MacArthur Green 2021). This is because this latter submission considers the full extent of the Natural England advised displacement impact ranges for auks (30-70% displacement and 1-10% mortality). Furthermore, the PVAs run by Norfolk Boreas have included the same projects in the in-combination assessments as the EA1N and EA2 Applicant, and the in-combination predicted impacts are also the same.

5. The Applicants are correct that the online version of the PVA Tool only allows selection of one method for including density dependent effects of population size on demographic rates, and that this is set such that whatever percentage point level of change is applied to a demographic rate (the effect is specified by the user) it operates for every 10-fold change in population size (i.e. a linear function of log10 of population size).

6. The reasons that only one method for specifying density dependence was included in the online version of the tool were:
    - to simplify the interface and the running of the online version;
    - because during the expert workshops for the development of the tool there was no agreement regarding the method to use for incorporating density dependence into the models on seabird populations, and the contractor (UK CEH and BiOSS) considered that the one they selected for the online tool was the best option; and,
    - SNCB advice is currently to not include density dependence unless there is robust evidence regarding the existence and nature of any density dependence operating on the population being modelled – therefore the capability to run a density independent model in the online version was prioritised.

7. The underlying R package for the tool includes four different models for applying density dependence to populations. These include the Weibull function which was suggested by MacArthur Green via the development workshops and subsequent discussion with the contractor. It is also possible to add additional models for density dependence to the underlying package (on top of the 4 options available) if required.

8. So, if there is good evidence to support use of a particular form of density dependence operating on a specific population then that can be presented by Applicants, and the PVA Tool R package can be used to run models and derive outputs with a range of different methods. However, if this were to be done, Natural England would still request that outputs run with a density independent model are presented, and we would also request that all the input parameters used are presented if running the R package with the alternative methods of density dependence being used. We note that currently we have not accepted or endorsed any particular method for incorporation of density dependence into population models for the species and populations that we have advised on.

9. We welcome that the Applicants have presented both the counterfactuals of population size (CPS) and counterfactuals of growth rate (CGR) metrics from their updated PVAs in Tables 2-4 of Royal Haskoning DHV et al. (2021). CPS and CGR should be considered in assessments. We note our advice provided at Deadline 4 during the Norfolk Boreas examination regarding use of both counterfactuals and around use of density dependent vs density independent PVA models[1,2] . We highlight that the counterfactual metrics are relative measures, and the use of the counterfactual metrics does make the metrics less sensitive to mis-specification of e.g. density dependence or density independence. Without having good evidence to support what form and strength of density dependence to add to a model there is no way of knowing whether the predictions from a density dependent model are robust

[1] Natural England (2020) Norfolk Boreas Offshore Wind Farm Deadline 4: Updated Ornithology Advice – Natural England's comments in relation to the Norfolk Boreas updated offshore ornithological assessment, submitted at Deadline 2 [REP2-035]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-001629-DL4%20-%20Natural%20England%20-%20Updated%20Ornithology%20Advice.pdf

[2] Natural England (2020) Norfolk Boreas Offshore Wind Farm: Natural England's Written Summary of Oral Representations made at Issue Specific Hearing 4 on offshore effects including the Draft Development Consent Order. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-001630-DL4%20-%20Natural%20England%20-%20Written%20Representation%20of%20Oral%20Case.pdf

or accurate, which is why Natural England advise use of the density independent models, or at least inclusion of a density independent option.

10. We welcome that the demographic parameters and starting populations used in the updated PVAs as presented in Appendix 3 of Royal Haskoning DHV *et al*. 2021 are those recommended by Natural England in our advice at Norfolk Boreas. We also welcome that the Applicants' updated PVA model outputs have been set as breeding pairs, reflecting Natural England's advice at Norfolk Boreas.

    However, there are a couple of issues with the Applicants' updated FFC PVAs:

    - The Applicants have not presented, either in their updated PVAs or updated in-combination assessment, the full range of predicted displacement impacts to guillemot and razorbill as advised by Natural England. Their updated assessment has focused only on predicted impacts at 30% displacement and 1% mortality, 70% displacement and 2% mortality and 70% displacement and 10% mortality, rather than the full range of 30-70% displacement and 1-10% mortality.

      However, the Norfolk Boreas Applicant submitted further updated FFC PVAs and in-combination assessments in their document titled 'Updated FFC SPA PVAs and in-combination assessments updated at the request of Natural England' (MacArthur Green 2021). These updated PVAs have been run across the full range of displacement (30-70%) and mortality (1-10%) rates recommended by Natural England. The PVAs run by Norfolk Boreas have included the same projects in the in-combination assessments as the EA1N and EA2 Applicant, and the in-combination predicted impacts are also the same. The PVA input parameters used by Norfolk Boreas and EA1N and EA2 are also the same for both guillemot and razorbill. Therefore, in our detailed advice in Annex 1 we have utilised the CGRs and CPSs presented by the Norfolk Boreas Applicant from their updated PVAs for the guillemot and razorbill features of the FFC SPA (MacArthur Green, 2021), as these represent the best available evidence on which to base an assessment.

