DOGGER BANK D WIND FARM

Preliminary Environmental Information Report

Volume 1
Chapter 13 Offshore and Intertidal Ornithology

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Glossary

Term	Definition
Additional Mitigation	Measures identified through the EIA process that are required as further action to avoid, prevent, reduce or, if possible, offset likely significant adverse effects to acceptable levels (also known as secondary (foreseeable) mitigation). All additional mitigation measures adopted by the Project are provided in the Commitments Register.
Bio-seasons	Bird behaviour and abundance is recognised to differ across a calendar year dependent upon the biological seasons (bio-seasons) that may be applicable to different seabird species. Separate bio-seasons are recognised in this Environmental Statement (ES) chapter in order to establish the level of importance any seabird species has within the offshore ornithology Study Area during any particular period of time.
Cumulative Effects	The effect of the Offshore Project taken together with similar effects from a number of different projects, on the same single receptor / resource. Cumulative impacts are those that result from changes caused by other past, present or reasonably foreseeable actions together with the Offshore Project.
Commitment	Refers to any embedded and additional mitigation, enhancement or monitoring measures identified through the EIA process and any commitments outside the EIA process. All commitments adopted by the Project are provided in the Commitment Register.
Department for Business, Energy and Industrial Strategy (BEIS)	The government department is responsible for business, industrial strategy, science and innovation and energy and climate change policy and consent under Section 36 of the Electricity Act.
Deemed Marine Licence (dML)	A consent required under the Marine and Coastal Access Act 2009 for certain activities undertaken within the UK marine area, which may be granted as part of the Development Consent Order.
Designated / Qualifying Feature	A species for which a protected site is designated due to containing a nationally or internationally important population.
Development Consent Order (DCO)	A consent required under Section 37 of the Planning Act 2008 to authorise the development of a Nationally Significant Infrastructure Project, which is granted by the relevant Secretary of State (SoS) following an application to the Planning Inspectorate.
Effect	An effect is the consequence of an impact when considered in combination with the receptor's sensitivity / value / importance, defined in terms of significance.

Term	Definition
Embedded Mitigation	Embedded mitigation includes: • Measures that form an inherent part of the project design evolution such as modifications to the location or design of the development made during the pre-application phase (also known as primary (inherent) mitigation); and • Measures that will occur regardless of the EIA process as they are imposed by other existing legislative requirements or are considered as standard or best practice to manage commonly occurring environmental impacts (also known as tertiary (inexorable) mitigation). All embedded mitigation measures adopted by the Project are provided in the Commitments Register.
Enhancement	Measures committed to by the Project to create or enhance positive benefits to the environment or communities. All enhancement measures adopted by the Project are provided in the Commitments Register.
Environmental Impact Assessment (EIA)	A process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information and includes the publication of an Environmental Statement.
Environmental Statement (ES)	A document reporting the findings of the EIA which describes the measures proposed to mitigate any likely significant effects.
Evidence Plan Process (EPP)	A voluntary consultation process with technical stakeholders via Expert Topic Group (ETG) meetings to encourage upfront agreement on the nature, volume and range of supporting evidence required to inform the EIA and Habitat Regulation Assessment (HRA) process.
Expert Topic Group (ETG)	A forum for targeted technical engagement with relevant stakeholders through the EPP.
Highest Astronomical Tide (HAT)	The highest level of tide that can be predicted to occur under average meteorological conditions and any combination of astronomical conditions.
Horizontal Directional Drilling (HDD)	A type of trenchless cable or duct installation method (see the definition for Trenchless Techniques).
Impact	A change resulting from an activity associated with the Project, defined in terms of magnitude.
In-combination Effects	In-combination effects relate to when a species is assessed for more than one impact that may occur simultaneously and interact. For example, when a species is assessed for both collision risk and displacement impacts.
Inter-Array Cables	Cables which link the wind turbines to the Offshore Platform(s).

