Department of Energy & Climate Change

APPROPRIATE ASSESSMENT

FINAL

***Project Title*: GALLOPER OFFSHORE WIND FARM**

May 2013

CONTENTS

Tables and Figures

1. INTRODUCTION

Background

1.1 This is a record of the Appropriate Assessment (AA) that the Secretary of State for Energy and Climate Change has undertaken under Regulation 61 of the Conservation of Habitats and Species Regulations 2010 (as amended) ("the Habitats Regulations") and Regulation 25 of the Offshore Marine Conservation (Natural Habitats & c.) Regulations 2007 (as amended) ("the 2007 Offshore Regulations") which serves the same function for the UK's offshore marine area. This AA is being made in respect of the Development Consent Order (DCO) and Deemed Marine Licence (DML) for the proposed Galloper Wind Farm and its associated infrastructure ("GWF"). For the purposes of Regulation 61 and 25, the Secretary of State is the competent authority.

1.2 On 21 November 2011, Galloper Wind Farm Ltd. ("the Applicant") submitted an application to the Infrastructure Planning Commission, the functions of which were transferred to the Planning Inspectorate ("PINS") on 1 April 2012, for consent under Section 37 of the Planning Act 2008 (as amended) for the construction and operation of a 504MW offshore wind farm, and its associated infrastructure, approximately 27km off the Suffolk coast. The GWF application is described in **Section 2**.

1.3 In England and Wales, offshore energy generating stations greater than 100MW constitute nationally significant infrastructure projects (NSIPs) and applications for consent are subject to the requirements of the Planning Act 2008 (as amended).

1.4 On 15 March 2012, the Chair of the IPC appointed a three-member Panel as the Examining Authority for the application (the "ExA"). The examination of the GWF application began on 29 May 2012 and was completed on 29 November 2012. The ExA submitted its report of the examination to the Secretary of State on 27 February 2013. The Secretary of State's conclusions on habitats and wild birds issues contained in this assessment have been informed by the ExA's report to him and further information and analysis, including a Report on the Implications for European Sites, as set out in paragraphs 1.13 and 1.21-1.23..

Appropriate Assessment

1.5 Council Directive 92/43/EC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and Council Directive 2009/147/EC on the conservation of wild birds (the Birds Directive) aim to ensure the long-term survival of certain species and habitats by protecting them from adverse effects of plans and projects.

1.6 The Habitats Directive provides for the designation of sites for the protection of habitats and species of European importance. These sites are called Special Areas of Conservation (SACs). The Birds Directive provides for the classification of sites for the protection of rare and vulnerable birds and for regularly occurring migratory species. These sites are called Special

Protection Areas (SPAs). SACs and SPAs are collectively termed “European sites” and form part of a network of protected sites across Europe. This network is called Natura 2000.

1.7 In the UK, the “the Habitats Regulations” transpose the Habitats and Birds Directives into national law as far as the 12 nautical mile (nm) limit of territorial waters. Beyond territorial waters, the 2007 Offshore Regulations serve the same function for the UK’s offshore marine area. The Convention on Wetlands of International Importance 1972 (the Ramsar Convention) provides for the listing of wetlands of international importance. These sites are called Ramsar sites. UK Government policy is to afford Ramsar sites the same protection as European sites and, for this reason these are treated as European sites in this assessment.

1.8 Regulation 61 of the Habitats Regulations provides that:

“*a competent authority, before deciding to... give consent, permission or other authorisation for... a project which is likely to have a significant effect on a European site [or Ramsar site]... (either alone or in combination with other plans or projects), and is not directly connected with or necessary to the management of that site, must make an appropriate assessment of the implications for that site in view of that site's conservation objectives*."

1.9 Comparable provisions are in place with regard to the 2007 Offshore Regulations. Under Regulation 25:

“…..*before deciding to give consent, permission or other authorisation for, a plan or project which is to be carried out on any part of the waters or on or in any part of the seabed or subsoil comprising an offshore marine area or on or in relation to an offshore marine installation and which is likely to have a significant effect on an European marine site (either alone or in combination) and which is not directly connected with or necessary to the management of the site, the competent authority must make an appropriate assessment of the implications for the site in view of the site’s conservation objectives.*”

1.10 This project (GWF) lies across the 12nm limit of territorial waters. It is not directly connected with, or necessary to, the management of a European site or a European marine site. However, it may have a likely significant effect on such sites and so an AA is required by Regulation 61 of the Habitats Regulations and by Regulation 25 of the 2007 Offshore Regulations.

1.11 As a consequence of its location, straddling English territorial and UK offshore waters, both Natural England (NE) and the Joint Nature Conservation Committee (JNCC) have advisory responsibilities as statutory nature conservation bodies (SNCBs) for GWF. The SNCBs co-ordinated and submitted joint responses throughout the examination, with NE largely taking the lead on this. For this reason, the views of the SNCBs are reported here as being advice from NE, although this can be taken to be representative of both organisations.

1.12 In considering the possible impacts of GWF and reaching his conclusions, the Secretary of State has also taken into account duties and obligations provided for under the Conservation of Habitats and Species (Amendment) Regulations 2012, SI 2012 No. 1927, which came into force on 16th August 2012 and amend the Habitats Regulations. In particular, new regulations 9(1) and 9A(1), (3) and (8) of the 2010 Regulations as inserted by regulation 8 of the 2012 Regulations are engaged when the Secretary of State exercises his functions in relation to granting consent for a new electricity generating station and applies Regulation 61(1). The key considerations in this context are securing compliance with the Habitats and Birds Directives;

preserving, maintaining and re-establishing a sufficient diversity and area of habitat for wild birds in the United Kingdom; and using all reasonable endeavours to avoid any pollution or deterioration of habitats of wild birds.

1.13 NE has noted the above amendments, particularly Regulation 9A, and in light of this, recommend that consideration be given to other non-SPA bird species. In this case, the relevant species are Arctic and Great Skua. NE advises that the above duty has been satisfied in relation to those species.

The RIES and statutory consultation

1.14 Under Regulation 61(3) of the Habitats Regulations, the competent authority must, for the purposes of an AA, consult the appropriate nature conservation body and have regard to any representation made by that body within such reasonable time as the authority specify.

1.15 The ExA, with support from PINS, prepared a "Report on the Implications for European Sites" ("RIES"), based on "working matricies" prepared by the Applicant. The RIES was published on PINS planning portal website on 5 November 2012, for a period of 21 days for the purposes of Regulation 61(3) consultation. At the time of publication, there were still a number of outstanding items and matters for clarification in the RIES and so the ExA issued a follow up Rule 17 request for further information. The RIES, written responses to it and to the Rule 17 request have been taken into account in this assessment. Written responses were received from the Applicant, NE and the RSPB.

1.16 The ExA reported back as follows:

"There was no final consensus on mitigation proposals that would result in concluding no adverse effects on the integrity of the Alde-Ore Estuary SPA and Ramsar. Consequently, the detailed proposition that we put forward … on mitigation has not been subject to consultation with the interested parties; nor has the Applicant considered it, although it is based on options and alternative mitigation drafting put for [SIC] by the Applicant and considered by NE."
[para. 5.131.]

Scope of this assessment

1.17 The ExA reports that all the parties that have commented on the RIES agree that the Secretary of State should make an AA of the implications for the Alde-Ore Estuary SPA/Ramsar site and it sees no reason to disagree with this advice. The evidence suggests that there will be a likely significant effect on Lesser Black-backed Gull (LBBG), a qualifying feature of this site, as a result of collisions with operational turbines. This is the only European site and feature for which the ExA recommends an AA. This is agreed by the Applicant and NE, but disputed by the RSPB which considers that there could be likely significant effects on two other sites and bird species. Other European sites considered by the ExA and in RIES, where it ruled out likely significant effects are:

- Alde-Ore and Butley Estuaries SAC;
- Flamborough Head and Bempton Cliffs SPA;
- Margate and Long Sands cSAC;

- Minsmere to Walberswick SPA and Ramsar;
- Minsmere to Walberswick Heaths and Marshes SAC;
- Orfordness to Shingle Street SAC;
- Outer Thames Estuary SPA; and
- Sandlings SPA.

1.18 In line with NPS EN-3, the RIES has considered potential impacts on the features of the Alde - Ore Estuary SPA and Ramsar sites as a result of collision risk, habitat loss, displacement and barrier effects (matrices 1 and 2). It concludes that the only likely significant effect is on LBBG as a result of collisions with operational turbines and therefore this is the only impact that will be addressed in this report.

Sufficiency of evidence

1.19 The Applicant and NE consider that sufficient information has been provided to inform the Secretary of State's AA. However, the RSPB has expressed concerns with the soundness of the evidence provided and considers that there is a need for further modelling and data gathering. The ExA supports the position agreed with the Applicant and NE and considers that sufficient information has been provided.

Structure of this Appropriate Assessment

1.20 This assessment contains a description of the proposed project **(Section 2**) and its location with respect to relevant European sites (**Section 3).** Context to the AA, including conservation objectives in respect of the Lesser Black Backed Gull (LBBG) feature of the Alde-Ore Estuary SPA / Ramsar, is contained in **Section 4,** as a risk of likely significant effect on this species could not be excluded. **Section 5** contains an assessment of potential impacts on this species as a result of the GWF alone. In combination effects with other relevant plans and projects is given in **Section 6.** Proposed mitigation measures are described in **Section 7** and overall conclusions on site integrity and the Secretary of State's reasoning behind these are presented in **Section 8**.

Background Information

1.21 This assessment should be read in conjunction with the following documents that provide extensive background information:

- Planning Act 2008 The Galloper Windfarm Order [201X] - Panel's Report to the Secretary of State, 27 February 2013 – termed "the ExA's report"
- Report on the Implications for European Sites (RIES): Galloper Wind Farm. An Examining Authority Report Prepared with the Support of the Planning Inspectorate Secretariat, November 2012. – termed "the RIES"
- Galloper Wind Farm Ltd (2012) Lesser Black Backed Gull Collision Risk Modelling Note, 20/09/2012 (REP3)

- Galloper Wind Farm Project Alde-Ore Estuary SPA Lesser Black-backed Gull Stochastic Population Viability Analysis. Doc 6.3.2, June 2012 (REP41)
- Galloper Wind Farm Project Environmental Statement, Chapter 5 Project Details. Document Reference 5.2.5. RWE, SSE and Royal Haskoning, November 2011.
- Galloper Wind Farm Project Environmental Statement, Chapter 11 Ornithology. Document Reference 5.2.11. RWE, SSE and Royal Haskoning, October 2011. - termed "the ES"
- Galloper Wind Farm Project Environmental Statement, Offshore Ornithology – Ornithological Technical Report 11.A in Technical Appendices 2 Document Reference 5.4.2. RWE, SSE and Royal Haskoning, October 2011
- Galloper Wind Farm Project – Habitats Regulations Assessment Report. Document Reference 6.3. RWE, SSE and Royal Haskoning, October 2011. – termed "the Applicant's HRA"

1.22 Further relevant information and correspondence was submitted during the examination period and has been considered by the Secretary of State. This includes, but is not limited to:

- Issue specific hearings on Biodiversity, Biological Environment and Ecology held on 18 and 19 October 2012;
- Statement of Common Ground between the Applicant, Natural England and JNCC (ornithology) October 2012
- Unilateral Undertaking Relating to land to the south of Sizewell Gap in the County of Suffolk, pursuant to Section 106 of the Town and Country Planning Act 1990 (as amended) Ref: SS19/JB13, Burges Salmon (REP 60, Annex D) - termed "the unilateral undertaking"
- Responses from Interested Parties to Rule 17 requests by the Panel; and
- Additional written representations from interested parties – see ExA's Report, Appendix C - List of submitted documents.

1.23 The key information in these documents and written representations is summarised and referenced in this assessment.

2 PROJECT DESCRIPTION

Key aspects of the project

2.1 The project will comprise two NSIPs that are contained in the DCO. The offshore works will involve the construction and operation of up to 140 turbines, with a maximum installed capacity of up to 504 MW. In addition, there will be up to:

- Two offshore substation platforms;
- Two collection / accommodation platforms;
- Three meteorological masts;
- Inter-array cabling; and
- Three 132kV export cables to shore.

2.2 The wind turbine array would be located in the North Sea, approximately 27km at its closest point from the Suffolk coast, lying partly within English Territorial Waters, but mostly within the Renewable Energy Zone. The array is proposed to comprise three distinct groups of turbines: development areas A, B and C, which are largely adjacent to and seaward of the existing Greater Gabbard Offshore Wind Farm. These three turbine development areas encompass approximately 183km^2.

2.3 The Outer Gabbard Bank (an open shelf linear tidal sand bank) is within the Development Area A cluster of turbines and the Applicant indicates that the bank would be kept largely clear of turbines, platforms and meteorological masts – Development Area A turbine exclusion area. During the course of the examination, the Applicant also suggested reducing the size of Development Area B by introducing another turbine exclusion area as project mitigation. This is discussed further in paragraph 5.19 and in **Section 7.**

2.4 Each turbine will have a rotor diameter of 107-164m. Typical rated capacities of current and future marketed turbines vary from 3.6MW – 7MW. Each turbine would be fixed to the seabed by foundations, which may be one of four types: monopile; space-frame (including jackets and tripods, both with piled and suction can options); gravity-based structures; and suction monopods.

2.5 The turbines would be connected to each other within and between arrays by buried subsea cables that would be connected to a maximum of four offshore platforms comprising electrical substations, collection platform(s) and/or an accommodation platform. Once the substations have transformed the voltage upwards, AC current would be transmitted to shore by up to three high voltage export cables that would run adjacent to those of Greater Gabbard Offshore Wind Farm, coming to shore to the south of Sizewell Power station - see **Figure 1**. for the offshore scheme layout.

2.6 The onshore works would include:

- a 132kV substation compound;

- a 13 kV/400kV transmission compound and screening landform; and
- underground onshore grid connection cabling.

2.7 The onshore transition bay(s) would be located in land to the south of Sizewell Gap with onshore cabling from there, crossing the existing Greater Gabbard cables, to the proposed GWF substation. Additional cabling would connect the transmission compound, the sealing end compounds, the existing Greater Gabbard cables and Leiston A substation.

2.8 The substation and transmission compounds encompass some 3.1ha of mostly arable land and would be located north of Sizewell Gap, to the west of the existing Greater Gabbard substation. It would be located approximately 1km inland, mostly within plantation woodland (Sizewell Wents) and partly on arable land and grazed pasture (Broom Covert).

2.9 A second NSIP comprises overhead 400kV electric lines connecting two sealing end compounds to the existing pylon infrastructure.

Table 1. Key offshore project characteristics

Key project characteristics	
Maximum capacity	504MW
Maximum number of wind turbines	140
Site area	Approximately 183km²
Minimum distance from to shore	Approximately 27km
Wind turbine maximum rated capacity	3.5-7MW
Maximum wind turbine rotor diameter	164m
Maximum wind turbine hub height	120m above Lowest Astronomical Tide (LAT)
Maximum wind turbine tip height	195m above LAT
Minimum clearance above sea level	22m above mean high water level (MHW)
Foundation type	Subject to final selection
Inter-array cables	Up to 300km
Export cables	Up to 3* 132kV cables
Cable outfall location	Land to the south of Sizewell power station

2.10 Fuller details of the infrastructure likely to be used in the project and construction methodologies are detailed in Chapter 5 of the ES, Project Details. An overview of the physical layout of the project can be gained from viewing the onshore and offshore Order limits plans.

Rochdale Envelope

2.11 The DCO is framed to allow for multiple design options in accordance with the Rochdale Envelope concept. This allows flexibility for different sizes of turbines and foundation types, as long as they lie within the limits of the authorised consenting (Rochdale) envelope. Prescriptive locations of individual turbines are not included in consents for offshore wind farms, as flexibility is required to ensure that the scheme can be delivered post-consent, once detailed ground investigations and design optimisation work has been undertaken, alongside the results of procurement tendering exercises.

2.12 The precise layout of the turbines within the application boundary will depend upon the size of the wind turbine selected and site-specific issues, which may require micro-siting of individual

turbines. Geotechnical site investigation surveys will be undertaken prior to construction to allow for the detailed design and installation planning.