    - As with the Norfolk Boreas and Norfolk Vanguard recently updated FFC SPA PVAs, the EA1N and EA2 Applicants updated PVA models in Royal Haskoning DHV et al. (2021) have also been run based on the precise impact levels from the in-combination assessments – the models have been run to

an impact level 0.1 of a bird. It would have been beneficial to also present some tables with the counterfactuals for a wider range of figures e.g. for the guillemot in-combination 70% displacement and 10% mortality assessment to present outputs against impacts of 1,740 and 1,750 birds, rather than 1,748.3 only as has been done currently.

2) Flamborough and Filey Coast (FFC) SPA In-Combination Impacts Detailed Comments / Conclusions

2.1 Flamborough & Filey Coast (FFC) SPA: Gannet - Impacts from EA1N and EA2 In-Combination with other Plans and Projects: Operational Collision Risk, Displacement and Collision + Displacement

11. We agree with the updated in-combination totals for collision, displacement (at 80% displacement and 1% mortality) and collision plus displacement for all projects excluding Hornsea 4, DEP and SEP presented by the Applicants in Table 1 of Royal Haskoning DHV et al. (2021).

12. We have utilised the CPGRs and CPSs presented by the Applicants in Table 2 of Royal Haskoning DHV et al. (2021) as these represent the best available evidence on which to base an assessment, though this should not be taken as an endorsement or 'acceptance' of the model outputs.

13. The Applicant's updated in-combination collision total for FFC SPA gannet is 293 birds per annum for all projects excluding Hornsea Project 4, SEP and DEP. This level of predicted in-combination collision impact equates to more than 1% of baseline mortality of the colony.

14. For the collision impacts in-combination with other plans and projects and using the Applicants' updated PVAs in Royal Haskoning DHV et al. (2021), if the additional mortality from the offshore wind farms is 293 per annum (in-combination collision total excluding Hornsea Project 4, SEP and DEP) then the population of FFC SPA after 30 years will be 33.4% lower than it would have been in the absence of the additional mortality. The population growth rate would be reduced by 1.3% (Table 1 below).

15. The Applicant's updated in-combination displacement totals for FFC SPA gannet for the worst-case scenario of 80% displacement and 1% mortality is 62 gannets from

the FFC SPA per annum for all projects excluding Hornsea Project 4, SEP and DEP (predicted total impacts rounded to whole birds). This level of predicted in-combination displacement impacts equates to more than 1% of baseline mortality of the colony.

16. For the displacement impacts in-combination with other plans and projects and using the Applicants' updated PVAs in Royal Haskoning DHV et al. (2021), if the additional mortality from the offshore wind farms is 62 per annum (in-combination displacement mortality figure for 80% displacement and 1% mortality excluding Hornsea 4, SEP and DEP) then the population of FFC SPA after 30 years will be 8.2% lower than it would have been in the absence of the additional mortality. The population growth rate would be reduced by 0.3% (Table 1 below).

17. The combined in-combination impact for all projects excluding Hornsea Project 4, SEP and DEP of collision plus displacement to gannet from the FFC SPA equals:

    - 293 mortalities per annum from collisions plus up to 62 mortalities per annum from displacement = up to 355 mortalities from the FFC SPA.

18. This combined in-combination impact again equates to over 1% of baseline mortality of the colony. Therefore, the potential combined impacts from in-combination collision plus displacement on the SPA requires further consideration.

19. For the collision plus displacement impacts in-combination with other plans and projects and using the Applicants' updated PVAs in Royal Haskoning DHV et al. (2021), if the additional mortality from the offshore wind farms is 355 per annum (in-combination collision plus displacement mortality figure for all projects excluding Hornsea Project 4, SEP and DEP) then the population of FFC SPA after 30 years will be 38.9% lower than it would have been in the absence of the additional mortality. The population growth rate would be reduced by 1.6% (Table 1 below).