Term	Definition
Landfall Area	The point on the coastline at which the offshore export cables are brought onshore, connecting to the onshore cables at the transition joint bays above Mean High Water Springs.
Mean High Water Springs (MHWS)	MHWS is the average of the heights of two successive high waters during a 24-hour period.
Mean Low Water Springs (MLWS)	MLWS is the average of the heights of two successive low waters during a 24-hour period.
Mitigation	Any action or process designed to avoid, prevent, reduce or, if possible, offset potentially significant adverse effects of a development. All mitigation measures adopted by the Project are provided in the Commitments Register.
Monitoring	Measures to ensure the systematic and ongoing collection, analysis and evaluation of data related to the implementation and performance of a development. Monitoring can be undertaken to monitor conditions in the future to verify any environmental effects identified by the EIA, the effectiveness of mitigation or enhancement measures or ensure remedial action are taken should adverse effects above a set threshold occur. All monitoring measures adopted by the Project are provided in the Commitment Register.
Offshore Development Area	The area in which all offshore infrastructure associated with the Project will be located, including any temporary works area during construction, which extends seaward of Mean High Water Springs. There is an overlap with the Onshore Development Area in the intertidal zone.
Offshore Export Cable Corridor (ECC)	The area within which the offshore export cables will be located, extending from the Dogger Bank D Offshore Wind Farm Array Area to Mean High Water Springs at the landfall.
Offshore Export Cables	Cables which bring electricity from the Offshore Platform(s) to the transition joint bays at landfall.
Offshore Infrastructure	All of the offshore infrastructure including wind turbines, substructures, mooring lines, seabed anchors, Offshore Substation Platform and all cable types (export and inter-array). This encompasses the infrastructure that is the focus of this application and ES and the parts of the Offshore Project consented under Section 36 of the Electricity Act and the Marine and Coastal Access Act 2009.

Term	Definition
Offshore Platform(s)	Fixed structures located within the DBD Array Area that contain electrical equipment to aggregate and, where required, convert the power from the wind turbines, into a more suitable voltage for transmission through the export cables to the onshore converter station(s). Such structures could include (but are not limited to): Offshore Converter Station(s) Collector Platform(s). This also includes a Switching Station to enable coordination as an Offshore Hybrid Asset Platform. This combines infrastructure for offshore electricity generation with an interconnector to facilitate the transfer of electricity generated by the Project between different countries.
Project Design Envelope	A range of design parameters defined where appropriate to enable the identification and assessment of likely significant effects arising from a project's worst-case scenario. The project design envelope incorporates flexibility and addresses uncertainty in the DCO application and assessed during the EIA process.
Receptor	A species present in the intertidal or offshore environment which may be impacted by the Project.
Scoping Opinion	A written opinion issued by the Planning Inspectorate on behalf of the SoS regarding the scope and level of detail of the information to be provided in the Applicant's ES. The Scoping Opinion for the Project was adopted by the SoS on 02 August 2024.
Scoping Report	A request by the Applicant made to the Planning Inspectorate for a Scoping Opinion on behalf of the Secretary of State. The Scoping Report for the Project was submitted to the SoS on 24 June 2024.
Scour Protection	Protective materials to avoid sediment erosion from the base of the wind turbine foundations and offshore substation platform foundations due to water flow.
The Applicant	SSE Renewables and Equinor acting through 'Doggerbank Offshore Wind Farm Project 4 Projco Limited'.
The Project	Dogger Bank D Offshore Wind Farm Project, also referred to as DBD in this PEIR.
Transition Joint Bays (TJB)	Underground structures at landfall that house the joints between the offshore and onshore export cables.
Trenchless Techniques	Trenchless cable or duct installation methods used to bring offshore export cables ashore at landfall, facilitate crossing major onshore obstacles such as roads, railways and watercourses and where trenching may not be suitable. Trenchless techniques included in the Project Design Envelope include Horizontal Directional Drilling (HDD), auger boring, micro-tunnelling, pipe jacking / ramming and Direct Pipe.

Term	Definition
Wind Turbines	Power generating devices located within the DBD Array Area that convert kinetic energy from wind into electricity.