2.13 The Applicant is, however, bound by the DCO application boundary, setting out areas within which the infrastructure can be located, together with various technical restrictions. Example specifications for turbine types that fit within the DCO Rochdale Envelope constraints for GWF are set out in **Table 2.**

Table 2. Example specifications for turbines

Turbine specification	Turbine A	Turbine B
Maximum project capacity / MW	504	504
Maximum rated capacity per turbine MW/	3.0-3.6	3.6-4.0
Maximum no. turbines	140	140
Max tip height below LAT/ m	133m	146m
Max hub height below LAT / m	79.5	86
Minimum clearance above mean high water springs (MHWS)/m	22	22
Rotor diameter "r"/m	107	120
Total project rotor swept area (πr^2*140)/ km^2	1.264	1.583

Source: the Applicant's ES, Chapter 5.

2.14 Were the Applicant to select a turbine type with a higher rated capacity than 3.6MW, then the number of turbines would need to decrease to below 140 to ensure that the project's total maximum generating capacity does not exceed the 504 MW threshold. For example, only 84 turbines of 6MW capacity would fit within the DCO capacity limits. If the Applicant selected a turbine with a rated capacity below 3.6 MW, then the total project output would fall to below 504MW, as no more than 140 turbines could be installed.

2.15 The implications of this are discussed further in **Section 7** with regard to project mitigation. Further details on Rochdale Envelope principles are set out in PINS Advice Note 9.

Indicative construction timescales

2.16 In its ES, the Applicant has provided typical timescales and phasing of activities to construct an offshore wind farm of the scale of GWF. These are shown in in **Table 3.** It should be noted that the actual construction programme could well vary from this, as it will be influenced by a variety of factors, such as logistics, procurement and contractual issues and adverse weather conditions.

2.17 **Table 3. Indicative timescales**

Activity	Duration	Commencement	Completion
Grid construction	30 months	Q2 2013	Q3 2015
Offshore foundations	18 months	Q2 2015	Q3 2016
Offshore cabling	27 months	Q2 2015	Q2 2017
Offshore topsides	27 months	Q2 2015	Q2 2017
Commissioning and Handover	12 months	Q2 2016	Q2 2017

2.18 The Applicant proposes that the installation of the offshore elements would avoid the winter months due to the potential for adverse weather conditions and associated risks offshore. The ES indicates that the main offshore construction season is likely to be from March to November and it is expected to be carried out on a 24-hour working basis. The Applicant's HRA highlights that the offshore construction phase of the wind farm would take approximately three years, and suggests that, although a 56 month construction window is assessed in the ES, this is to ensure that the most likely construction strategies and timescales fall within the scope of their assessment.

2.19 The construction of the onshore substation and associated onshore works are expected to take up to two years.

Operation and maintenance

2.20 During its operation, the wind farm will be serviced and maintained from a local port which will be the subject of commercial discussions. A safety zone will be applied for separately from the DCO and be subject to separate consideration. The operational life of GWF is estimated to be 25 years and there is a requirement to either decommission or repower after this period. The Applicant indicates that it intends to enter into a 50-year lease with The Crown Estate prior to construction.

Decommissioning / Repowering

2.21 The project falls within the scope of the Energy Act 2004 which includes decommissioning provisions. Broadly speaking, the Secretary of State shall require a person who is responsible for an offshore renewable energy installation to prepare a costed decommissioning programme and ensure that it is carried out. The Secretary of State can approve, modify or reject a decommissioning programme at any point.

2.22 Decommissioning activities will need to comply with all relevant UK legislation at the time. The person(s) responsible for the wind farm will produce and agree a decommissioning programme with DECC and in consultation with the Marine Management Organisation (MMO), JNCC, NE, or their respective successors.

2.23 Decommissioning will take place at the end of the GWF lifetime and will involve the removal of all accessible installed components of the wind turbine including parts of the wind turbine foundation structures (those above seabed level) and the sections of the inter-array cables close to the offshore structures, as well as sections of the export cable(s). The decision on repowering would be taken on commercial grounds, based on the performance of the wind farm and would be subject to a future consents application and a fresh assessment under the Habitats Regulations / 2007 Offshore Regulations by the relevant authorities at that time. Accordingly, decommissioning and repowering impacts are not addressed here.

3 PROJECT LOCATION AND EUROPEAN SITES

Location

3.1 The project is proposed to be located in the Southern North Sea, approximately 27km off the Suffolk coast. It straddles the 12nm limit of English Territorial Waters, with the bulk of GWF lying in the Renewable Energy Zone. GWF would be situated adjacent to and mostly seaward of the existing Greater Gabbard Offshore Wind Farm, with the site boundaries adjoining all three proposed turbine development areas (A, B and C). See **Figure 1** for the offshore site boundaries for GWF.

European sites

3.2 The Applicant scoped in all European sites within 2km of the onshore components of the scheme and all sites with marine and coastal features within 30km of the offshore works. The identification of relevant European sites with ornithological features was informed by the foraging ranges and connectivity of the qualifying bird species. This is particularly significant given the large foraging range of many seabirds, such as gannets. The closest European sites are the Outer Thames Estuary SPA, which the export cable corridor route passes through and Sandlings SPA, which is within 300m of the onshore substation.

3.3 Seven other European sites were scoped into the Applicant's HRA. These are: the Alde-Ore Estuary SPA/Ramsar, Minsmere to Walberswick SPA/Ramsar; Minsmere to Walberswick Heaths and Marshes SAC; Flamborough Head and Bempton Cliffs SPA; Orfordness and Shingle Street SAC and Margate and Long Sands candidate (c)SAC.

3.4 A summary of the qualifying features of each of these European sites and distance from the project (wind farm array, onshore substation and export cable) is presented in **Table 4.** The location of these European/Ramsar sites are shown in **Figure 2**.

Alde-Ore Estuary SPA / Ramsar

3.5 As noted in paragraphs 1.17 - 1.18, the evidence suggests that there will be a likely significant effect on LBBG, a qualifying feature the Alde-Ore Estuary SPA/Ramsar, as a result of collisions with operational turbines. The ExA and NE consider that an AA is required and the Secretary of State agrees with this recommendation.

Flamborough Head and Bempton Cliffs SPA

3.6 NE initially raised concerns about the potential impact on the ornithological protected interest features of the Flamborough Head and Bempton Cliffs SPA and the Outer Thames Estuary SPA. However, these were subsequently withdrawn, following further information and modelling undertaken during the examination. A population viability analysis (PVA) for the Flamborough Head and Bempton Cliffs SPA was undertaken by the Wildfowl and Wetlands Trust Consultancy in 2012 suggesting an additional mortality of up to 113 gannets per annum as a result of the project alone. NE considers that this would not pose a risk of population decline,

especially given the greater than average growth rate of this gannet colony. A more simplistic Potential Biological Removal (PBR) model was used to estimate population-level effects, based on in combination collisions of between 242 and 351 gannets per annum, calculated using a precautionary 98% avoidance rate. Using standard gannet demographic parameters, NE estimates that these collision levels would appear to be sustainable at all but the most precautionary values of the recovery factor. NE therefore advises that, on balance, and based on the assessments presented, a likely significant effect can be excluded on the Flamborough Head and Bempton Cliffs SPA, both from GWF alone and in combination with other plans and projects.

Outer Thames Estuary SPA

3.7 At the HRA hearing, NE advised that there would not be a likely significant effect on red-throated divers as a result of in combination displacement effects. It drew this conclusion on the basis of figures provided by Vattenfall Wind Power in support of its HRA addendum report for Kentish Flats Extension (Vattenfall 2012). Using these figures, NE recalculated the level of density-dependent mortality as a result of the 89 divers estimated to be displaced by GWF. This indicated that the strength of density dependence would need to be as strong or stronger than the most extreme values for immigration into the SPA to result due to displaced birds from GWF. [GWF lies outside the outer Thames Estuary SPA]. NE was, therefore able to advise that an AA is not required in respect of the Outer Thames Estuary.

The RSPB's views

3.8 The RSPB made representations during the examination indicating its view that the Applicant's modelling was insufficiently precautionary. It considers that there is insufficient evidence to rule out likely significant effects on Flamborough Head and Bempton Cliffs SPA as a result of collision risk to gannets. It also expressed concerns about the adequacy and analysis of data associated with potential cumulative disturbance and collision risk to red-throated diver, a qualifying feature of the Outer Thames Estuary SPA. The RSPB also suggested that an expert review be undertaken of the proportion of birds at risk of collision, prior to an AA. This view was not accepted by the ExA.

Conclusions on scope of the AA

3.9 The Secretary of State has considered the available evidence, the views of the ExA and the advice from NE. He appreciates the uncertainly associated with predicting the likely behaviour of highly mobile seabird species, especially their population-level responses to changing environments. However, he considers that a suitably precautionary approach has been taken in the modelling of collision risk, displacement and in determining likely population level effects. He agrees with the advice of NE and the ExA's recommendation and considers that there will not be a likely significant effect on The Outer Thames Estuary SPA, nor on the Flamborough Head and Bempton Cliffs SPA. He considers that potential risks to Flamborough Head and Bempton Cliffs and the Outer Thames Estuary SPAs have been satisfactorily ruled out by the

results of the population modelling. Therefore, this assessment focusses solely on potential threats to the integrity of the Alde-Ore Estuary SPA/Ramsar as a result of collision risk to LBBGs only.

Other offshore wind farms

3.10 Apart from Greater Gabbard, the potential closest offshore wind farm to GWF is the proposed East Anglia ONE site, which lies to the north west of GWF. A development consent application has been submitted to and accepted by PINS and is currently undergoing its examination. A number of other wind farms are located in or are proposed to be located south of GWF in vicinity of the Outer Thames Estuary. These include: London Array (Phase 1 and 2); Kentish Flats and its extension; Thanet; and Gunfleet Sands (I, II and III). See **Figure 3** for a map of the nearest offshore wind farm sites, both current and planned.

3.11 In combination impacts with other wind farms are considered in **Section 6**. Given the extensive foraging range of the species, some 23 offshore wind farms have been included in combination with GWF, including a number located in Belgium and the Netherlands.

Other offshore activities

3.12 Other offshore activities in the area include commercial fisheries, shipping and navigation and dredging for aggregates.

Commercial fisheries

3.13 Beam trawling for plaice and sole by numerous foreign fleets takes place in and around the GWF site and export cable corridor, as well as drift netting along offshore banks for bass by UK vessels. The inshore areas of the cable corridor are used by passive gear, such as drift nets, which target sole and bass, along with some localised potting for shellfish close to the export cable landfall.

Shipping and navigation

3.14 The main navigational features in the vicinity of the GWF site are the Sunk Traffic Separation Schemes to the west of the GWF site and the port operations at Harwich Haven Authority and Port of London Authority. The Applicant's surveys indicate that an average of 12 vessels per day pass through GWF, these include cargo vessels, tankers and fishing vessels. The main destinations of the vessels recorded were Harwich Haven, the Netherlands and ports in the Thames and Medway.

Aggregates extraction

3.15 There are numerous aggregate extraction areas within the vicinity of GWF, including an application / prospecting area from Cemex UK Marine Ltd. that overlaps with the export cable route. As a result of consultation with aggregate extraction companies, the export cable corridor has been altered in anticipation of any future extraction activity at the site on the northern boundary of the GWF export cable corridor (Area 498). The Applicant reports in its ES that it is

in discussions with Cemex Marine UK Ltd and The Crown Estate with regard to the proposed aggregate extraction area which is situated inside the cable corridor.

Marine Environment

3.16 The seabed within the study area is dominated by sand and gravel substrates, with the Outer Gabbard sandbank lying across the northern half of the GWF site. The GWF site supports a number of fish species of commercial importance that use the Outer Thames Estuary for spawning and as nursery grounds. Nine species of commercial importance are known to use spawning and nursery grounds that overlap or are in close proximity to the study area or, are sensitive to wind farm impacts. The southern North Sea is an important area for seabirds. The shallow seas of the Outer Thames Estuary and along the east coast of the UK attract a mixture of 'true seabirds' (for example: gannet, gulls and auk species), species that spend part of their life cycle at sea (for example, divers and seaducks) and a wide range of species on seasonal migration, both to and from the UK and Continental Europe. The offshore ornithological assemblage within and adjacent to the GWF site suggests that the site is used at different times by seabirds overwintering in the area; foraging from nearby breeding coastal colonies; and on migration.

Terrestrial Environment

3.17 Approximately 4ha of arable land, 2ha of woodland and 0.7ha of pasture grassland will be lost as a result of the onshore developments. Three bat roosts have been identified within Sizewell Wents that could be lost as a result of the proposed works. A European Protected Species licence will be required ahead of any works, detailing mitigation measures to ensure that bats are not harmed during construction.

3.18 The woodland edge and hedgerows are reported to support good populations of reptiles. A reptile mitigation strategy is included in the DCO. The Applicant's ES indicates that badgers, otters, breeding birds and invertebrates are either known to use, or have the potential to be found within, the onshore development footprint.

Figure 1. Offshore scheme layout

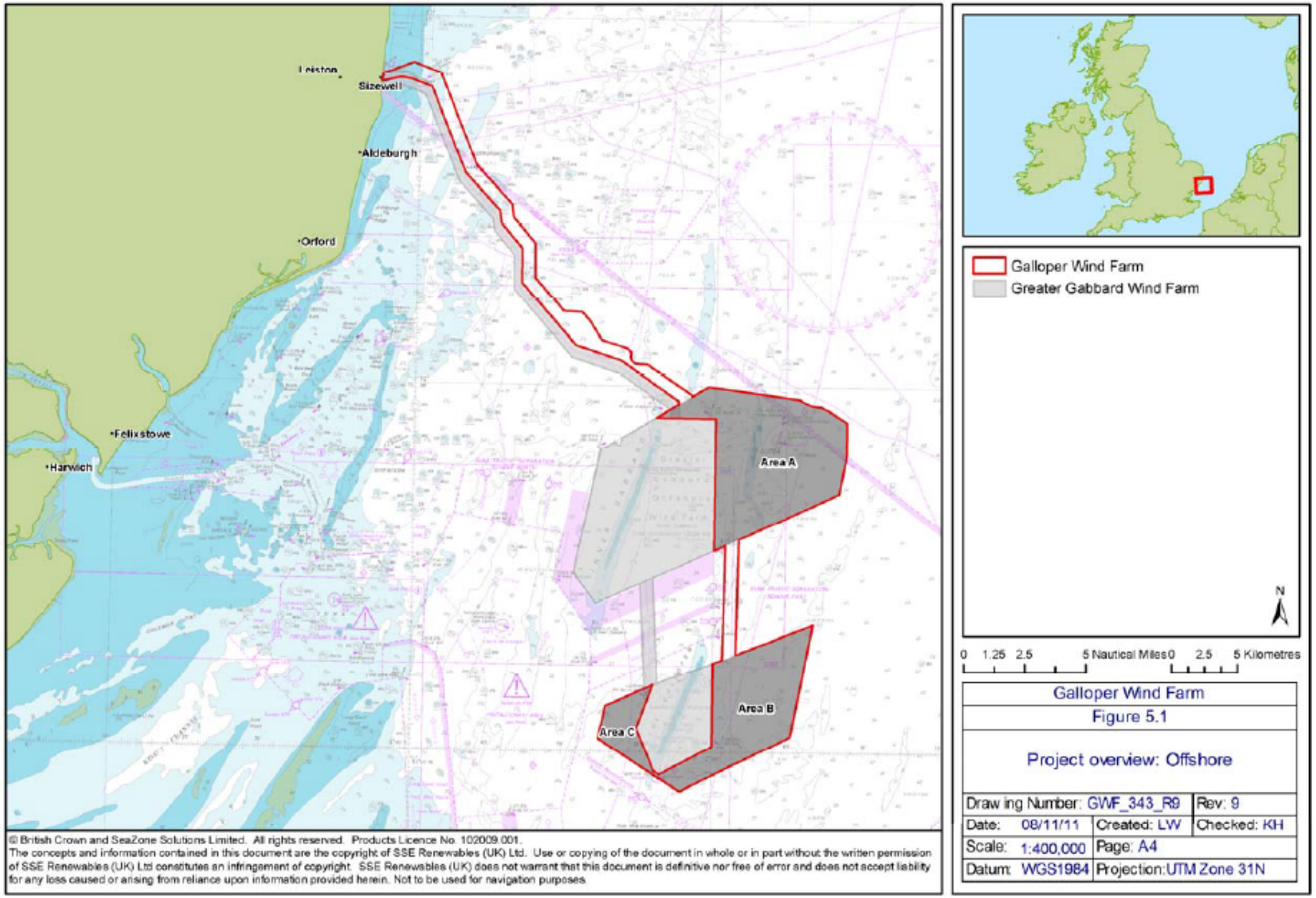


Table 4. European and Ramsar sites

Designated site and area	Site qualifying features	Distance / km to:		
		windfarm	Onshore substation	Other
Alde Ore Estuary SPA, Ramsar and European Marine site Area = 2417ha (SPA) and 2,544ha (Ramsar)	***Annex I (breeding*)**: avocet; little tern; marsh harrier; sandwich tern. ***Annex I (wintering:*** avocet ***Annex II (breeding***): lesser black backed gull ***Annex II (wintering***): redshank *Seabird assemblage – used regularly by over 20,000 seabirds* *Wintering wildfowl assemblage - used regularly by over 20,000 wildfowl*	28	5	n/a
The Sandlings SPA Area = 3,392ha	***Annex I (breeding*)**: nightjar; woodlark ***Key supporting habitats:*** woodland; and heath with support acid grassland and heather dominated plant communities. Comprises six component SSSIs.	32.5	0.3	n/a
Minsere to Walberswick SPA and Ramsar Area=2,019ha (SPA) and 2,009 (Ramsar)	***Annex I (breeding***): avocet; bittern; little tern; marsh harrier; nightjar ***Annex I (wintering:*** hen harrier ***Annex II (breeding***): shoveler; gadwall; teal ***Annex II (wintering***): shoveler; gadwall; white fronted goose	35.5	2	n/a
Outer Thames Estuary SPA Area = 379,772ha	***Annex I (wintering):*** red-throated diver	8	n/a	export cable corridor
Flamborough Head and Bempton Cliffs SPA Area = 212ha	Regularly supports over 305,784 seabirds. Included in this assessment only due to presence of gannet that are known to forage in excess of 300 km from the breeding colony	Over 250km	n/a	n/a
Margate and Long Sands cSAC Area = 64,915ha	***Annex I Habitat:*** Sandbanks slightly covered by seawater at all times; biogenic reef	16	n/a	n/a
Orfordness Shingle Street SAC Area = 901ha	***Annex I Habitat***: annual vegetation of drift lines; perennial vegetation of stony banks and lagoons	28	7	n/a
Minsere to Walberswick Heaths and Marshes SAC Area = 1266ha	***Annex I Habitat***: annual vegetation of drift lines and European dry heaths; perennial vegetation of stony banks; coastal lagoons ***Annex II species*** Great-crested newt.	35.5	2	n/a