Table 1 Predicted population impacts on the gannet population of FFC SPA for the range of mortality impacts predicted for in-combination collision, displacement and collision plus displacement. PVA impact metrics are as provided in Table 2 of Royal Haskoning DHV et al. (2021)

GANNET	FFC SPA		
Additional mortality (all prjs excl. H4, DEP & SEP)	% Baseline Mortality using mean 2017 census data (26,782 adults)	Counterfactual of Final Population Size (CPS)	Counterfactual of Growth rate (CGR)
62 (in-combination displacement)	2.86	0.9180	0.9972
293 (in-combination collision)	13.51	0.6661	0.9870
355 (in-combination displacement + collision)	16.38	0.6108	0.9842

20. The gannet population of FFC SPA increased at 11.1% per annum (between 2003/4 and 2015, JNCC Seabird Monitoring Programme 'SMP' data). Using FFC SPA census data 2002-2017 the growth rate was 9.4% per annum. However, it is not known what the growth rate of the colony will be over the next 30 years, and this should therefore be considered when judging the significance of predicted impacts against the conservation objectives for the feature.

21. As was undertaken during the Norfolk Vanguard examination, Natural England has reviewed growth rates for the 22 gannet colonies across Britain, Channel Islands and Ireland with repeated census data (Cramp et al. 1974, Lloyd et al. 1991, Mitchell et al. 2004, plus more recent count data from the SMP). The Flamborough/Bempton gannet colony was founded in the late 1930s (Cramp et al. 1974) and so has been in existence now for about 80 years. Thus, by the end of the lifespan of the EA1N and EA2 projects it will be about 110 years in age. Given the analysis of trends in gannet colony growth rates amongst a suite of long-established colonies, it is highly likely that its annual growth rate averaged over the whole period since founding will drop from its current average of approximately 11% over the first 80 years. The highest annual colony growth rate calculated over a period of >100 years is 4.5% at Grassholm. The Flamborough colony is unlikely to achieve a higher annual growth rate than this. The average annual growth rate calculated over a period of >90 years across the 8 gannet colonies with records exceeding 90 years is 1.8%. Amongst these colonies the mean annual growth rate over the most recent years of their records (80+ years) has been just 1.2% per annum (or 1.3% excluding Sula Sgeir, as the growth rate here may be influenced adversely by an annual licenced harvest of young birds) compared to an average rate of 2.0% per annum during the first 80 or so years of their existence. Therefore, Natural England has considered the counterfactuals of final population size for the predicted levels of in-combination

additional mortality for a range of plausible future growth rate scenarios for FFC of 1, 1.3, 2, 3, 4 and 5% per annum.

22. The Conservation Objective for the gannet population of the FFC SPA is to maintain the size of the breeding population at a level which is above 8,469 pairs (16,938 adults), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest mean count is 24,594 adults based on the mean of the 2012, 2015 and 2017 counts.

23. For the predicted in-combination collision mortality to FFC SPA gannets of 293 mortalities per year for all projects excluding Hornsea Project 4, SEP and DEP, from the Applicants' updated PVAs in Royal Haskoning DHV et al. (2021), the colony would be predicted to reduce from its current size of 24,594 adults for a growth rate of 1% but would still be above the size of the 8,469 pairs or 16,938 adults. The colony would be predicted to remain at approximately the mean current population of 24,594 adults under a growth rate scenario of 1.3% and would be predicted to continue to grow above the current mean population of 24,594 adults under any growth rate scenario from 2% to up to 5% per annum.

24. For the predicted in-combination displacement mortality for 80% displacement and 1% mortality to FFC SPA gannets of 62 mortalities per year for all projects excluding Hornsea Project 4, SEP and DEP, from the Applicants' updated PVAs in Royal Haskoning DHV et al. (2021), the colony would still be predicted to grow above the current mean population of 24,594 adults under any growth rate scenario from 1% to up to 5%. This would allow the conservation objective to be met.

25. For the predicted in-combination collision plus displacement mortality to FFC SPA gannets of 355 mortalities per year for all projects excluding Hornsea Project 4, SEP and DEP, from the Applicants' updated PVAs in Royal Haskoning DHV (2021), the colony would be predicted to reduce from its current size of 24,594 adults for a growth rate of 1% and 1.3% but would still be above the size of the 8,469 pairs or 16,938 adults. The colony would be predicted to continue to grow above the current mean population of 24,594 adults under any growth rate scenario from 2% to up to 5% per annum.

26. If the colony were to experience an annual growth rate of 2% or more per annum over the next 30 or so years, then the integrity of the site for this feature is high, with high rates for self-repair, and self-renewal under dynamic conditions with minimal external management. Therefore, the FFC gannet population is believed to be robust enough to allow the conservation objective to maintain the population at (or above) designation levels and sustain additional alone and in-combination mortalities from the offshore wind farms. Our justification for this position is that we consider it to be highly unlikely that the FFC annual growth rate would be as low as 1%, and from the analysis of gannet colony growth rates we have conducted the current annual growth rate of approximately 11% appears to be relatively high for a colony of this age and so the colony is likely to do better than a 1.3 % annual growth rate in the foreseeable future.