Source: the Applicant's HRA

Figure 2. European and Ramsar sites

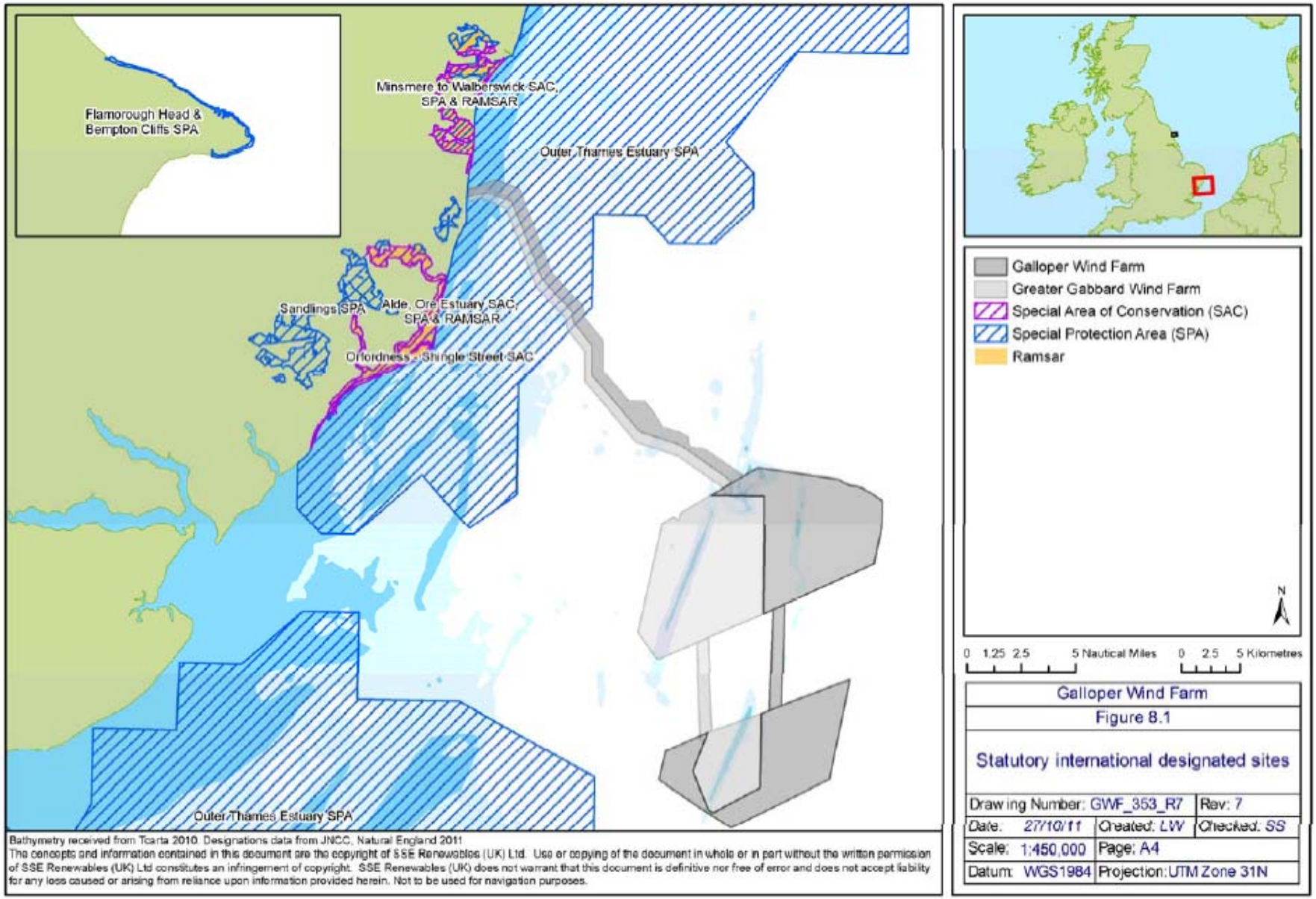
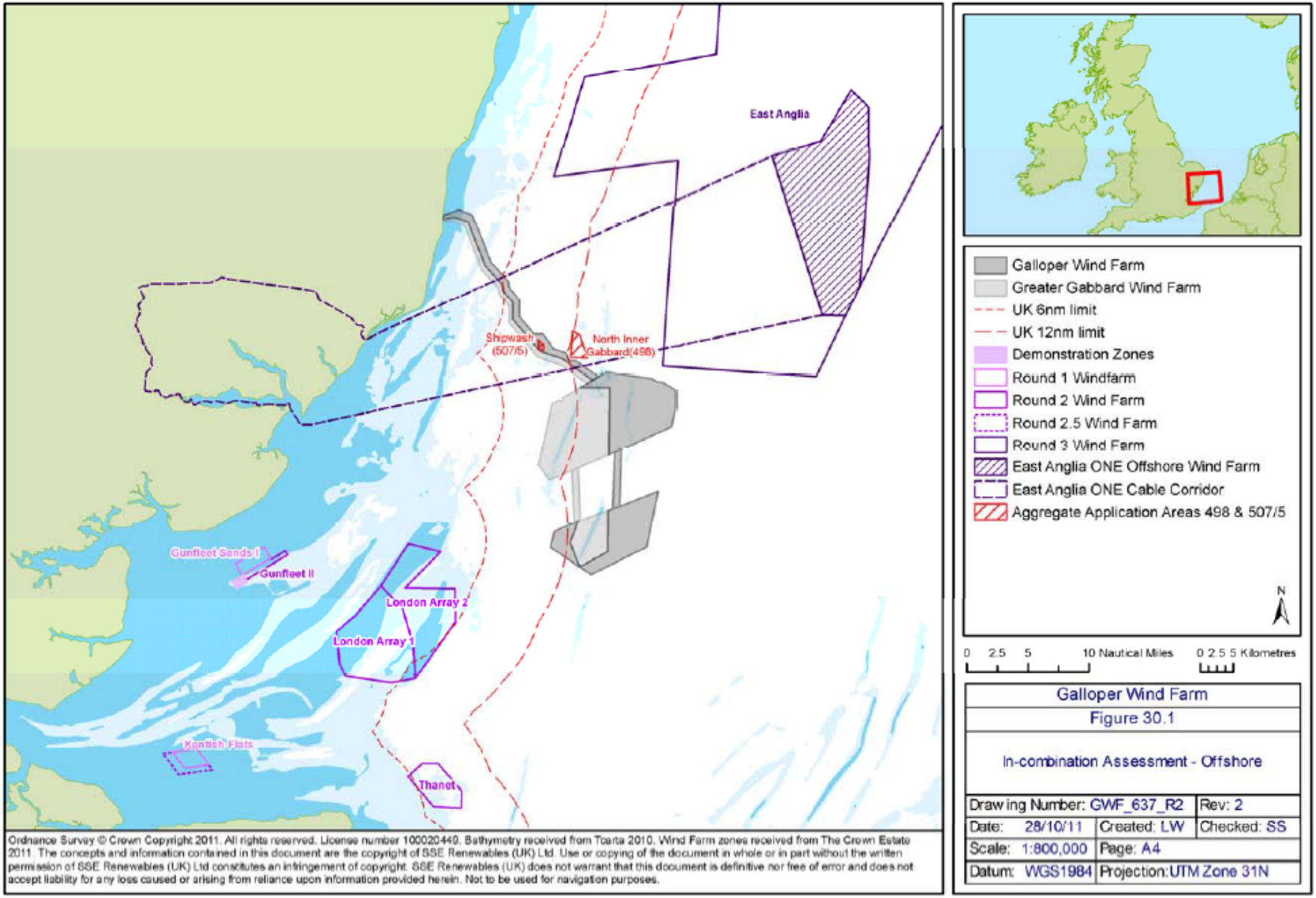


Figure 3. Nearest offshore wind farms and aggregates extraction



4 APPROPRIATE ASSESSMENT

4.1 An AA is triggered when the competent authority, in this case the Secretary of State, determines that a plan or project may result in a likely significant effect on a European site. Guidance issued by the European Commission (EC) states that the purpose of an AA is to determine whether adverse effects on the integrity of the site can be ruled out as a result of the plan or project, either alone or in combination with other plans and projects, in view of the site's conservation objectives (EC, 2000).

4.2 The purpose of this assessment, therefore, is to **determine whether adverse effects on the integrity of the Alde-Ore Estuary SPA/Ramsar site ("the site"), can be ruled out as a result of GWF alone or in combination with other plans and projects – taken to be other offshore wind farms – in view of the site's conservation objectives.**

4.3 If the competent authority cannot ascertain the absence of an adverse effect on site integrity within reasonable scientific doubt, then under Regulation 49 of the Habitats Directive, alternative solutions should be sought. In the absence of an acceptable alternative, the project can proceed only if there are imperative reasons of overriding public interest (IROPI) and suitable compensatory measures are secured. These IROPI issues are beyond the scope of this AA.

The Alde-Ore Estuary SPA/Ramsar site

4.4 The Alde-Ore Estuary SPA/Ramsar site covers 2,417ha and is located on and around the Suffolk coast, being some 26.9km from the application site at its closes point. It comprises an estuarine complex of the rivers Alde, Butley and Ore. The Alde-Ore Estuary was also listed as a Ramsar site in October 1996 for its internationally important wetland assemblage. The SPA citation was published in January 1996 and the site was was classified by the UK Government as an SPA under the provisions of the Birds Directive in August 1998. The site also includes the Alde-Ore Estuary SSSI, which was notified in 1952, with the SSSI boundary being coincident with that of the SPA and Ramsar sites. The shingle and saline lagoon habitats of the SSSI comprise the Orfordness to Shingle Street SAC, while its estuary habitats comprise the Alde, Ore and Butley Estuaries SAC. The SPA/Ramsar site also forms part of the Alde-Ore and Butley European Marine Site. See **Figure 2** for a map of the site boundaries.

4.5 There are a variety of habitats within the site, including intertidal mud-flats, saltmarsh, vegetated shingle (including the second-largest and best-preserved area in Britain at Orfordness), saline lagoons and semi-intensified grazing marsh. The Orfordness/Shingle Street land form is geomorphologically unique within the UK in combining a shingle spit with a cuspate foreland. The diversity of wetland habitat types present is of particular significance to the birds occurring on the site, as these provide a range of opportunities for feeding, roosting and nesting within the site complex. At different times of the year, the site supports notable assemblages of wetland birds including seabirds, wildfowl and waders. As well as being an important wintering

area for waterbirds, the Alde-Ore Estuary provides important breeding habitat for several species of seabird, wader and birds of prey. The Suffolk Wildlife Trust, the National Trust and the RSPB have nature reserves within the SPA/Ramsar.

4.6 JNCC's SPA site description (as published in 2001) indicates that the Alde-Ore Estuary qualifies as an SPA under Article 4.1 of the Wild Birds Directive (79/409/EEC) by regularly supporting populations of the following Annex I species of European importance: Avocet *Recurvirostra avosetta* (both breeding and wintering); breeding populations of Little Tern *Sterna albifrons*; Marsh Harrier *Circus aeruginosus*; and Sandwich Tern *Sterna sandvicensis*.

4.7 The site also qualifies under Article 4.2 of the Directive by supporting two Annex II species - a breeding population of LBBG *Larus fuscus* and a wintering population of Redshank *Tringus totanus*.

4.8 Following the UK SPA review (Stroud *et al*. 2001), additional Article 4.2 qualifying features were identified as needing protection:

- a breeding seabird assemblage of international importance (at least 20,000 seabirds) and
- a wintering waterbird assemblage of international importance (at least 20,000 waterbirds).

4.9 During the breeding season, the area regularly supports 59,118 individual seabirds including: Herring Gull *Larus argentatus*; Black-headed Gull *Larus ridibundus*; LBBG *Larus fuscus*; Little Tern *Sterna albifrons*; and Sandwich Tern *Sterna sandvicensis*.

4.10 NE considers, and the ExA agrees, that LBBGs are the only feature of the site where there may be a likely significant effect, as LBBGs are known to fly at a height that places them at risk of collisions with operational turbines (Cook *et al*. 2012) and are present in the GWF footprint. All other potential impacts have been screened out, as not likely to be significant. This is as set out in paragraphs 1.17- 1.18, paragraphs 3.5-3.9 and in the RIES.

Conservation Objectives

4.11 EC guidance indicates that disturbance to a species or deterioration of a European site must be considered in relation to the integrity of that site and its conservation objectives (EC, 2000). Section 4.6.3 defines site integrity as:

"…the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified."

4.12 Conservation objectives outline the desired state for any European site, in terms of the interest features for which they have been designated. If these interest features are being managed in a way which maintains their nature conservation value, they are assessed as being in a 'favourable condition'. An adverse effect on integrity is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of its designation (English Nature, 1997).

4.13 There are no set thresholds at which impacts on site integrity are considered to be adverse. This is a matter for interpretation on a site-by-site basis, depending on the designated feature and nature, scale and significance of the impact.

4.14 The conservation objectives of the site are as set out in **Table 5** and include restoring the LBBG population to 14,074 pairs, subject to natural change.

Table 5. Conservation Objectives for LBBG at the Alde-Ore Estuary SPA

Conservation Objectives	Avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Birds Directive. Subject to natural change, to maintain or restore [for each qualifying feature]: ➢ The extent and distribution of the habitats of the qualifying features; ➢ The structure and function of the habitats of the qualifying features; ➢ The supporting processes on which the habitats of the qualifying ➢ features rely; ➢ The populations of the qualifying features; and ➢ The distribution of the qualifying features within the site.
Target	The site qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex II of the Directive: Lesser Black-backed Gull *Larus Fuscus (Breeding)* 14,074 pairs (4 year mean peak (1994-1997).

Source: European Site Conservation Objectives for the Alde-Ore Estuary SPA, as set by NE

4.15 As a result of NE's Integrated Site Assessment of the Alde-Ore Estuary SPA and SSSI, the conservation status of the LBBG was considered to be "*unfavourable declining"*. The population target for the LBBG feature was reduced from 21,700 pairs (1998 count) to 14,074 pairs, or 12% of the biogeographic population. This amendment was approved by NE's Chief Scientist in February 2012 and was derived through a standard procedure of the 4-5 year mean at time of site classification. NE advise that it is against this revised population target and in light of the "unfavourable declining" conservation status of LBBG that the impacts of the proposed development should be assessed.