27. **Therefore, based on the above information, an adverse effect on integrity (AEoI) of the gannet feature of the FFC SPA can be ruled out for in-combination collision impacts, in-combination displacement impacts and in-combination collision plus displacement impacts when all projects up to and including Hornsea Project 3, Norfolk Vanguard, Norfolk Boreas, EA1N and EA2 are included in the in-combination totals (i.e. if the Hornsea Project 4, DEP and SEP projects are excluded from the in-combination totals). For the avoidance of doubt, this is also our advice for a similar scenario presented by the Applicants where EA1N and EA2 are excluded from the in-combination totals.**

28. **As set out in our most advice at Norfolk Boreas (Natural England 2021a), due to the inevitable uncertainty associated with the figures for Hornsea Project 4 being from a recently submitted application, and those from DEP and SEP being from the PEIRs and are hence subject to change, Natural England therefore is again not in a position to advise that an AEoI can be ruled out for the gannet feature of the FFC SPA for in-combination collision impacts, in-combination displacement impacts and in-combination collision plus displacement impacts when the Hornsea Project 4, DEP and SEP projects are included in the in-combination totals.**

2.2 Flamborough & Filey Coast (FFC) SPA: Kittiwake – Impacts from EA1N /EA2 In-Combination with other Plans and Projects: Operational Collision Risk

29. We note that the SoS has not requested the Applicants provide further information on in-combination assessments and updated PVAs for FFC SPA kittiwakes.

30. Therefore, our advice regarding in-combination collision impacts to FFC SPA kittiwakes remains as set out in our Deadline 12 [REP12-090] response during the EA1N and EA2 examinations. Namely that as this feature has a restore conservation objective, and because there are indications that the predicted level of mortality would mean the population could decline from current levels should it currently be stable, **it is not possible to rule out AEoI of the kittiwake feature of the FFC SPA for collision impacts from in-combination with other plans and projects, for all projects up to and including Hornsea Project 3, Norfolk Vanguard, Norfolk Boreas, EA1N and EA2, irrespective of whether Hornsea Project 4, DEP and SEP are included in the totals or not.**

31. **We again highlight that the in-combination total of collision mortality across consented plans/projects has already exceeded levels which are considered to be of an AEoI to kittiwake at FFC SPA, and that any additional mortality arising from the EA1N and EA2 proposals would therefore be considered adverse.**

32. This advice is consistent with our recent advice at Norfolk Boreas and Norfolk Vanguard (Natural England 2021 a & b), where the in-combination projects and totals are the same as those presented in EA1N and EA2's updated tables in MacArthur Green & Royal Haskoning DHV (2021).

2.3 Flamborough & Filey Coast (FFC) SPA: Guillemot– Impacts from EA1N EA2 In-Combination with other Plans and Projects: Operational Displacement

33. We agree with the updated in-combination guillemot predicted mortalities for all projects excluding Hornsea Project 4, DEP and DEP presented by the Applicants in Table 3 of Royal Haskoning DHV et al. (2021). However, as noted above, in Royal Haskoning DHV *et al*. (2021) the Applicants have not considered predicted impacts covering the whole range of possible impacts advised by Natural England (i.e. a range of displacement rates of 30-70% and a range of mortality rates of 1-10%) and have only considered potential impacts for 30% displacement and 1% mortality, 70% displacement and 2% mortality and 70% displacement and 10% mortality.

34. However, as set out above, the recently updated FFC SPA PVA run by the Norfolk Boreas Applicant in MacArthur Green (2021) has run PVAs covering the predicted impacts across the full range of scenarios of 30-70% displacement and 1-10% mortality. Therefore, in addition to the Applicants' CGRs and CPSs for the scenarios presented in Royal Haskoning DHV et al. (2021), we have also utilised the CGRs and CPSs presented by the Norfolk Boreas Applicant from their updated PVA for FFC SPA guillemot in MacArthur Green (2021) as these represent the best available evidence on which to base an assessment, though this should not be taken as an endorsement or 'acceptance' of the model outputs.

35. Based on the updated in-combination abundance totals presented by the Applicants in Table 7 of MacArthur Green & Royal Haskoning DHV (2021), the annual in-combination total number of guillemots to be at risk of displacement for all projects **excluding** Hornsea Project 4, SEP and DEP is estimated to be 24,975.

36. For the Natural England recommended rates of 30-70% displacement and 1-10% mortality, the number of predicted additional in-combination mortalities **excluding** Hornsea Project 4, SEP and DEP is between 75 (30% displacement and 1% mortality) and 1,748 (70% displacement and 10% mortality) guillemots from the FFC SPA (as set out by the Applicants in Table 3 of Royal Haskoning DHV et al 2021). This equates to 1.01-23.54% of baseline mortality for the colony (Table 2 below). This is significant and therefore requires further consideration.

Table 2 Predicted annual displacement mortalities for in-combination impact levels for excluding Hornsea 4 (H4), Sheringham extension (SEP) and Dudgeon extension (DEP) for guillemot for FFC SPA. Shaded cells indicate predicted mortalities that exceed 1% of baseline (Aitken et al. 2017) mortality – baseline mortality calculated using colony starting size of 121,754 breeding individuals and adult mortality rate (6.1% from Horswill & Robinson 2015) – 1% baseline mortality = 74 birds.

Guillemot in-combination mortality figures, EXCLUDING H4, SEP & DEP		% mortality			
FFC adults mean of population		1	2	5	10
% displacement	30	75	150	375	749
	40	100	200	499	999
	50	125	250	624	1,249
	60	150	300	749	1,498
	70	175	350	874	1,748

37. As noted above, in addition to the PVA counterfactual metrics presented by the Applicants in Royal Haskoning DHV et al. (2021) for selected displacement and mortality rates within the recommended range, we have also utilised the recently

updated PVA counterfactual metrics presented by the Norfolk Boreas Applicant in MacArthur Green (2021) that cover the whole range of recommended displacement and mortality rates.

38. The FFC SPA guillemot colony increased by 2.8% per annum between 1987-2008 and the designated population size is 83,214 breeding adults. The 2017 colony count indicated approximately 121,754 breeding adults across the site (Aitken et al. 2017). It is not clear whether the colony will continue to grow at the current rate for the next 30 years, and this should be considered when judging the significance of predicted impacts against the conservation objectives for the feature. The Conservation Objective for the guillemot population of the FFC SPA is to maintain the size of the breeding population at a level which is above 41,607 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.

39. Using the CPSs and CGRs from the EA1N/EA2 Applicants updated PVA (Table 3 of Royal Haskoning DHV et al. 2021), if the additional mortality from the windfarms is 1,748 birds per annum (predicted mortalities for the in-combination totals for all projects excluding Hornsea 4, SEP and DEP at 70% displacement and 10% mortality) then the population of FFC SPA after 30 years will be 39.7% lower (based on CPS presented in Table 3 of Royal Haskoning DHV et al. 2021) than it would have been in the absence of the additional mortality. The population growth rate would be reduced by 1.6% (based on CGR presented in Table 3 of Royal Haskoning DHV et al. 2021), see Table 3 below. This level of impact would be considered significant in the context of the current colony population trend.

Table 3 Predicted population impacts on the guillemot population of FFC SPA for the range of mortality impacts predicted for in-combination displacement. PVA impact metrics are those presented by the EA1N/EA2 Applicants in Table 3 of Royal Haskoning DHV et al. (2021)

GUILLEMOT			
Additional mortality (70% displacement, 10% mortality)	% Baseline Mortality using 2017 population size (121,754 breeding individuals)	Counterfactual of Final Population Size (CPS)	Counterfactual of Growth rate (CGR)
1,748 (all prjs excl. H4, DEP & SEP)	23.54	0.6033	0.9838

40. While there is some empirical evidence to support the displacement levels for auks, we do not know what the likely mortality impacts of displacement are. We therefore consider it appropriate to consider a range of mortalities from 1-10%. However, on the basis that the majority of the projects that have been scoped into the assessment

lie in areas of the North Sea that represent low to medium levels of guillemot density during both the breeding (where relevant) and non-breeding seasons (Seabird Sensitivity Mapping Tool), it is assumed that areas of low/medium density will be less important/desirable feeding areas and therefore mortality impacts of displacement from lower quality areas would be lower than displacement from optimal/important areas. Therefore, we do not anticipate that mortality rates will be at the top of the range considered for projects with low/medium densities. When Hornsea Project 4 and DEP and SEP are excluded from the in-combination totals (as requested in the SoS letter), Table 4 below indicates that the mortality is unlikely to exceed a level where the population growth rate would decline by more than approximately 0.5% per annum.

Table 4 Predicted % reductions in population growth rates from EA1N and EA2 in-combination with other plans and projects excluding Hornsea 4 (H4), DEP and SEP. Shaded cells are those where the reduction in growth rate exceeds 0.5%, 1% or 2%).