The "Alde-Ore Estuary - securing a future for wildlife" project

4.16 The RSPB, the National Trust and other partners are engaged in ongoing management to improve conditions within the SPA for its designated features. Funding under the EU LIFE+ Nature biodiversity stream has enabled a partnership project (*Alde-Ore Estuary - securing a future for wildlife*) to enhance the conditions for a number of the Annex I SPA species and habitats. This funding is for the period 2010-2014 and builds in part on the success of two previous LIFE programme projects.

4.17 The LIFE+ project's overall aims include: improving the marshland habitat for Annex I bird species; creating new coastal lagoons; and protecting rare shingle habitat. The LIFE+ proposals have not been initiated to expressly benefit LBBG (an Annex II species), but

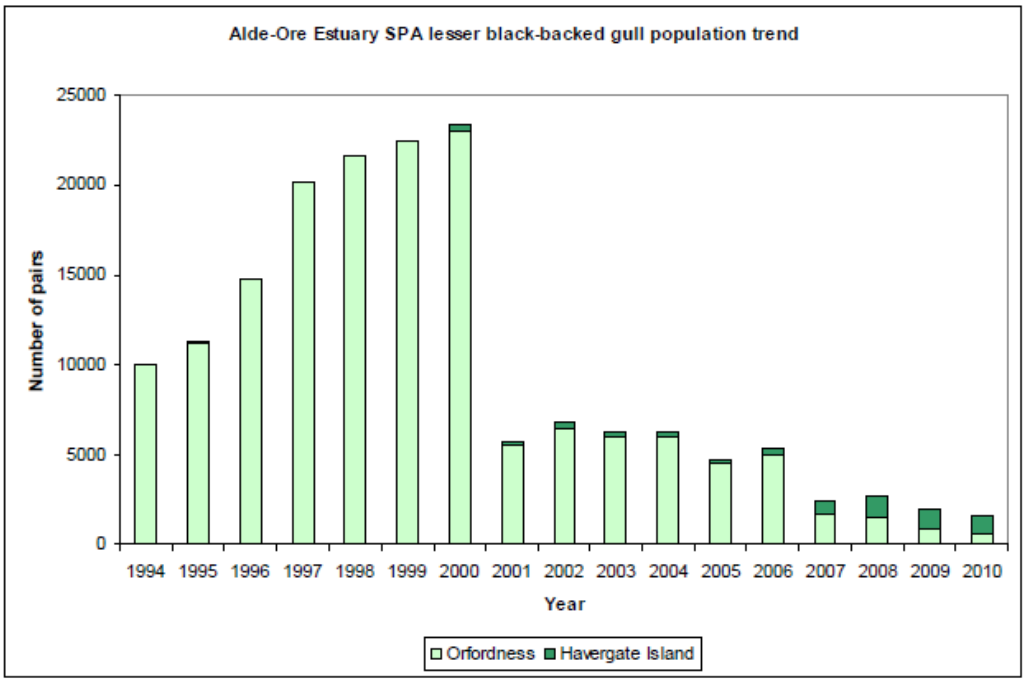
measures, such as the 2011 predator control programmes on Havergate Island and Orfordness, plus clearance of some areas of vegetation, are considered to benefit the species.

Population growth and decline at the Alde-Ore Estuary SPA

4.18 The fluctuations and trends in the background population levels of LBBG breeding at the SPA are significant when trying to predict the likely impact of additional mortality as a result of GWF. This is because the background population is not static, but has been subject to massive growth, followed by rapid decline. As well as site-specific factors relating to the breeding colony, there have also been UK-wide changes to the population in response to environmental factors, such as food availability. This situation is summarised in the following paragraphs, as it sets the context to this assessment and assists in interpreting the likely impacts of GWF.

4.19 The first pairs of LBBG became established at the Orfordness site in the Alde-Ore SPA in the mid-1960s. By 1986, the colony had grown to 5,000 pairs, increasing rapidly to 19,700 pairs by 1997. The population continued to increase, with a population of 21,700 pairs described in the Alde-Ore Estuary SPA site account in the UK SPA Review (Stroud *et al*. 2001). The population peaked at nearly 25,000 breeding pairs in 2000, followed by a severe decline the following year from which the population has never recovered. The population levels appear to have stabilised in recent years, but only at levels of around, or just under, 2,000 pairs - a much lower level than when the site was designated. A chart showing the LBBG population levels at the Alde-Ore Estuary SPA between 1994 and 2010 is given in **Figure 4.** The current (2012) population comprises some 1,811 breeding pairs (Piotrowski 2012).

Figure 4. **LBBG population levels at the Alde-Ore Estuary SPA (1994-2010)**.



Source: the Applicant's HRA

4.20 The SPA comprises two nesting colonies. Since 2009, the majority of birds have nested on Havergate Island (RSPB reserve), with the remainder on Orfordness Lantern Marshes (National Trust reserve). This has not always been the case: previously Orfordness supported the majority of the SPA population and it is here where dramatic population changes have been experienced, whilst the Havergate Island colony has increased since the RSPB ceased controlling the population.

4.21 The reasons for the Orfordness decline are not fully understood, but have been attributed by various parties to: fox predation (affecting chicks and, to a lesser extent, adult birds); disturbance of nest sites at the southern end of Orfordness by dog walkers, boaters and anglers; a reduction in available food; and a decline in nesting habitat quality. The loss of pigs from free-range pig units following an outbreak of swine fever in 2000 has been highlighted as an important factor in reducing inland feeding opportunities. The RSPB highlight the impact of botulism in the colony and a trend towards emigration to urban and industrial rooftop sites for nesting.

4.22 A recent study of gull colonies in Suffolk and South Norfolk highlights the increasing importance of such roof-top nesting sites for gulls, alongside steps being taken by local businesses to discourage them from these sites (Pietrowski, 2012). An increase in gulls nesting on warehouse roofs, silos and sheds at the port of Felixtowe was reported and monitored by Rock (2007), until falconers were employed to deter nesting birds. This general pattern illustrates the transitory nature of the choice of LBBG nest sites, with unfavourable nesting sites being deserted in favour of perceived “better” opportunities elsewhere.

4.23 In addition to predation/disturbance and issues related to the Orfordness nesting site, decreases in the population may also partly reflect a nationwide decline in LBBG numbers over the last ten years, due to a reduced availability of food from fishery discards and landfill sites.

Recent population levels

4.24 As stated in paragraph 4.18, breeding LBBG numbers appear to have stabilised at Orfordness in recent years, albeit at a much lower level than in the 1990s. The 2012 SPA population numbered some 1,811 pairs, of which just over a third (640 pairs) bred at the NT Orfordness reserve. See **Table 6** for a breakdown of breeding pairs over the period 2009-2012.

Table 6. Size of LBBG colonies over the past four years (as breeding pairs)

Site/year	2009	2010	2011	2012
Orfordness (NT)	900	550	550	640
Havergate Island (RSPB)	1,074	1,053	1030	1,171
SPA total	**1,974**	**1,603**	**1,580**	**1,811**

Source: Piotrowski (2012 figures), JNCC Monitoring Programme Database (2010 figures) cited in the Applicant’s HRA, as verified by Mike Marsh, Ringing Secretary, Landguard Ringing Group.

LBBG Conservation Status, Distribution and Vulnerabilities

Conservation status

4.25 The UK is home to an estimated 112,000 breeding pairs of LBBG equating to around 30-40% of the European population. It is one of 126 species listed as *Amber* in the UK's Birds of Conservation Concern 3 (Eaton *et a*l. 2009). The species qualifies to be on the UK Amber List because its breeding population is highly localised, with 70-80% of breeding birds found at fewer than ten sites and because it meets the criteria of at least 20% of the European breeding population being found in the UK. The biggest UK colony is on Walney Island, Cumbria, which holds one third of the UK population. The Alde-Ore Estuary is the only SPA for LBBG on the east coast of England. At the time of designation, it held 12% of the biogeographic population. Based on the most recent (2012) population estimate, it holds 1.62% of the UK population.

4.26 The LBBG is identified as a conservation priority in the Birds Directive as a migratory species.

4.27 The International Union for Conservation of Nature *(*IUCN, 2012) evaluates LBBGs as being a species of "*Least Concern*" on an international basis. This is on the basis that it has a very large range; that it does not approach the thresholds for Vulnerable under the range size criterion; and that the population trend appears to be increasing.

Distribution

4.28 The LBBG is divided into three different subspecies that differ in the darkness of the back. Only one of the subspecies *(L. f. graellsii*) breeds in Britain and Ireland. It is the palest of the forms, with its back being much lighter than the black wingtips. The European population of LBBG has been estimated at between 300,000 and 350,000 pairs (Birdlife International 2004), including all sub-species. The *L. f. graellsii* population amounts to approximately 176,705-187,740 pairs (Wetland International 2006).

4.29 LBBGs have a breeding range that extends from Iceland east to the Taimyr Peninsula and south to Portugal. The range of the *L. f. graellsii* that breed in Britain and Ireland also includes Iceland, France and north-west Spain. The species is widespread throughout Britain and Ireland, with East Anglia, the west coast of England and Wales, and southern Scotland recorded as holding the majority of the coastal breeding population during the Seabird 2000 monitoring programme from 1998 to 2002 (Mitchell et al. 2004).

4.30 LBBGs are typically regarded as a highly migratory species, with British breeding birds moving south along the west coasts of Europe to coastal France, Iberia and further. However, more recently, it is reported that many birds have become less migratory in nature and can now be found within much of their breeding range throughout the year, with sightings of birds at sea around Britain and Ireland in all months of the year (Lack, 1986; Stone et al. 1995, Rock, 2002, Mitchell et al. 2004). According to Cramp and Simmons (2004) winter recoveries of British LBBGs suggests that up to 80% spend the entire winter in Britain. Lack (1986) reports that wintering birds occur mainly in the southern half of Britain, with highest concentrations in the

Midland and Greater London areas. This pattern is supported by more recent gull-ringing evidence and radio-tagging studies (Thaxter *et al*. 2011 and 2012a). The latter also show that some LBBGs pass through both London Array and Gunfleet Sands windfarm sites on migration.

4.31 According to Rock (2002), gulls breeding in the Netherlands and in Germany occur in Britain in large numbers, especially in autumn and in winter. During the non-breeding season, the extent of migration varies between and within populations. LBBGs tracked from colonies in the Netherlands (sub-species *L. fuscus graellsii* and *L. fuscus intermedius*) are known to migrate initially to the UK immediately after breeding, before travelling further south to overwinter on the coasts of the Iberian Peninsula and north-west Africa (Ens et al. 2008). This pattern is well-documented for other populations of the same sub-species from ringing data (Wernham *et al*. 2002). However, *L. fuscus graellsii* breeding in the UK may differ in their migratory strategy to those on the continent, and to members of the *L. fuscus intermedius* sub-species, which overlap with *L. fuscus graellsii* in their breeding range.

4.32 It is, therefore, reasonable to assume that a sizeable proportion of the birds present at the GWF and SPA sites in winter are from other breeding colonies. The effective period of conflict with offshore windfarms in the Netherlands was determined by Camphuyson (2011) to be a period of six months (March – August, inclusive).The implications of this for the assessment of impacts on LBBG at the Alde-Ore Estuary SPA as a result of the project are discussed further in sections of this report dealing with in combination impacts (**section 6);** periods of breeding activity (paragraphs 5.12 - 5.13); and the likely provenance of birds at the GWF site (paragraphs 5.14 - 5.16).

National population trends

4.33 In the UK, the breeding population has been estimated at 112,074 pairs in the summer (Mitchell et al. 2004), with the winter population between 118,000 and 131,000 individuals (Baker et al. 2006). JNCC estimates the UK breeding population to be some 112,000 pairs or Apparently Occupied Nests (AONs), representing 62.6% of the biogeographic population of the *L. f. graellsii* sub-species and 30-40% of the European breeding population (Eaton *et al*. 2009).

4.34 The LBBGs in north and west Europe increased in numbers throughout their range during much of the 20th Century. In Britain, both numbers and range of the species increased from the 1960s – 1990s, as a result of an increased availability of food from fishing vessel discards (Furness et al. 1992) and from landfills (Lack, 1986). The coastal population of Britain and Ireland increased from around 50,000 pairs (1969-70) to 64,000 pairs (1985-88). This trend continued in 2000, where 91,323 pairs were counted (Mitchell et al. 2004).

4.35 However, since the late 1990s to early 2000s, populations in parts of England and Wales,have shown some declines (Mavor et al. 2006), possibly due to reversals in availability of discards and landfill sites. Decline in adult survival seems to have been a major factor over this period, as witnessed at the major colony on Skomer from 1993-2002 for example (JNCC, 2011). A decline of 32% between 2000 and 2011 has been reported for the UK breeding population,

based on an analysis of recent survey data (RSPB, 2012), although this still represents a 5% increase on 1986 levels.

Characteristics and behaviour

Nest sites

4.36 The species nests colonially, often with other gulls, especially the herring gull. It breeds on coastal grassy slopes (flat and unbroken) (Richards 1990), sand-dunes (Richards 1990, Mitchell et al. 2004), cliffs (Richards 1990, del Hoyo et al. 1996, Mitchell et al. 2004), rocky offshore islands (del Hoyo et al. 1996, Mitchell et al. 2004), saltmarshes (Mitchell et al. 2004), and on inland habitats such as the margins of lakes (Richards 1990, Olsen and Larsson 2003), high moorland (Richards 1990, Mitchell et al. 2004), and islands in lakes and rivers (Olsen and Larsson 2003). It shows a preference for well-vegetated sites, with fairly close, short vegetation (Richards 1990, Snow and Perrins 1998), and may forage on arable land, pasture land (Richards 1990), and on refuse dumps (Richards 1990, del Hoyo et al. 1996).

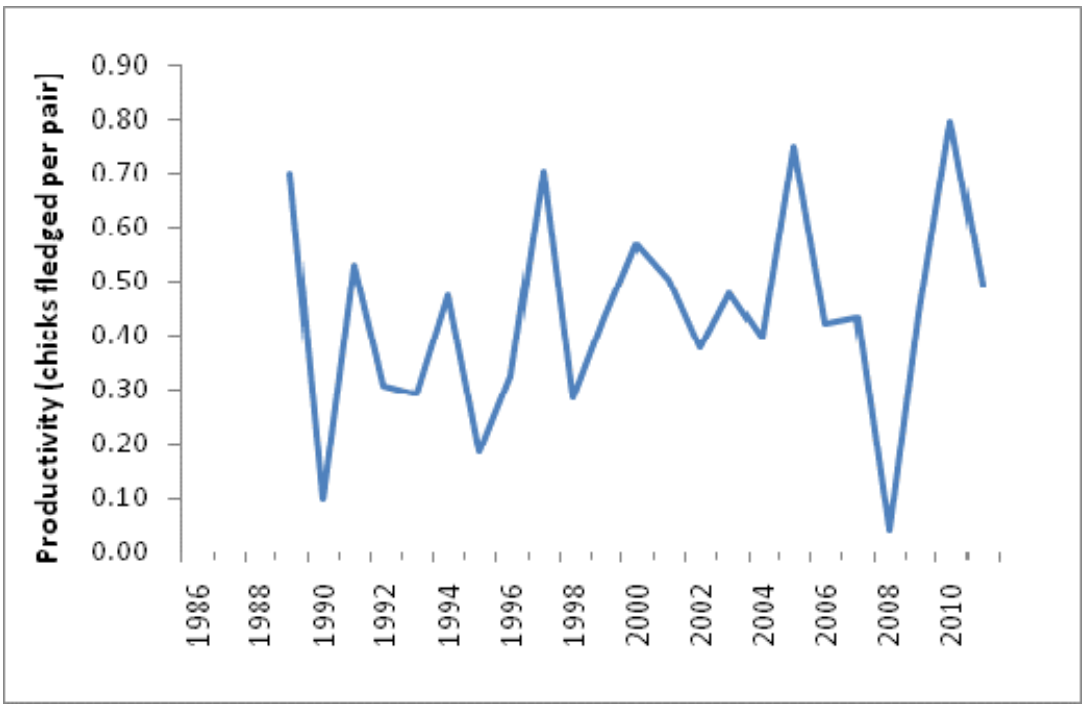
4.37 Colonies are found on islands offshore and within inland freshwater bodies, coastal cliffs, sand dunes, salt marshes, moorland and on the rooftops of buildings. Many sites that are either inaccessible to ground predators (e.g. islands and urban rooftops) or where ground predators are particularly scarce (e.g. narrow peninsulas or on moorland) can prove attractive for nesting. At breeding colonies, immatures, nonbreeding adults, and failed and off-duty breeders form "clubs" near the colony, where they spend time loafing, resting, and preening

4.38 Though often sharing breeding areas with herring gulls, their nest sites and feeding strategies generally differ; LBBGs forage over larger distances and tend to nest within more vegetated areas.

Productivity and lifespan

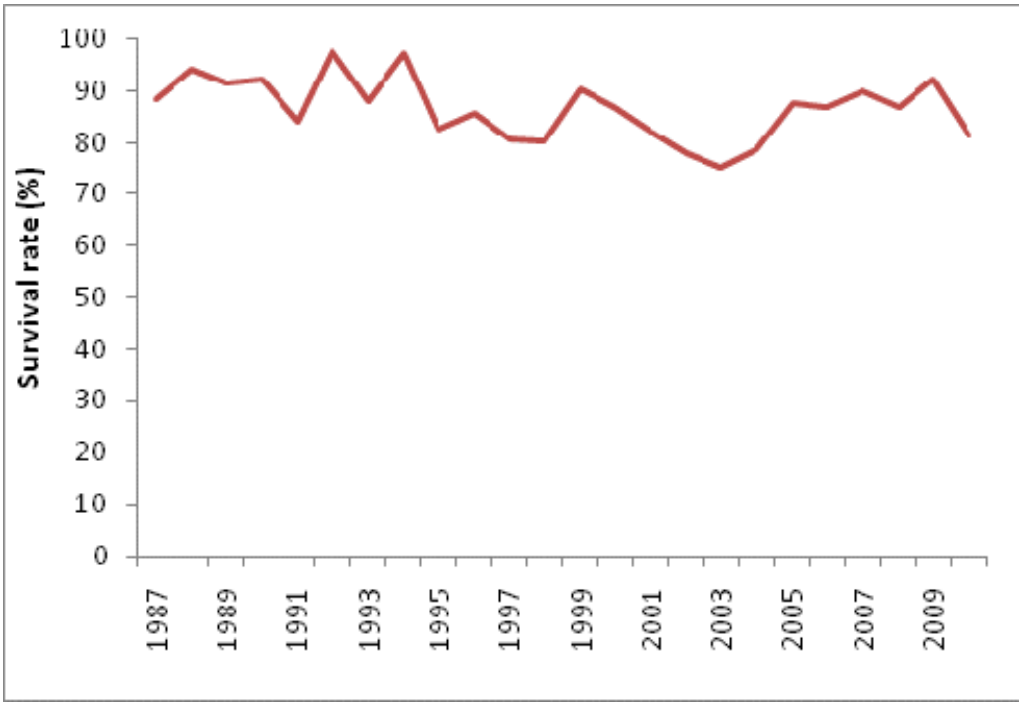
4.39 The bird's age at first breeding is four years and typical lifespan is around 15 years. The British Trust for Ornithology (BTO, 2011) report a maximum recorded age of 34 years 10 months 27 days (set in 2000). JNCC has published data on LBBG productivity (number of fledged chicks per pair) of LBBG between 1986 and 2011 around the UK. This is based on its annual Seabird Monitoring Programme (SMP) data. The results are shown in **Figure 5.** The trend of productivity shown is heavily influenced by data from the very large colony on Skomer, SW Wales, where productivity has fluctuated widely for unknown reasons. It is noted by JNCC that that there were few successful years over the recording period.

Figure 5. LBBG productivity in the UK (1986-2011)



Source: JNCC (SMP) data

Figure 6. Estimated LBBG adult survival rate (Skomer 1987-2010)



Source: JNCC (SMP) data

Adult survival rate

4.40 The single estimate of adult survival rate from the SMP comes from the large population breeding on Skomer, SW Wales. Survival rate there declined between 1994 and 2003, but increased thereafter. This decline in survival rate coincided with a rapid decline in the number

breeding on Skomer. It is not known to what extent changes in survival have affected the UK population as a whole. NE advises that an annual survival rate of 82% per annum is appropriate to use for the Alde – Ore SPA colony.

Diet

4.41 The species is an omnivorous, opportunistic feeder that forages extensively at sea, but also inland. Its diet consists of small fish (especially Baltic herring *Clupea harengus*) (del Hoyo *et al.* 1996), aquatic and terrestrial invertebrates (e.g. beetles, flies and larvae, ants, moths (Urban *et al*. 1986), grasshoppers (Olsen and Larsson 2003), crustaceans, molluscs, worms and starfish (Urban *et al*. 1986)), bird eggs and nestlings, carrion, offal (del Hoyo *et al.* 1996), rodents, berries (del Hoyo *et al.* 1996) and grain (Urban *et al*. 1986). It often follows fishing fleets, feeding on discarded bycatch (BirdLife International 2013).

Foraging patterns

4.42 The foraging range of LBBG has implications for plans and projects to be considered in combination and also for the provenance of birds that may be found at the GWF site. A recent peer-reviewed assessment of seabird foraging ranges (Thaxter *et al*. 2012b) gives a mean maximum foraging range for LBBG of 141.0+/-51km from the breeding colony. The review places the highest relative level of confidence in this figure, based on the robustness of the source data from which it is derived, although notes that foraging ranges may vary between colonies, years and regions. The locations of foraging habitat, and thus seabird distributions, will be ephemeral (i.e. linked to the relevant habitats) and, therefore colony-specific information should be considered when assessing the potential impacts of individual applications.

4.43 Tracking studies based on 10 tagged Alde-Ore SPA birds (Thaxter *et al*. 2011) and subsequently 13 birds (Thaxter *et al*. 2012a) gave a maximum distance travelled from the colony of 159km (2010 breeding season) and 91km (2011 breeding season) which are in keeping with the mean maximum foraging ranges set out in the review. The Applicant based its HRA calculations on a "core foraging range" of 40km and an upper range of 80km, based on the account in Rock (2002). However, this HRA was superseded by the publication of a review of foraging ranges of seabirds (Thaxter *et al*. 2012b). This new information was addressed during the examination period, with the Applicant submitting revised calculations on the likely provenance of birds observed at the GWF site.

4.44 The Applicant reports that large flocks of 50-100 birds were commonly recorded in the GWF study area during its boat-based surveys between 2008-2010, reaching a peak of over 500 birds in June and August 2008. It considers that the "vast majority" were probably engaged in some sort of foraging behaviour, with flocks commonly associated with trawler activity, scavenging discards behind the vessel. Around 15% were estimated to be "actively associated" with fishing vessels. As a consequence, it concludes that any restrictions on commercial fisheries within the wind farm footprint and its immediate vicinity would be likely to lower the site utilisation by the species, although the RSPB highlight that this must be balanced by possible

attractions of the gulls to the wind farm for other reasons, such as the increased availability of food.

4.45 Failed breeders at a colony in the Netherlands were observed to perform very different trips in a tagging study conducted by Camphuysen *et al*. (2011) and tended to travel further afield to forage, reaching the UK, deep inland in The Netherlands, into Germany, Belgium and Northern France.

Vulnerabilities

4.46 Some *L f. graellsii* populations have significantly declined due to decreasing food availability and by competition and predation from sub-species (*Larus argentatus* and *Larus marinus)* (Barcena *et al.* 1984, del Hoyo *et al.* 1996, Olsen and Larsson 2003) and by changes in fishing and refuse disposal practices (Olsen and Larsson 2003, Mitchell *et al.* 2004) (e.g. closure of landfill sites and the covering of waste) (Barcena *et al.* 1984, del Hoyo *et al.* 1996, Olsen and Larsson 2003, Mitchell *et al.* 2004). Population declines may also have been aided by poisoning from organochloride pollution (Bustnes *et al.* 2006), although contamination from pesticides is no longer considered a likely threat. Historically, LBBG colonies have been culled in Britain and Ireland in order to protect other breeding seabirds from predation and competition (Mitchell *et al.* 2004). The species is susceptible to avian botulism, so may be threatened by future outbreaks of this disease (Mitchell *et al.* 2004). Given its dependency on fishery discards, it would be affected by any changes to EU fisheries policy in this respect.

Vulnerabilities in relation to wind farms

4.47 The mode of operation of LBBGs could be described as “distinctly opportunistic” and so they would not be expected to avoid wind turbines nor be displaced by them. The species is relatively long-lived (around 15 years on average), with a rather variable level of breeding success in recent times. This would suggest that populations are likely to be susceptible to adult mortalities.

4.48 Cook *et al*. (2012) undertook a review of flight heights and avoidance rates of birds in relation to offshore wind farms. A total of 35,114 LBBGs were recorded during 29 studies of 23 offshore wind farm sites. The model showed that some birds fly at a height that places them at risk of collision with turbine rotor blades. Assuming a minimum rotor blade height of 20m and a maximum rotor blade height of 150m, approximately 25.2% of flights by LBBG were considered to be at a height which places them at risk of collision. Previous studies have estimated mean flight heights for LBBG at 170m (range 20 – 200m), however, there was wide variation around this value (Walls *et al.* 2004; Parnell *et al.* 2005).

4.49 The large offshore foraging range of LBBGs also places them at risk from collisions with a number of offshore wind turbines, although different birds display different foraging patterns, with some showing a preference for onshore foraging.

5 ASSESSMENT OF EFFECTS - PROJECT ALONE

Introduction

5.1 This section contains a description of the modelling that was used to determine, first, the likely number of collisions of LBBG per annum as a result of the operational GWF (collision risk model) and, second, the analysis that was undertaken to predict what the likely population level effects would be of these predicted mortalities (population viability analysis). The Applicant, NE and the RSPB disagreed on elements of this and so, where possible, a summary of the main points of disagreements is presented, alongside the ExA's recommendations. The Secretary of State's conclusions are presented at the end of this section and summarised in **section 8**.

Collision risk model (CRM) and input parameters

5.2 To quantify the potential risk of additional mortality above the likely baseline level, collision risk modelling (CRM) was undertaken as part of the impact assessment process. This is detailed in the Applicant's HRA and also its ES (Technical Appendix 11.A). The CRM was based on the Band *et al*. (2007) model (directional approach) and incorporated one year of boat-based survey data (2009). This is the approach recommended by Maclean *et al.* (2009).

5.3 Some input parameters to the CRM and data refinements proposed by the Applicant were not accepted by NE as being suitably precautionary. The issues where differences remained at the close of the examination are addressed in turn below and comprise:

- The LBBG's ability to avoid wind turbines (avoidance rate);
- The proportion of LBBGs flying at potential collision height (PCH) and the appropriate data to use to derive this;
- The proportion of LBBG originating from the Alde-Ore SPA /Ramsar breeding colony (provenance of birds); and
- The reduction in mortality to be attributed due to reduced fishing effort within the wind farm post-construction.

5.4 A summary of the effects of different CRM parameters on the final estimate of collisions is summarised in **Table 7**, which also sets out the Applicant's and NE's respective positions on a number of refinements proposed by the Applicant. A fuller account of the positions of the parties is contained in their written representations.

Table 7 – Views from the Applicant and NE on CRM parameters

	The Applicant		Natural England	
Parameter / data	**Reasons / assumptions**	**LBBG annual mortality / at risk**	**Assumptions / advice**	**LBBG annual mortality / birds at risk**
dataset used	Use 2009 data as one complete season available only, due to construction of Greater Gabbard	477	use partial seasons data available for 2008 & 2010	555
% flight activity at potential collision height (PCH)	17% - based on GWF vantage point surveys at the site	as above - this is based on 17%	19.1% is a more precautionary figure - based on average of Greater Gabbard surveys and published data elsewhere. This increases the number of potential collisions compared to a 17% rate.	624
Discounting birds outside the breeding season - breeding season is March - August incl.	Birds counted in September - Feb (150) excluded from calculation, as they are not considered to be part of SPA breeding colony.	327	NE accept and deduct 245 birds from their total of 624. NE exclude mortality of birds in September and February with caution	379
Discounting non-SPA Birds	Assume that 31.5% of flight activity is from Alde-Ore SPA - based on known LBBG foraging range and that density is a function of distance from colony.	103	NE reserve judgement and indicate that the figure could also be 40%, but ultimately content with 31.5%.	119
Impact of reduced fishing in GWF site	15% reduction initially chosen to account for reduced fishing and gull activity within the operational wind farm. By the end of the examination, the Applicant also offered to change the DCO boundary to exclude part of the site with the highest level of fishing by Dutch trawlers (Area B turbine exclusion zone) to allow a 15% or greater reduction on predicted collisions.	88	NE agree that gulls are associated with fishing vessels, but consider that there no justifiable rationale for assigning a value to this relationship in collision calculations. Dispute the inclusion of Area B exclusion zone, if a 15% collision reduction value is to be assigned to it	119
Avoidance Rate	99% on the basis of a COWRIE report (MacLean *et al*. 2009) in which gulls are ascribed an avoidance rate of 99.5% and also monitoring work at Blyth Harbour wind farm in Northumberland which showed that micro avoidance rates alone for large gulls are likely to be above 99% (Lawrence *et al.* 2007).	44	98% - on the basis of work undertaken by Krijgsveld *et al.* (2010, 2011) and Poot et al (2011) for the Egmund aan Zee wind farm. This is also the default avoidance rate suggested in the SNH (2010) guidance where there is a lack of suitable data to determine species-specific avoidance rates.	119
Final estimate of annual collisions (Applicant)		**44**	**Final estimate of annual collisions (NE)**	**119**

Avoidance rate

5.5 A key step in predicting collision mortality is to define the percentage of birds that are likely to make a behavioural response to the presence of a wind farm, or to an individual turbine, so as to avoid flying on a path that puts them at risk of collision with the rotating turbine blades. This is the avoidance rate. The choice of avoidance rate has a significant influence on the number of predicted collisions, with a 1% increase in avoidance rate giving rise to a doubling in the predicted collision mortalities. The overall avoidance rate will be the result of a combination of factors including macro-avoidance (of the whole wind farm, by diverting over or around it) and micro-avoidance (ability to avoid collision with a turbine once within a wind farm). Species-specific avoidance rates have been developed by SNH to take into account factors such as the behaviour patterns, reactions, size and agility of different bird species (SNH, 2010). The actual avoidance rate for a given location, will also be affected by site-specific issues, including the layout of turbines, weather and visibility, whether the birds are foraging or migrating and also whether they are part of a large flock.

5.6 NE suggest that a **98% avoidance rate** is suitably precautionary for LBBG, given the uncertainty regarding bird behaviour when encountering a windfarm. This is largely on the basis of work undertaken by Krijgsveld *et al.* (2010, 2011) and Poot et al (2011) for the Egmund aan Zee wind farm – the first large-scale offshore wind farm built off the Dutch North Sea coast. This is also the default avoidance rate suggested by Scottish National Heritage (SNH) in its guidance note on avoidance rates (SNH, 2010) where there is a lack of suitable data to determine species-specific avoidance rates. NE considers that this is a realistic basis on which to make an assessment that incorporates a degree of precaution and is consistent with the available empirical evidence.

5.7 The Applicant has conducted a literature review in its HRA and highlights, in particular, a COWRIE report (MacLean *et al*. 2009) in which gulls are ascribed an avoidance rate of 99.5% and also monitoring work at Blyth Harbour wind farm in Northumberland which showed that micro avoidance rates alone for large gulls are likely to be above 99% (Lawrence *et al.* 2007). The HRA literature review notes that some studies, such as those for wind farms in Flanders (e.g. Everaert, 2011; Everaert & Kuijken, 2007) indicate avoidance rates from 98.69% down to 91.53%. However, methods of calculations between studies are different and the location and layouts of wind farms are also different to GWF with respect to gull colonies. For example, there is a local migration route of gulls towards a roost site in one example (Brugge), whilst another wind farm studied lies near to a breeding colony (Zeebrugge). The Applicant suggests that turbines closer to nesting colonies would be subject to more short nocturnal trips and, hence, collision chance per turbine would be likely to be higher for such smaller, linear wind farms located close to colonies than for a large multi-row wind farm further offshore, such as GWF. As a result of its literature review, and taking into account the similarities/differences between the proposed GWF and other wind farms studied, the Applicant considers that the avoidance

rate for LBBGs is likely to be **at least 99%** and possibly higher in the offshore environment, particularly for large multi-row wind farms, such as GWF.

5.8 The ExA recommends that, on balance, the **98%** figure be used and that this would give an adequate level of precaution, because of the lack of species-specific evidence that can be used to confirm an avoidance rate with certainty.

Flight height and use of partial season's data

5.9 On the basis of boat-based survey data collected during one full season (2009), the Applicant estimates that **17%** of LBBG would fly at PCH at the GWF site. The Applicant has collected data for part of the 2008 and 2010 seasons, but excluded this from the calculations on the basis that it does not represent a complete season.