Guillemot growth rate figures*, EXCLUDING H4, SEP & DEP		% mortality			
FFC adults in-combination		1	2	5	10
% displacement	30	0.07	0.14	0.35	0.69
	40	0.09	0.18	0.46	0.92
	50	0.12	0.23	0.58	1.16
	60	0.14	0.28	0.69	1.39
	70	0.16	0.32	0.81	1.62

* Guillemot CGRs presented in Table 3 of Royal Haskoning DHV et al. (2021) for 30% displacement & 1% mortality, 70% displacement & 2% mortality and 70% displacement & 10% mortality. For the remaining displacement and mortality scenarios through the Natural England recommended range, guillemot CGRs are presented in Table A3.4 of MacArthur Green (2021) (Norfolk Boreas Applicant's most recently updated PVAs)

41. Therefore, based on the above, the current population trend for the colony and the restore conservation objective, **Natural England advise that an AEoI on the guillemot feature of the FFC SPA can be ruled out from displacement in-combination with other plans and projects when all projects up to and including Hornsea Project 3, Norfolk Vanguard, Norfolk Boreas, EA1N and EA2 are included in the in-combination totals (i.e. if the Hornsea Project 4, DEP and SEP projects are excluded from the in-combination totals)**.

42. However, the Hornsea Project 4 Application data indicates that there are high densities of guillemot present at the Hornsea Project 4 site compared to other projects and therefore it may be an important area for guillemot, particularly as Hornsea Project 4 is significantly closer to FFC SPA compared to other Round 3 projects. As a result, Hornsea Project 4 is likely to have a higher importance for guillemot from the colony during the breeding season and the immediate post-

breeding period. For both these reasons, Natural England considers that the consequences of displacement for guillemot are likely to be significantly higher for this project, and therefore it cannot be assumed that mortality will be at the lower end of the range at Hornsea Project 4. We also note that when Hornsea Project 4, DEP and SEP are included in the in-combination totals there is a higher risk of a more substantial reduction in the CGR. Therefore, it should not be considered for future projects that Natural England's advice regarding guillemot displacement is that a displacement rate of 70% and mortality rate of 2% is appropriate for use in displacement assessments and we continue to advise that a range of displacement rates of 30-70% and mortality rates of 1-10% should be considered in impact assessments.

43. **Due to the issues identified above regarding the numbers of guillemot in Hornsea Project 4 array area and its proximity to FFC SPA, the increased risk of reductions in growth rate and population size when Hornsea Project 4, DEP and SEP are included, the inevitable uncertainty associated with the figures for Hornsea Project 4 being from a recently submitted application, and those from DEP and SEP being from the PEIRs and are hence subject to change, Natural England is again not in a position to advise that an AEoI can be ruled out for the guillemot feature of the FFC SPA for in-combination displacement impacts when the Hornsea Project 4, DEP and SEP projects are included in the in-combination totals.**

2.4 Flamborough & Filey Coast (FFC) SPA: Razorbill – Impacts from EA1N & EA2 In-Combination with other Plans and Projects: Operational Displacement

44. We agree with the updated in-combination razorbill predicted mortalities for all projects excluding Hornsea Project 4, DEP and DEP presented by the Applicants in Table 4 of Royal Haskoning DHV et al. (2021). However, as noted above, in Royal Haskoning DHV et al. (2021) the Applicants have not considered predicted impacts covering the whole range of possible impacts advised by Natural England (i.e. a range of displacement rates of 30-70% and a range of mortality rates of 1-10%) and have only considered potential impacts for 30% displacement and 1% mortality, 70% displacement and 2% mortality and 70% displacement and 10% mortality.

45. However, as set out above, the recently updated FFC SPA PVA run by the Norfolk Boreas Applicant in MacArthur Green (2021) has run PVAs covering the predicted impacts across the full range of scenarios of 30-70% displacement and 1-10%

mortality. Therefore, in addition to the Applicants CGRs and CPSs for the scenarios presented in Royal Haskoning DHV et al. (2021), we have also utilised the CGRs and CPSs presented by the Norfolk Boreas Applicant from their updated PVA for FFC SPA razorbill in MacArthur Green (2021) as these represent the best available evidence on which to base an assessment, though this should not be taken as an endorsement or 'acceptance' of the model outputs.

46. Based on the updated in-combination abundance totals presented by the Applicants in Table 8 of MacArthur Green & Royal Haskoning DHV (2021), the annual in-combination total number of razorbills to be at risk of displacement for all projects (**excluding** from Hornsea Project 4, SEP and DEP) is estimated to be 6,220.

47. For the Natural England recommended rates of 30-70% displacement and 1-10% mortality, the number of predicted additional in-combination mortalities **excluding** Hornsea Project 4, SEP and DEP is between 19 (30% displacement and 1% mortality) and 435 (70% displacement and 10% mortality) razorbills from the FFC SPA. This equates to 0.44-10.24% of baseline mortality for the colony (Table 5 below). This is significant towards the upper level of the displacement/mortality range that the SNCBs advise for auks (30-70% displacement and 1-10% mortality) and therefore requires further consideration.