5.10 NE provides an alternative calculation by incorporating the partial data from the 2008 and 2010 seasons, which it considers valid to include, as well as data from the adjacent Greater Gabbard offshore wind farm. Using this additional data provides an average figure of **19.1%** of birds at PCH. NE state that the 19.1% figure has been derived with regard to the application of Cook *et al*. (2012) as described in paragraph 4.48. The RSPB highlights that, using this report, would give a figure of **22%** of flights by LBBGs at PCH for GWF.

5.11 The ExA gives weight to the view that it is desirable to use more data when they are available and relevant and recommends that the **19.1%** figure, advised by NE as precautionary, should be used for modelling collision risk.

Period of breeding activity/collision risk

5.12 The Applicant indicates that the period of collision risk for breeding LBBGs is **March to August** inclusive. This is based on evidence from the scientific literature, GPS-tagged SPA birds, Wetland Bird Survey Counts and ringing recoveries. Additional information was collected during 2012, following concerns raised by NE and the RSPB over whether this period should be extended to include February and September bird count data. The main assumption behind this is that, during the breeding season, LBBGs behave as "central place foragers" that is to say that they return to the nest site to provide food for their chicks, or support their partner during incubation, unless there has been nest failure, or failure to breed. Although an increase in numbers at the GWF site was observed between February and March and also in September, the Applicant suggests that these are likely to be birds en route to colonies further north or on the coastal continent e.g. Texel, Netherlands, as shown by GPS tagging. NE accepts, with caution, the exclusion of the birds present during the months of February and September.

5.13 The ExA recommends that the Applicant's position, as accepted by NE, is used i.e. **a March to August** breeding period. Whilst differences in opinion were expressed during the examination, this is not identified by NE as an area where there is a lack of precaution and can be taken to be suitably robust.

Proportion of Alde-Ore Estuary SPA / Ramsar birds within GWF

5.14 In order to be able to determine the likely provenance and composition of flocks recorded within the GWF site during the breeding season, it is necessary to determine how many LBBG colonies lie within potential foraging range, the size of each colony and distances from GWF. As stated in paragraph 4.42, in its HRA report the Applicant initially based its assessment on a "core" foraging range of 40km and a "regular" foraging range of 80km, based on information available at that time. Subsequently, the mean maximum range for the species was established as 141km+/-51km by Thaxter *et. al* (2012b). In response, the Applicant commissioned a census of large gull colonies in 2012 to incorporate those within 141km of the GWF site. This census, combined with evidence of other breeding sites in regional bird reports and contact with local bird recorders indicates that a total of 52,336 pairs of LBBGs are estimated to be found within 141km (with an additional tolerance of 5km), comprising 87 sites. The weighting given to each colony within GWF has been calculated in the Applicant's collision risk modelling note as a proportion of the colony size and the square of its distance to the GWF site. The results provide an indicator of the provenance of birds within GWF that can be applied to collision risk modelling.

5.15 On this basis, the Applicant estimates that some 31.5% of birds found within the GWF wind farm are from the Alde-Ore Estuary SPA/ Ramsar and so **31.5% of potential LBBG collisions will be of these SPA birds**. Both NE and RSPB consider the general approach to be reasonable, but queried the detail of how the figure had been derived. The RSPB expressed concern regarding the likely variance between colonies on foraging distances and assumptions regarding an even prey distribution. The RSPB considers that an expert review is needed, prior to the production of an AA to ensure the reliability of the figures. NE advise that the figure should be considered as indicative only, but were not able to put forward any firm alternative calculations in the short time period available, prior to the conclusion of the examination.

5.16 The ExA recommends that the **31.5%** figure is used in the CRM and notes that neither NE nor the RSPB were able to provide an improved evidence-based alternative figure, in the time available during the examination. It also highlights NE's advice regarding the need for precaution. The Secretary of State has examined this calculation and considers it to be a reasonable basis for determining the likely provenance of birds at the GWF site.

Data refinement - reduction in fishing effort / turbine exclusion zone

5.17 In its HRA, the Applicant proposed a **15%** reduction in mortality to account for reduced commercial fishing activity within the wind farm footprint once the wind farm has been built. This is on the basis that LBBG foraging behaviour is strongly associated with large trawlers, which they follow, attracted by discards being thrown back to sea. The Applicant considers that large commercial trawling operations will be significantly reduced within the GWF site due to the presence of the wind turbines and, hence, LBBGs activity will also be reduced.

5.18 In response to challenges to its assumptions on fishing reduction and a Rule 17 question (39.1), the Applicant clarified its position on its proposed fishing-related 15% collision reduction. This is that, given the strong relationship between gulls and trawler activity and significant evidence of reduced trawler activity within other wind farm footprints, there is a strong case for a reduction in the modelled collisions between gulls and turbines. It states that 15% is a somewhat "arbitrary" figure, but considers that it is lower and more precautionary than has been observed and reported at other wind farm sites.

5.19 The Applicant's original proposed 15% reduction in collisions was non-locational, i.e. it relied on a general principle of reduced fishing operations within wind farm footprints and correspondingly lower gull numbers. However, following challenges made to this assumption during the examination, the Applicant proposed to exclude turbines from a specific part of the windfarm footprint where higher levels of commercial fishing activity occur. This is an area of deeper water on the eastern side of the "Area B" cluster of turbines (Area B Turbine Exclusion Zone). It was put forward by the Applicant during the examination on the basis of analysis of Vessel Monitoring System records over a five-year period (2006-2010) for the Dutch fleet and correlates to an area of 19% of the fishing effort. Noting that this is an "extremely significant commercial decision", the Applicant puts forward the **Area B Turbine Exclusion Zone** as a potential concession to provide sufficient confidence that a 15% or higher reduction in collision mortality can be applied, if the Secretary of State considers this necessary to rule out adverse effects on the integrity of the SPA. The Applicant contends that to *not* adopt a 15% or higher reduction in collision risk would be to assume that there is no relationship between trawling and its associated discards as attractors of gulls.

5.20 The ExA is of the view that the restricted build area of the Area B exclusion zone will contribute generally to a reduction in LBBG mortality and also reduce adverse impacts on commercial fishing. It recommends that this mitigation measure is included within the DCO, but that no specific percentage reduction in collision mortality is attributed on the basis of reduced fishing effort within the wind farm footprint, as there is a lack of certainty surrounding the effect and no evidence-based mechanism for corroboration. The purpose of the exclusion zone would be to give added confidence to the Secretary of State's conclusions on the predicted LBBG mortality levels.

5.21 Whilst NE agrees that gull activity is often enhanced in the vicinity of fishing effort, it considers that there is no evidence base on which to derive a percentage reduction in LBBG collisions that could be meaningfully attributed to this factor. Therefore, NE does not support the Area B Turbine Exclusion Zone, if this is conditional on the application of a 15% fisheries reduction to the calculation of LBBG mortalities. The RSPB does not agree that there can be reasonable confidence that a fishing-related reduction in collisions would occur, as other factors may attract the LBBG into the windfarm footprint post-construction, such as an increased availability of natural prey and continued fishing operations (albeit at reduced levels). For a further discussion on this and other mitigation measures, **see Section 7**.

Conclusions on CRM parameters

5.22 The effect of inputting the Applicant's preferred parameters into the CRM model leads to a predicted annual mortality of **44** LBBGs as a result of collisions with turbines. Use of the parameters recommended by NE (most notably a 98% avoidance rate in preference to a 99% avoidance rate) leads to a predicted annual mortality level of **119** LBBGs. This represents a predicted additional annual mortality of around 6.5% of the 2012 SPA population (1,811 pairs – see **Table 6).**

5.23 The ExA concludes that it will be "*suitable to apply the methodology that gives the figure of 119 birds, rather than 44 birds.*" It makes this recommendation on the basis of: advice from SNCBs, requiring the assessment to be duly precautionary; because of the lack of certainty surrounding the data and methods; and because of the inherent variability in the behaviour of seabirds. NE considers that a 119 bird mortality figure can reasonably be derived from empirical data; but states that the figure could be as high as 152.

5.24 The Secretary of State agrees with the recommendation from the ExA and NE's advice. He cannot rule out the possibility that LBBG collisions with turbines could be of the order of 119 per annum and he considers that this provides a suitably precautionary basis to assess the possible impacts of GWF on the conservation objectives of the Alde-Ore Estuary SPA / Ramsar. The Secretary of State is, however, sympathetic to the case put forward by the Applicant that commercial fishing activity will reduce within the wind farm footprint and considers it reasonable to assume that this is likely to lead to a reduction in gull flight activity, as observed at the Egmond aan Zee and Princess Amalia wind farms in the Netherlands. This in turn is likely to lead to a reduction in actual collisions compared to the modelled level of collisions. However, he does not consider that he has sufficiently robust evidence to quantify with certainty the relationship between the number of "at risk" gull flights and the level of fishing vessel activity within the wind farm footprint. He, therefore, cannot agree that a 15% (or greater) reduction of fishing effort within GWF would necessarily lead to a directly proportional decrease in "at risk" gull flights and associated collisions.

Population Viability Assessment (PVA) demographics

5.25 Two population viability assessments (PVAs) have been constructed by the Applicant to test the long term consequences of additional mortality on the dynamics of the LBBG population at the SPA. This was considered to be representative of the current population (i.e. 1,603 breeding pairs recorded in 2011 – see **Table 6**), rather than the higher population levels recorded in the SPA citation (14,074 breeding pairs – **see Table 5**).

5.26 Deterministic modelling was undertaken during the environmental impact assessment process, that is to say modelling that reflects a system where no randomness is involved in predicting future states. A deterministic model will always produce the same output from a given starting condition and set of input parameters. The Applicant's deterministic model is described in the ES (Chapter 11) and the HRA. NE advised that a stochastic model would be more appropriate

in order to better account for the likely variation in demographic parameters and random processes. In response, the Applicant submitted the results of its stochastic PVA during the examination period. This was bespoke for the SPA population and based on the same or similar demographic data to the deterministic model. The results are expressed as a range of probabilistic outcomes for the LBBG population under different scenarios over a 25-year time period.

5.27 The ExA reports that all parties agree that both deterministic and stochastic models yield very similar results in respect of likely impacts on the LBBG population. Both models are "closed", that is to say that they do not factor in immigration into or emigration out of the colony. From what is known about LBBG colonies (see, for example paragraph 4.22), the birds do readily move to more favourable nesting sites in response to local conditions, opportunities and pressures. For this reason, the models can be considered to be precautionary – as improved on-site management could be assumed to lead to more attractive conditions, in the absence of other factors, that would in turn be expected to attract birds to nest in the colony and population increases.

5.28 The PVA modelling process attempts to reflect the likely LBBG population from the time of construction of GWF through the operational period of the wind farm. It takes into account reasonably foreseeable changes due to factors such as reduced disturbance and predation, increased food availability and improved nesting habitat, which in turn are likely to affect adult survival and productivity. Below is a description of the scenarios, key demographic parameters and outputs of the stochastic PVA model.

Stochastic PVA scenarios

5.29 The primary focus of the stochastic PVA is a "*Management Scenario*", which is based on a future situation that incorporates NE's requirements for the LBBG population to meet its SPA population target in order to achieve favourable condition for the site. [As the SPA is in unfavourable declining condition in respect of the LBBG population, NE has a statutory duty to restore this feature and so a future scenario would need to take this into account.] These statutory NE measures are separate from any additional SPA management measures that may be funded by the Applicant. These would be "top-up" mitigation and are described further in **Section 7**.

5.30 In addition, two alternative scenarios "*Historic*" and "*Baseline*" were included to represent the past and current levels of management at the Alde-Ore Estuary SPA / Ramsar respectively. These scenarios have different assumptions around adult survival rates and chick productivity of LBBG under different conditions.

5.31 **Table 8** shows the differences in key assumptions made for each of these scenarios.

Table 8. Stochastic PVA scenarios and key demographics used

Scenario	Adult survival / year	Chick productivity / pair	breeding adults	Assumptions
Management	0.95	1.00	66%	Targeted and realistic management measures to restore LBBG feature
Baseline	0.93	0.80	66%	Current situation – SPA management, but not targeted at LBBG. Typical UK colony
Historic	0.90	0.45	66%	Lack of management intervention. Population continues to be unfavourable declining.

Management scenario- future situation

5.32 Under the management scenario, the model predicts that growth will occur over a 25-year period from the starting (2011) population of 1,603 pairs to approximately 8,000 pairs, thereby reducing the general trend of decline. The favourable conservation status population target of 14,074 pairs, however, would not occur during the lifetime of the wind farm. The model predicts that average population growth is positive for all additional mortality rates tested and that 95% of simulations have positive growth at all rates tested.

5.33 The probability of the SPA population decreasing to below its current size increases from approximately 3% (with no additional mortality) to 15% if 250 additional adult deaths were to occur. The probability of the SPA population decreasing by 5% increases from 0.1% (no additional mortality) to 1% (250 additional deaths).

Baseline scenario – current and near future situation

5.34 Under the baseline scenario, growth will occur over a 25-year period, albeit at a slower rate than under the management scenario, to 3,400 pairs. Without immigration, it would take over 50 years before the favourable conservation status target is met. Population growth is predicted until additional mortality reaches approximately 250 birds during the breeding season. Based on the lower confidence level, 95% of simulations have positive growth on average, until mortality reaches around 160 individuals.

5.35 The probability of the SPA population declining below the starting size increases from approximately 23% (no additional morality) to approximately 83% (250 additional deaths). The probability of the SPA population declining by 5% increases from 2% (no additional mortality) to 62% (250 additional deaths).

Historic scenario – past situation, with lack of management

5.36 Under the historic scenario, a decline in the population would be expected if none of the SPA management measures had been implemented. This provides a “moderate level of fit” to the actual SPA population over the period 2001-2011. Any additional mortality further reduces the population growth rate and the probability of decline is 1.0 (i.e. 100%), regardless of additional mortality.

Sensitivity analysis

5.37 A sensitivity analysis was undertaken of the model and its predictions to explore the relationships between the model's inputs and outputs. This demonstrated that the demographic with the greatest effect on population growth rate is adult survival – as would be expected for a relatively long-lived and slow breeding seabird species. All other demographics generated virtually identical results.

Conclusions on the PVA modelling

5.38 At the close of the examination, there were continued differences between the Applicant, NE and the RSPB regarding the most appropriate demographics to use in the PVA management scenarios to represent the current and likely future state of the colony and, hence, whether or not mitigation is required to avoid a conclusion of adverse impact on the SPA.

5.39 The ExA gives significant weight to the unfavourable declining status of the LBBG colony in light of it being one of the SPA interest features. It also gives weight to the need for SPA management measures to address this decline, as well as the identified project impacts on the population. For these reasons, and because of uncertainties surrounding likely future population trends, it recommends that mitigation be applied to the project to **counter all 119 predicted increases in mortality** to enable a conclusion of no adverse effect on integrity to be reached.

5.40 The Secretary of State agrees with the ExA that all predicted collision mortalities should be mitigated in order to confidently reach a conclusion of no adverse impacts on the SPA, given the unfavourable declining status of the LBBG. The Secretary of State acknowledges the precaution built into the PVA model in that it does not take into account possible immigration into the colony. Were this to be factored in, then more favourable growth rates might be expected in response to more attractive breeding site. However, he is also mindful of the largely unexplained variances in reported chick productivity levels at Orfordness and Havergate Island reserves, despite recent positive measures being undertaken as part of the LIFE+ programme. The Secretary of State notes, that whilst SPA management measures are proposed to be undertaken by NE that should increase chick productivity, a sensitivity analysis indicates that the outputs of the PVA modelling are most sensitive to changes in adult survival that would largely be influenced by other factors in the wider environment.

5.41 NE's position is that, without mitigation, it cannot be safely concluded that an adverse impact on site integrity will not occur. In light of the unfavourable declining status of LBBG, NE advise that *any* level of additional mortality would:

- reduce the future growth rate of the population;
- increase the probability that, over the course of 25 years, the population will at some point fall by various amounts below its initial size relative to the probability that it will do so in the absence of additional mortality; and

- increase the length of time it will take this population to recover and reach the revised favourable conservation target for that population i.e. 14,074 pairs.

5.42 NE also advises that there is no certainty that the recent LIFE+ management measures are solely responsible for the enhanced chick productivity experienced in 2011 and that more years of similar results would be necessary to have confidence in the assumption that the improved survival and productivity modelled under the baseline scenario are now typical of the current and near future condition of the colony. In the absence of that confidence, it advises that a precautionary baseline assessment would actually be based on the demographics assigned by the Applicant to the historic scenario. Shortly before the conclusion of the examination, the RSPB supplied information on unexpectedly low productivity figures experienced at the SPA colony in 2012 (0.19 fledged chicks/pair).