Table 5 Predicted annual displacement mortalities for in-combination impact levels for excluding Hornsea 4 (H4), Sheringham extension (SEP) and Dudgeon extension (DEP) for razorbill for FFC SPA. Pink shaded cells indicate predicted mortalities that exceed 1% of baseline mortality – baseline mortality calculated using colony starting size of 40,506 breeding individuals (Aitken et al. 2017) and adult mortality rate (10.5% from Horswill & Robinson 2015) – 1% baseline mortality = 43 birds.

Razorbill in-combination mortality figures, EXCLUDING H4, SEP & DEP		% mortality			
FFC adults mean of population		1	2	5	10
% displacement	30	19	37	93	187
	40	25	50	124	249
	50	31	62	156	311
	60	37	75	187	373
	70	44	87	218	435

48. As noted above, in addition to the PVA counterfactual metrics presented by the Applicants in Royal Haskoning DHV et al. (2021) for selected displacement and mortality rates within the recommended range, we have also utilised the recently updated PVA counterfactual metrics presented by the Norfolk Boreas Applicant in MacArthur Green (2021) that cover the whole range of recommended displacement and mortality rates.

49. The FFC SPA razorbill colony increased by 3% per annum 1987-2008 and the designated population size is 21,140 breeding adults. The 2017 colony count indicated approximately 40,506 breeding adults across the site, indicating continued increases (Aitken et al. 2017). It is not clear whether the colony will continue to grow at the current rate for the next 30 years and this should be considered when judging the significance of predicted impacts against the conservation objectives for the feature. However, colony productivity is higher than the national average. The Conservation Objective for the razorbill population of the FFC SPA is to maintain the size of the breeding population at a level which is above 10,570 breeding pairs whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.

50. Using the CPSs and CGRs from the EA1N/EA2 Applicants updated PVA (Table 4 of Royal Haskoning DHV et al. 2021), if the additional mortality from the windfarms is 435 birds per annum (predicted mortalities for the in-combination totals for all projects excluding Hornsea Project 4, SEP and DEP at 70% displacement and 10% mortality) then the population of FFC SPA after 30 years will be 32.8% lower (based on CPS presented in Table 4 of Royal Haskoning DHV et al. 2021) than it would have been in the absence of the additional mortality. The population growth rate would be reduced by 1.3% (based on CGR presented in Table 4 of Royal Haskoning DHV et al. 2021), see Table 6 below. This level of impact would be considered significant in the context of the current colony population trend.

Table 6 Predicted population impacts on the razorbill population of FFC SPA for the range of mortality impacts predicted for in-combination displacement. PVA impact metrics are those presented by the EA1N/EA2 Applicants in Table 4 of Royal Haskoning DHV et al. (2021)

RAZORBILL			
Additional mortality (70% displacement, 10% mortality)	% Baseline Mortality using 2017 population size (40,506 breeding individuals)	Counterfactual of Final Population Size (CPS)	Counterfactual of Growth rate (CGR)
435 (all prjs excl. H4, DEP & SEP)	10.24	0.6722	0.9873

51. Whilst there is some empirical evidence to support the displacement levels for auks, we do not know what the likely mortality impacts of displacement are. We therefore consider it appropriate to consider a range of mortalities from 1-10%. However, on the basis that the majority of the projects that have been scoped into the assessment

lie in areas of the North Sea that represent low to medium levels of razorbill density during both the breeding (where relevant) and non-breeding seasons[3], it is assumed that areas of low/medium density will be less important/desirable feeding areas and therefore mortality impacts of displacement from lower quality areas would be lower than displacement from optimal/important areas. Therefore, we do not anticipate razorbill mortality rates to be at the top of the range considered for projects with low/medium densities. When Hornsea Project 4 and DEP and SEP are excluded (as requested in the SoS letter), Table 7 below indicates that the mortality is unlikely to exceed a level where the population growth rate would decline by more than approximately 0.5% per annum.

Table 7 Predicted % reductions in population growth rates from EA1N and EA2 in-combination with other plans and projects excluding Hornsea 4 (H4), DEP and SEP. Shaded cells are those where the reduction in growth rate exceeds 0.5%, 1% or 2%).

Razorbill growth rate figures*, EXCLUDING H4, SEP & DEP		% mortality			
FFC adults in-combination		1	2	5	10
% displacement	30	0.05	0.11	0.27	0.55
	40	0.07	0.14	0.36	0.73
	50	0.09	0.18	0.45	0.91
	60	0.11	0.22	0.55	1.09
	70	0.13	0.25	0.64	1.27

* Razorbill CGRs presented in Table 4 of Royal Haskoning DHV et al. (2021) for 30% displacement & 1% mortality, 70% displacement & 2% mortality and 70% displacement & 10% mortality. For the remaining displacement and mortality scenarios through the Natural England recommended range, razorbill CGRs are presented in Table A3.10 of MacArthur Green (2021) (Norfolk Boreas Applicant's most recently updated PVAs)

52. Therefore, based on the above, the current population trend for the colony and the restore conservation objective, **Natural England advise that an AEoI on the razorbill feature of the FFC SPA can be ruled out from displacement in-combination with other plans and projects when all projects up to and including Hornsea Project 3, Norfolk Vanguard, Norfolk Boreas, EA1N and EA2 are included in the in-combination totals (i.e. if the Hornsea Project 4, DEP and SEP projects are excluded from the in-combination totals)**.