5.43 The Applicant's position is that, based on the PVA modelling under a management scenario and an annual collision mortality of 44 birds, there will be no adverse effect on the integrity of the Alde-Ore Estuary SPA/ Ramsar and that no further mitigation is required, beyond that undertaken at the pre-application stage.

6 ASSESSMENT OF EFFECTS - PROJECT IN COMBINATION

Introduction

6.1 In light of the findings of Thaxter *et al*. (2012), the Applicant revised its HRA assessment of in-combination effects to incorporate an increased mean maximum foraging range of around 141km and calculations were provided as part of its updated collision risk model. This had the effect of increasing the number of wind farms to be considered in combination to some 24 offshore wind farms (including GWF). This includes 12 other UK wind farms located in or near the Outer Thames Estuary and the Wash, 7 Belgian and 4 Dutch wind farms. These are shown in **Table 9.**

6.2 The Applicant estimated the likely collision mortality effects on Alde-Ore Estuary SPA birds on the basis of its 99% avoidance rate and also applied other refinements, including a 15% reduction to account for the likely reduction in fishing effort. Given that this approach was not accepted by the ExA and NE (as described in **Section 5**), the Applicant's results have been doubled to also show the effects of a more precautionary 98% avoidance rate. An alternative calculation has been presented by NE (by scaling up the Applicant's in combination results in the same way that 44 can be scaled to 119).

Results

6.3 The cumulative mortality rate was calculated by the Applicant to be 135 LBBG per annum, using a 99% avoidance rate and similar data refinements to those described in **Section 5**. It estimates that this cumulative level of mortality would lead to population growth of 2-3.5% under the PVA baseline scenario. This compares to a growth rate of 3.8% in the absence of additional mortality. Under the management scenario, a growth rate of 5-7% would be achievable, so the Applicant concludes that there would be no adverse effect on site integrity as the population would still increase under two of the PVA scenarios, albeit at a slower rate than in the absence of additional mortality.

6.4 As stated in **Section 5,** the Secretary of State considers that a more precautionary 98% avoidance rate is more appropriate to be used to estimate LBBG collisions. This would lead to an in combination impact of approximately 270 LBBG collisions per annum (i.e. by doubling the 135 figure). It has not been possible for the Secretary of State to calculate exactly what a revision of the 135 in combination mortality figure might be in the same way that the value of 119 was derived in comparison with the figure of 44 due to GWF alone. On the assumption that the correction scales roughly the same way, NE advise that one arrives at a value of 357 in combination, of which GWF alone accounts for 119, i.e. one third (which is the same as 44 alone, relative to 135 in combination.)

6.5 Comparing these figures with the stochastic PVA model outputs indicates that, under the management scenario, the risk of the population declining below its starting size would increase to over 15% (at 250 additional mortalities) and around 20% (at 300 additional mortalities).

6.6 NE highlight that, under the more conservative baseline scenario, the in-combination level of additional mortality is predicted to at least double the probability that the population will decline to below its current size by some amount (from 35%-c50%) during the foreseeable future and increase the probability of it falling by 5% or more below that current size to c15%, rather than 2% in the absence of additional mortality. NE also note that under the baseline scenario, this level of additional mortality is predicted to:

- Lead to a negative growth rate of 0.995;
- Result in the probability that the population will decline below its current size (from 23%-c50%) during the foreseeable future, increasing fourfold from 23% (in the absence of additional mortality) to c 90% (i.e. almost certain); and
- Increase the probability of the population falling by one quarter or more below its current size to c30% (almost 1 in 3 chance), rather than 0% in the absence of additional mortality.

Conclusions on in combination effects

6.7 Given the uncertainties surrounding future growth rates of the LBBG colony at Orfordness and a possible in combination impact of around 357 additional mortalities per annum, based on a 98% avoidance rate, the Secretary of State is not able to rule out an adverse impact on the conservation objectives of the Alde-Ore Estuary SPA/ Ramsar, unless mitigation measures are applied to the GWF. The Secretary of State considers that to ensure a conclusion of no adverse effect on site integrity as a result of GWF alone and in combination with other wind farms, the Applicant would need to mitigate for the entire additional mortality arising from GWF (119 potential LBBG collisions). This is also the recommendation of the ExA and reflects the conclusions of the alone assessment in **Section 5.**

6.8 It is NE's view that, without mitigation, at this level of additional mortality, the Secretary of State cannot be certain that the development, acting in combination with other wind farm developments, will not adversely affect the integrity of the Alde-Ore Estuary SPA.

6.9 The Applicant's position is that, based on the PVA modelling under a management scenario and an annual collision mortality of 135 birds, there will be no adverse effect on the integrity of the Alde-Ore Estuary SPA/ Ramsar either alone or in combination with other wind farms and that no further mitigation is required, beyond that undertaken at the pre-application stage.

Table 9. Cumulative LBBG mortality rates

Wind farm	Area	Distance from SPA / km	no. turbines	Annual mortality	Breeding mortality	Main source colony (% typical flock)	Proportion SPA birds	Total SPA mortality (99% AR)	Total SPA mortality (98% AR)
1. Galloper	Outer Thames Estuary	28	140	225-230	139	Havergate and Orfordness	31.5%	44	88
2. Greater Gabbard	Outer Thames Estuary	27	140	120	51	Havergate and Orfordness	36.4%	19	38
3. East Anglia ONE	Outer Thames Estuary	62	325	8	6	Dintelhaven & Maasvlatke (39%)	8.4%	7	14
4. Thanet	Outer Thames Estuary	68	100	32	14	Westelijke Voorhaven (18%)	16.6%	2	4
5. Kentish Flats and Extension	Outer Thames Estuary	73	81	5	2	Havergate and Orfordness	18.3%	0.4	0.8
6. Gunfleet Sands I & II	Outer Thames Estuary	40	48	<1	<1	Hamford Water	15.7%	1	2
7. London Array	Outer Thames Estuary	35	175	?	150	Havergate and Orfordness	27.6%	41	82
8. Scroby Sands	Outer Thames Estuary	59	30	?	?	Great Yarmouth (64%)	1.4%	?	?
9. Race Bank	The Wash	132	88-206	143	61	Outer Trial Bank (44%)	11.4%	7	14
10. Lincs	The Wash	135	75	17	7	Outer Trial Bank (68%)	6.4%	0.5	1
11. Lynn & Inner Dowsing	The Wash	135	54	0	0	Outer Trial Bank (70%)	6.0%	0	0
12. Dudgeon	The Wash	124	168	54	23	Outer Trial Bank (24%)	15.2%	3	6
13. Sheringham Shoal	The Wash	112	88	16.5	7	Outer Trial Bank (28%)	12.5%	1	2
14. Northwester Zone 7	Belgium	87	?	-	?	Dintelhaven & Maasvlatke (35%)	2.5	1	2
15. Belwind	Belgium	95	55	-	54	Dintelhaven & Maasvlatke (32%)	1.8	2	0
16. Belwind Phase 2 (Area 6)	Belgium	101	55	-	54	Dintelhaven & Maasvlatke (30%)	1.5	1	4
17. Seastar (Area 4)	Belgium	117	41	-	41	Westelijke Voorhaven (45%)	0.6	0.2	2
18. Northwind	Belgium	105	72	-	71	Westelijke	1.2	1	0.4

Wind farm	Area	Distance from SPA / km	no. turbines	Annual mortality	Breeding mortality	Main source colony (% typical flock)	Proportion SPA birds	Total SPA mortality (99% AR)	Total SPA mortality (98% AR)
(Eldepasco)						Voorhaven (29%)			
19. Thorntonbank I, II & III	Belgium	111	54	-	53	Westelijke Voorhaven (37%)	0.8	0.4	2
20. Rentel	Belgium	108	48	-	48	Westelijke Voorhaven (32%)	1.0	0.5	0.8
21. West Rijn	Netherlands	138	72	-	71	Dintelhaven & Maasvlatke (72%)	0.4	0.3	1
22. Rijnveld West	Netherlands	132	41	-	41	Dintelhaven & Maasvlatke (68%)	0.6	0.2	0.6
23. Brown Ridge Oost	Netherlands	141	94	-	93	Dintelhaven & Maasvlatke (49%)	1.2	1.1	0.4
24. Breeveertien II	Netherlands	141	97	-	96	Dintelhaven & Maasvlatke (57%)	0.9	1	2.2
							TOTAL	**135**	**270**
							NE calculation based on scaling up results		**357**

Source: 99% avoidance rate figures as supplied by the Applicant in its LBBG collision risk monitoring note (20/09/2012).

The Applicant estimated collision mortality on the basis of the relevant ES, where available. For the East Anglia ONE offshore wind farm, collision estimates were provided by the project developer. No data was available for the Dutch and Belgian wind farms so a best estimate was made for each site, based on a similar per turbine mortality rate to GWF during the breeding season.

98% avoidance rate also shown for comparison and NE calculation, based on scaling up the applicant's 135 in the same ratio as the alone collision ratio of 44:119

7 MITIGATION MEASURES

Introduction

7.1 The ExA sets out three mitigation options for consideration by the Secretary of State, should he decide that such measures are necessary to rule out an adverse impact on site integrity. These are:

A. SPA site-based mitigation, comprising funds for SPA management measures targeted at improving conditions for the LBBG breeding colony at the National Trust's Orfordness reserve and secured by the activation of a unilateral undertaking by the applicant.

B. Project mitigation comprising

(i) Restrictions to the turbine specifications in the project's Rochdale Envelope (as described in paragraphs 2.11 - 2.15) by applying a percentage reduction; and/or

(ii) Excluding turbines from an area of deeper water of preferred commercial trawling grounds - the "Area B exclusion zone" (as described in paragraph 5.19).

7.2 In addition, the ExA proposed

C. Introducing "Grampian-style" flexibility to the project mitigation, such that the Applicant could release restrictions B(i) and (ii) post-consent, with the provision of suitable environmental information

7.3 The ExA makes clear that the Secretary of State may choose to impose all or a combination of the above measures in order to avoid a conclusion of adverse impacts on site integrity and it sets out its preferred option. By the close of the examination, the parties had expressed views on the merits of the different forms of mitigation, but there was no agreement on the need for, nor on an overall preferred combination of mitigation. For this reason, the above mitigation options A) to C) are described in more detail below, alongside a summary of the ExA's recommendations and views of NE, the Applicant and the RSPB. The Secretary of State's conclusions on mitigation are presented at the end of this section in paragraphs 7.31 -7.34.

7.4 In broad terms, the ExA recommends a "dual approach" to mitigation, combining both elements of SPA site and project mitigation. This, it considers, reduces the likelihood of failure through reliance on a single mode of mitigation. NE supports the dual approach, whilst highlighting that project-based mitigation is more certain to reduce the predicted level of impacts and should be considered first in the mitigation hierarchy. The Applicant's position is that additional mitigation is not required. However, if the Secretary of State were to come to a different conclusion, then its preference is for SPA site-based mitigation, rather than placing turbine or other project restrictions on GWF.

7.5 The RSPB expressed strong views that there is insufficient evidence to have certainty about the likely success of the SPA site-based mitigation and highlighted the potential difficulties in distinguishing between improvements as a result of the Applicant-funded mitigation measures,

and those required to be undertaken by NE as part of its statutory duties to return the site to favourable conservation status. In response, NE indicated that it was confident that a broader package of measures would deliver extra management. NE considers it would be possible to differentiate and apportion mitigation success at the SPA site, acknowledging that a monitoring and adaptive feedback element would be required and that this is included in the agreed unilateral undertaking.

A. SPA site-based mitigation

Description

7.6 Management measures would be introduced to increase the chick productivity of breeding birds at the SPA nesting colony at Orfordness, managed by the National Trust. Measures would involve controlling predators (mainly foxes); reducing disturbance to nesting birds by dog walkers and anglers; fencing; warden patrol; vegetation management; education and signage. This would be funded by the Applicant via a unilateral legal agreement. This would fund "top up" measures over and above those required to be undertaken by NE as part of its statutory duties to improve the conservation status of LBBG at the site. There would be a monitoring and adaptive feedback element, whereby different or further site management measures would be adopted in response to new information on recorded chick productivity and LBBG population levels. Monitoring requirements on the efficacy of the measures are included in the unilateral undertaking and these have been agreed by NE and by Suffolk Coastal District Council.

ExA view

7.7 The ExA is of the view that this is a necessary and essential component of a dual approach to mitigation and highlights that additional management has been demonstrated in trials to make a positive difference to LBBG chick productivity. Requiring the Applicant to fund additional improvements at the colony will give the Secretary of State more certainty that there will be no adverse effects on the SPA. The ExA does, however, highlight that evidence presented during the examination indicates a background of largely unexplained variance in chick productivity and considers that the Secretary of State should exercise caution in over-reliance on SPA mitigation, as the likelihood of delivering improvements in productivity to mitigate all collisions is uncertain.

How much mitigation can SPA site management deliver?

7.8 In order to calculate the level of LBBG mortalities that could be mitigated via SPA-based measures, it is necessary to make some assumptions about current productivity levels and enhancements to breeding success that may realistically be achieved, given more favourable future conditions at the SPA. This then needs to be translated to extra chicks that would fledge and survive to become adult birds to replace the predicted mortalities as a result of turbine collisions. During the examination, NE produced a "mitigation table" setting out how this might look, based on:

- An annual 82% survival rate of fledged chicks for the first 4 years until reaching adulthood and breeding age (i.e. 45% survival rate over the 4 years);
- A baseline SPA population of 1,600 pairs; and
- An assumed baseline productivity rate i.e. 0.5 chicks/pair.

7.9 The increase in chick productivity required to offset a given level of adult mortality is calculated as follows.

- Select the overall annual figure of mortality for adult birds at GWF (e.g. 119).
- Select the proportion of this overall figure which remain after any chosen level of project mitigation is discounted from the overall figure (e.g. 70% remaining if 30% project mitigation is assumed).
- Calculate the remaining revised annual adult mortality that is required to be produced by increased productivity.
- On the basis that the annual survival of sub-adult birds is 82% per annum over each of their first four years of life, back calculate the number of chicks that would have to fledge per annum to result in the number of additional adults surviving to recruit to the colony each year in future, matching the assumed level of annual adult mortality.
- Divide the required number of adult fledged young per annum by the number of breeding pairs to estimate the required increase in productivity in terms of chicks per pair per annum.
- To estimate the elevated level of productivity required and, hence, assess the likelihood of this being a) biologically possible and b) achieved with improved management, add this required increase to the assumed baseline productivity rate and assess whether this falls within a realistic range.

7.10 The ExA has adopted NE's approach to ascertain the likely levels of mitigation that may be achieved via SPA site-based measures. However, it has changed the input parameters to reflect the fact that the mitigation is proposed for just one of the two SPA colonies (Ordfordness). As a result, it has substituted data that it considers better reflect the situation at the Orfordness colony, rather than the SPA as a whole.

7.11 The results of the Orfordness chick productivity calculation are shown in **Table 10** and have not been subject to discussion by the parties. Project mitigation is shown as increments from 0%-30%, reflecting the fact that the Applicant has offered up to 30% project mitigation, if required. The ExA recommends that SPA-based mitigation should account for **92.4**% of the total mitigation (i.e. be relied upon to "generate" an additional 110 adult birds per annum to replace collision casualties). As a consequence of this and the adoption of a dual approach, project mitigation would be required to deliver **7.6%** mitigation (i.e. an annual 9 bird reduction in collisions) to ensure 100% mitigation. This would mitigate all 119 predicted LBBG collision

casualties (110+9). The rationale for this is based on NE advice that productivity levels of 0.5-0.7 fledged chicks/pair have been attained in some study plots on Orfordness and so there is a reasonable expectation that a figure of an average of 0.6 fledged chicks/pair could be achieved. This back calculates to a figure of 84.8% SPA mitigation (101 additional adult birds) and a 15.2% reduction in collisions as a result of project mitigation (18 birds.)

7.12 The ExA does not, however, recommend an 84.8% (SPA)/15.2%(project) split on the following basis:

"*to avoid over-reliance on one set of measures, we have split the risk equally between the SPA site and project-based mitigation. This assumes that 50% of the required reduction in mortality would be mitigated for through increased chick productivity and the other 50% accounted for through a reduction in collisions with the WTG;*" [5.302]

7.13 This leads it to recommend 7.6%, rather than 15.2%, project mitigation and a correspondingly higher level of SPA site mitigation (92.4%).