53. However, Hornsea Project 4 is located significantly closer to the FFC SPA compared to other Round 3 projects, and as a result is potentially of a higher importance for razorbill during the breeding season and the immediate post-breeding period. For this reason, Natural England considers that the consequences of displacement for razorbill is likely to be higher for this project, and therefore higher mortality rates are more likely to be appropriate at Hornsea Project 4 and it cannot be assumed that

[3] NE/MMO Seabird Sensitivity Mapping Tool. [redacted]

mortality will be at the lower end of the range. Therefore, it should not be considered for future projects that Natural England's advice regarding razorbill displacement is that a displacement rate of 70% and mortality rate of 2% is appropriate for use in displacement assessments and we continue to advise that a range of displacement rates of 30-70% and mortality rates of 1-10% should be considered in impact assessments.

54. **Due to the issues identified above regarding the proximity of Hornsea Project 4 to FFC SPA and the implications for displacement effects, and the inevitable uncertainty associated with the figures for Hornsea Project 4 being from a recently submitted application, and those from DEP and SEP being from the PEIRs and are hence subject to change, Natural England therefore is not in a position to advise that an AEoI can be ruled out for the razorbill feature of the FFC SPA for in-combination displacement impacts when the Hornsea Project 4, DEP and SEP projects are included in the in-combination totals.**

REFERENCES

Cramp, S., Bourne, W.R.P. & Sanders, D. (1974) The Seabirds of Britain and Ireland. Collins, London.

Horswill, C. & Robinson R. A. (2015) *Review of seabird demographic rates and density dependence*. JNCC Report No. 552. Joint Nature Conservation Committee, Peterborough.

Lloyd, C., Tasker, M.L. & Partridge, K. (1991) *The status of seabirds in Britian and Ireland.* Poyser, London

MacArthur Green (2021) *Norfolk Boreas Offshore Wind Farm Updated Population Viability Analysis: Flamborough and Filey Coast SPA – updated at the request of Natural England*. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-002896-SoS%20Deadline%20-%20Applicant%20-%20Updated%20Population%20Viability%20Analysis%20Flamborough%20and%20Filey%20Coast%20SPA%20-%20Updated%20at%20the%20request%20of%20Natural%20England.pdf

MacArthur Green & Royal Haskoning DHV (2021) *East Anglia Two and East Anglia One North Offshore Windfarms Updated Offshore Ornithology Cumulative and In-Combination Collision Risk and Displacement Assessment.* Available from: EN010078-007889-ExA.AS-3.SoSQ.V1 Updated Offshore Ornithology Cumulative and In Combination Collision Risk and Displacement Assessment.pdf (planninginspectorate.gov.uk)

Mitchell, P.I., Newton, S.F., Ratcliffe, N. & Dunn, T. E. (2004) *Seabird Populations of Britain and Ireland*. T and A.D. Poyser, London.

Natural England (2021a) *Norfolk Boreas Offshore Wind Farm 2nd Consultation on Applicant's response to the Secretary of State's Additional Information Request: Appendix 1: Updated Population Viability Analyses (PVAs) and implications for in-combination assessments for Flamborough and Filey Coast Special Protection Area (FFC SPA).* Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-002883-SoS%20Deadline%20-%20Natural%20England.pdf

Natural England (2021b) Norfolk Vanguard Offshore Windfarm: Natural England advice on Flamborough and Filey Coast (FFC) SPA PVAs and in-combination assessments. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-004442-EN010079%20374820%20Norfolk%20Vanguard%20Annex%206%20NE%20advice%20on%20FFC%20SPA%20PVAs%20and%20in-combination%20assessments.pdf

Royal Haskoning DHV, Scottish Power Renewables & Shepherd and Wedderburn LLP (2021) *East Anglia One North and East Anglia Two Offshore Windfarms Applicants' Responses to the Secretary of State's Questions of 2nd November 2021 (Items 4-7).* Available from: EN010078-007888-ExA.AS-1.SoSQ.V1 Applicants' Responses to the Secretary of State's Questions of 2nd November 2021 (Items 4-7).pdf (planninginspectorate.gov.uk)