7.14 The Secretary of State accepts the ExA's reasoning on the use of best available data that is specific to Ordfordness, rather than SPA-wide figures, as the SPA mitigation will take place at the Orfordness reserve only, where breeding success has been relatively poor, compared to the other LBBG colony at Havergate Island. However, he does not agree with the rationale expressed in paragraph 5.302 of halving the project mitigation to 7.6%. The Secretary of State notes that this reduced level of project mitigation would require a chick productivity level at Orfordness of 0.64 fledged chicks/pair (see **Table 10**) Whilst this is within the range achieved at the study plots, it is above the mean of 0.6 fledged chicks/pair. This would also require an increase of chick productivity of 248% compared to the three-year baseline average.

7.15 Based on the evidence and analysis presented, the Secretary of State considers that it would be more robust for project mitigation to be set at a level that requires chick productivity to be no more than the mean reported at the Orfordness trial plots, i.e. an increase from the current baseline of 0.256 to 0.6 fledged chicks/pair. This corresponds to a requirement for **15.2% project mitigation (18 birds) and 84.8% SPA site mitigation (101 birds**). Both of these scenarios are shown in **Table 10**. He notes that this would still require an increase in productivity of 236% on recent baseline levels, but considers this to be achievable, given: the current depleted status of the colony; the lack of positive management measures until recent times; and the likelihood of immigration to boost LBBG numbers.

7.16 The Secretary of State is aware that the Applicant has offered up to 30% project mitigation, if it is deemed necessary to avoid a conclusion of adverse impact. The Secretary of State considers that there is sufficient precaution built into his calculations to not require any further project restrictions, based on the likely success of the SPA site measures.

Table 10. SPA site mitigation: levels of chick productivity required at Orfordness to mitigate additional mortality as a result of collisions

% project - based mitigation	no. collisions to be mitigated by project	% SPA mitigation	remaining mortalities to mitigate via SPA measures	82% annual survival over four years	no. extra chicks needed	2012 colony size / pairs	increase in productivity required (chicks/pair)	3 year ave productivity (chicks/pair)	target productivity (chicks/pair)	target productivity (as % of 3 year ave. productivity)
0%	0	100%	119	45%	263	640	0.411	0.256	0.67	261%
7.6%	9	92%	110	45%	243	640	0.380	0.256	0.64	248%
10%	12	90%	107	45%	237	640	0.370	0.256	0.63	245%
15.2%	18	84.8%	101	45%	223	640	0.349	0.256	0.60	236%
20%	24	80%	95	45%	211	640	0.329	0.256	0.59	229%
30%	36	70%	83	45%	184	640	0.288	0.256	0.54	212%

7.6% project mitigation = ExA's recommendation

15.2% project mitigation = Secretary of State's preferred option.

Based on Orfordness data submitted during the examination:

- The population of LBBG at Orfordness was 640 pairs in 2012. This figure was selected rather than an average to allow for a slight upward trend in recent years.
- The baseline productivity is taken as 0.256 fledged chicks per pair, based on RSPB field data, an average of the most recent three years to 2011.
- LBBG take four years to reach adulthood
- An annual survival rate of 82%, equating to 45% fledged chicks becoming adults
- 100% of a predicted 119 collisions to be mitigated by a dual approach (project and SPA site)

B. Project mitigation

7.17 As set out in paragraph 7.1, two types of project mitigation were discussed during the examination, namely, restrictions on turbine specification to favour a smaller number of turbines and the exclusion of turbines from part of the wind farm footprint currently supporting higher levels of commercial fishing. These are described below, alongside the ExA's recommendations**.**

(i) Restrictions on turbine specifications/number of turbines

7.18 This form of mitigation could involve a reduction in the number of turbines, of the total area swept by the rotor blades and/or changes to the height of the turbine blades though choice of turbine type. The assessment of collision risk undertaken by the Applicant has been based on a "worst realistic case scenario" using the Rochdale Envelope approach as described in paragraphs 2.11 - 2.16. This is for 140 turbines of 3.6MW each - assuming that the wind farm is to be built out to its maximum installed capacity (504MW). If higher capacity machines are selected, then fewer will be required to achieve this capacity. However, the Applicant is unlikely to know which turbines are to be installed at GWF, until procurement exercises are undertaken, which would normally be post-consent, after project finance is secured.

7.19 The Applicant has set out a post-consent process whereby it would apply to the Secretary of State for approval of the turbine type, the maximum number and minimum clearance to be approved under the DCO, once this information is known. It is then proposed that the Secretary of State would consult with NE to confirm whether the required percentage reduction in collisions would be met. Assuming this to be the case, the Secretary of State would issue a formal approval that would take place under the DCO, allowing the Applicant to proceed with the project.

7.20 As set out in paragraph 7.15, the Secretary of State considers that a 15.2% project reduction needs to be achieved by the Applicant through its selection of a turbine type / number of turbines, so that the wind farm performs better than its Rochdale Envelope "worst realistic case scenario" for bird collisions. This option should allow the Applicant the option of building out the project to its full capacity, albeit with a smaller number of larger turbines. The Applicant would also have the option of using smaller turbines, but may not be able to meet the maximum installed capacity of the site, with a percentage reduction applied. The Secretary of State would wish to see revised CRM modelling undertaken in light of the actual turbine type and number proposed to be installed.

(ii) Turbine exclusion area (Area B)

7.21 The ExA recommends that the Area B turbine exclusion zone would contribute generally to a reduction in LBBG mortality and also reduce adverse impacts on fishing. It recommends that this be included within the DCO and DML on the basis that it will give added confidence to the Secretary of State's conclusions on predicted LBBG mortalities. The exclusion area would not,

however, be credited with making a quantifiable contribution to mitigation, but would provide the Secretary of State with "greater comfort."

7.22 As set out in paragraph 5.18, the Applicant has put forward a case for a 15% or greater collision reduction to be associated with the turbine exclusion area, whilst NE indicates that it would not support the inclusion of the turbine exclusion area, if a quantifiable contribution to project mitigation were to be assigned to it. NE's reasoning is on the basis that a meaningful percentage reduction in LBBG collisions cannot be attributed to the measure in the absence of information on the amount of flight activity in the proposed exclusion zone.

7.23 The Secretary of State appreciates the different perspectives of the interested parties and the need for robustness in Habitats Directive decisions in the face of uncertainties associated with the marine environment in general and also in predicting the behaviour of wide-ranging species to environmental change. However, in this instance, he considers it unnecessary to restrict GWF by imposing the Area B turbine exclusion area. He notes that, were he to assign a quantifiable collision reduction value to this mitigation, it would be contrary to the advice of NE.

7.24 Bearing in mind that he has imposed a higher level of project mitigation, as regards turbine restrictions, than recommended by the ExA, he considers that it is unnecessary to require the additional Area B turbine exclusion area. It is Secretary of State's view that the Applicant should, therefore, be permitted to build in the proposed turbine exclusion area, provided that the 15.2% project mitigation is achieved, in combination with the SPA site mitigation measures, as set out the unilateral undertaking. The Secretary of State is confident that this combination of measures will be sufficient to mitigate the predicted LBBG collisions, without the need for additional comfort from further project restrictions.

7.25 The potential impact of GWF on commercial fishing operations are beyond the scope of this assessment.

C. Grampian–style flexibility on project mitigation

7.26 The ExA proposes that flexibility is included in the DCO for the project mitigation. This would, in theory, enable the Applicant to discharge both forms of project mitigation requirements post-consent, subject to the provision of suitably convincing evidence of absence of impact on the integrity of the Alde-Ore Estuary SPA / Ramsar.

(i) Restriction on turbine specifications/number of turbines

7.27 The ExA recommends that the Applicant be allowed to reduce the percentage reduction requirement by providing suitable evidence to the Secretary of State on:

- growth over a minimum of three years of the LBBG breeding population at the SPA in relation to its conservation objectives;
- the performance of other mitigation measures required in the DCO / DML or secured by the unilateral undertaking; and

- that the operation of the development has been shown to be effective in fully offsetting the level of additional mortality that is predicted and assessed to have occurred as a result of the project.

7.28 The Secretary of State welcomes research that may contribute to better understanding of bird behaviour in response to wind farms, however, he is mindful of what may be lawful, reasonable and practical to include in a DCO requirement. Whilst such monitoring may form part of a useful evidence base, the Secretary of State considers that it is inappropriate to use such monitoring as a form of control on development and has concerns about the reasonableness and enforceability of this requirement. He is also mindful of the variety of other factors in the wider environment, such as food availability, that may influence future LBBG population levels and be difficult to distinguish from the impact of GWF and other offshore wind farms.

7.29 Therefore, whilst the Secretary of State is, in general, supportive of a flexible approach for the consenting of renewable energy projects, in line with his responsibilities under NPS (EN-3), in this instance he does not accept the ExA's recommendation, as he does not have confidence that sufficiently robust data would be gathered to justify the use of such a Grampian-style requirement. He also wishes to maintain certainty on the delivery of mitigation measures.

Turbine exclusion area (Area B)

7.30 As set out in paragraph 7.24, the Secretary of State will not be requiring the applicant to exclude turbines from Area B. For this reason, the ExA's proposed Grampian-style requirement (to potentially allow turbines on the Area B Exclusion Zone at some future point) is no longer relevant.

Conclusions on mitigation

7.31 In summary, the Secretary of State, supports the principle put forward by the ExA of a dual approach to mitigation that comprises both SPA site and project-based measures. These would be needed to mitigate all potential 119 LBBG collisions per annum, given the unfavourable declining status of the birds. On the basis of recent trial plot data indicating a range of chick productivities in the range 0.5-0.7 fledged chicks per breeding pair at Orfordness, he considers it reasonable that 0.6 fledged chicks/pair can be achieved with the developer-funded package of mitigation measures in place including its associated monitoring and adaptive feedback mechanisms at the SPA colony.

7.32 This would require an 84.8% contribution from SPA site-based measures and a corresponding 15.2% from project mitigation, comprising restrictions to turbine specification and numbers compared to the "worst-case realistic scenario" used in the Rochdale Envelope and CRM modelling. This is twice the amount of project mitigation that is recommended by the ExA, which the Secretary of State considers necessary given the uncertainty surrounding future chick productivity and survival at the SPA. He is also mindful of the fact that the PVA models are more influenced by adult survival than by chick productivity and of evidence demonstrating

that LBBG productivity levels are known to vary significantly, for reasons that are often not fully understood.

7.33 The ExA has recommended the inclusion of further mitigation in the form of a turbine exclusion area and suggests that this should be included in the DCO to give the Secretary of State additional comfort as regards potential impacts on LBBG and also for reasons of commercial fishing. The Secretary of State is content that the 15.2% project mitigation, coupled with the SPA management measures are sufficient for him to have confidence in his conclusions of no adverse effect on site integrity. He considers it is unnecessary to impose further mitigation requirements on the Applicant.

7.34 The ExA has recommended a “Grampian-style” requirement that could allow the Applicant the possibility of discharging both forms of project mitigation on the basis of providing suitable information on the success of the colony, on SPA site mitigation and the results of studies on the actual level of collisions experienced by LBBG at the constructed GWF. Whilst welcoming a better understanding of these issues, the Secretary of State considers it inappropriate to include this as a legal requirement in the DCO, given the difficulty he anticipates in lawfully discharging this proposed requirement.

8 CONCLUSIONS ON SITE INTEGRITY - SUMMARY

8.1 Based on the environmental information submitted during the examination, the ExA's report and published data from other sources, the Secretary of State is satisfied that sufficient information is available to enable him to carry out an AA which sets out the relevant matters covered in Regulation 61 of the Habitats Regulations and Regulation 25 of the 2007 Offshore Regulations.

Project alone

8.2 The Secretary of State considers that there will be no adverse effects on the integrity of the Alde-Ore Estuary SPA / Ramsar site as a result of the project alone, including all mitigation, and that this is the only site where a likely significant effect is predicted.

8.3 The Secretary of State agrees with the recommendation from the ExA and NE's advice as regards the risk to LBBG as a result of collisions with operational turbines. Whilst the Applicant's HRA predicts an annual 44 mortalities as a result of collisions, the Secretary of State cannot rule out the possibility that additional mortality could be of the order of 119 birds per annum as a result of the project alone, based on a 98% avoidance rate. He considers that this this figure (119 potential collisions/annum) has been derived on a suitably precautionary basis to assess the possible impacts of GWF on the conservation objectives of the Alde-Ore Estuary SPA / Ramsar.

8.4 The Secretary of State agrees with the ExA and NE that all predicted collision mortalities need to be mitigated in order to confidently reach a conclusion of no adverse impacts on the SPA, given the unfavourable declining status of LBBG breeding colonies at the SPA. The Secretary of State has included robust requirements in the DCO to secure aspects of this mitigation relating to the GWF project and has confidence in the unilateral undertaking by the Applicant to deliver the required SPA site-based mitigation.

Project in combination with other wind farms

8.5 The Secretary of State considers that there will be no adverse effects on the integrity of the Alde-Ore Estuary SPA / Ramsar site as a result of the project alone and in combination with other plans and projects. Given the extensive foraging range of LBBG (recent research indicates a mean maximum of around 141 km) birds from the Alde-Ore Estuary SPA / Ramsar are likely to be at risk of collision with an additional 23 offshore wind farms from as far away as Belgium and the Netherlands. The Applicant predicts that this could result in an in combination mortality of around 135 SPA birds per annum, based on a 99% avoidance rate. NE advises that a figure of 357 is more likely. It has estimated this by scaling up the 135 figure to account for a 98% avoidance rate and other refinements undertaken by the Applicant, which it does not consider to be suitably precautionary.

Mitigation

8.6 The Secretary of State supports the principle put forward by the ExA of a dual approach to mitigation that comprises both SPA site and project-based measures. On the basis of recent

trial plot data, he considers it reasonable that 0.6 fledged chicks/pair can be achieved at Orfordness with the developer-funded package of mitigation measures in place, on top of statutory measures required to be undertaken by NE to restore the site to favourable conservation status. These additional measures, such as predator control and breeding habitat improvements, would ensure that, as a minimum, an additional 101 adult birds would be "generated" at the SPA per annum during the 25-year operational life of the project. This would make an 84.8% contribution to mitigating the 119 collision casualties (101/119).

8.7 A corresponding 15.2% (18 bird) reduction would, therefore, be required from project-based mitigation measures i.e. post-consent refinements to turbine specifications and numbers. This requirement is contained in the DCO and would be discharged by a post-consent process, in consultation with NE. This is twice the amount of project mitigation than has been recommended by the ExA (7.6%/9 birds). The Secretary of State considers this necessary on the basis of evidence submitted during the examination on current and likely future chick productivity and survival at Orfordness and LBBG avoidance rates of wind farms. He is also mindful of the fact that the PVA models are more influenced by adult survival than by chick productivity and of evidence demonstrating that LBBG productivity levels, in general, show significant annual variability for reasons that are not fully understood.

8.8 The ExA has recommended the inclusion of further mitigation in the form of an Area B turbine exclusion area and suggests that this should be required to give the Secretary of State additional comfort as regards potential impacts on LBBG and also for reasons of mitigating impacts on commercial fishing operations. The Secretary of State is content that the 15.2% project mitigation, coupled with the SPA management measures are sufficient for him to have confidence in his conclusions of no adverse effect on site integrity. He considers it unnecessary to impose further mitigation requirements on the Applicant on habitats grounds and does not need additional comfort from further project restrictions. The potential impacts of GWF on commercial fishing operations are beyond the scope of this AA.

8.9 The ExA recommended that a requirement be included in the DCO that would have allowed the Applicant the possibility of amending the percentage reduction project mitigation on the basis of providing suitably convincing information on the success of the colony and studies on the actual level of collisions experienced by LBBG at the constructed GWF. Whilst welcoming a better understanding of these issues, the Secretary of State considers it inappropriate to include this in the DCO. As a consequence, the 15.2% project mitigation will remain fixed. A monitoring and adaptive feedback process for the breeding colony is contained within the unilateral undertaking. This will enable changes to the SPA management regime in response to new information on breeding success and chick productivity at the colony.

8.10 With the unilateral undertaking agreed and in place for additional management measures at the SPA and a project reduction of 15.2% contained within the DCO, the Secretary of State is confident that the additional mortality of 119 LBBG will be mitigated and he can safely conclude

that there will be no adverse impact on the Alde-Ore Estuary SPA/Ramsar as a result of the GWF project alone and in combination with other projects.

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