13 Offshore and Intertidal Ornithology

13.1 Introduction

1. This chapter of the Preliminary Environmental Information Report (PEIR) presents the preliminary results of the Environmental Impact Assessment (EIA) of Dogger Bank D Offshore Wind Farm (hereafter 'the Project' or 'DBD') on offshore and intertidal ornithology receptors.

2. **Chapter 4 Project Description** provides a description of the design of infrastructure components and construction, operation and maintenance, and decommissioning activities for DBD presented in **Section 4.6** and **Section 4.7**.

3. The primary purpose of the PEIR is to support the statutory consultation activities required for a Development Consent Order (DCO) application under the Planning Act 2008. The information presented in this PEIR chapter is based on the baseline characterisation and assessment work undertaken to date. The feedback from the statutory consultation will be used to inform the final project design where appropriate and presented in an Environmental Statement (ES), which will be submitted with the DCO application.

4. This PEIR chapter:

- Describes the baseline environment relating to offshore and intertidal ornithology;
- Presents an assessment of the likely significant effects on offshore and intertidal ornithology during the construction, operation, and decommissioning phases of the Project;
- Identifies any assumptions and limitations encountered in compiling the environmental information; and
- Sets out proposed mitigation measures to avoid, reduce or offset potential adverse environmental effects identified during the EIA process and, where relevant, monitoring measures or enhancement measures to create or enhance positive effects.

5. This chapter should be read in conjunction with the following related chapters. Inter-relationships are discussed further in **Section 13.10.1**:

- **Chapter 10 Benthic and Intertidal Ecology**;
- **Chapter 11 Fish and Shellfish Ecology**; and
- **Report to Inform Appropriate Assessment (RIAA)** (document reference 5.3).

6. Additional information to support the offshore and intertidal ornithology assessment includes:

- **Volume 2, Appendix 13.1 Consultation Responses for Offshore and Intertidal Ornithology**;
- **Volume 2, Appendix 13.2 Offshore Ornithology Baseline Characterisation Report**;
- **Volume 2, Appendix 13.3 Offshore Collision Risk Modelling (CRM) Report**;
- **Volume 2, Appendix 13.4 Offshore Displacement Analysis Report**; and
- **Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation**.

13.2 Policy and Legislation

13.2.1 National Policy Statements

7. Planning policy on energy Nationally Significant Infrastructure Projects is set out in the National Policy Statements (NPS). The following NPS are relevant to the offshore and intertidal ornithology assessment:

- Overarching NPS for Energy (EN-1) (Department for Energy Security and Net Zero (DESNZ), 2023a); and
- NPS for Renewable Energy Infrastructure (EN-3) (DESNZ, 2023b).

8. The offshore and intertidal ornithology chapter has been prepared with reference to specific requirements in the above NPS. The relevant parts of the NPS are summarised in **Table 13-1**, along with how and where they have been considered in this PEIR chapter.

Table 13-1 Summary of Relevant National Policy Statement Requirements for Offshore and Intertidal Ornithology

NPS Reference and Requirement	How and Where Considered in the PEIR
NPS for Energy (EN-1)	
Paragraph 5.4.17: "The applicant should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England), on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats."	As detailed within **Section 13.5.3**, conservation value has been appropriately accounted for within assessments presented within **Section 13.6.4** onwards. Additionally, specific assessment against internationally designated site and features for ornithological features is considered within the **RIAA (**document reference: 5.3**)**.
Paragraph 5.4.22: "The design of energy NSIP proposals will need to consider the movement of mobile / migratory species such as birds, fish and marine and terrestrial mammals and their potential to interact with infrastructure. As energy infrastructure could occur anywhere within England and Wales, both inland and onshore and offshore, the potential to affect mobile and migratory species across the UK and more widely across Europe (transboundary effects) requires consideration, depending on the location of development."	Consideration of the potential for significant effects on all offshore and intertidal ornithological receptors with connectivity to the Project are considered throughout this chapter as appropriate.
Paragraph 5.4.35: "Applicants should include appropriate avoidance, mitigation, compensation and enhancement measures as an integral part of the proposed development. In particular, the applicant should demonstrate that: • during construction, they will seek to ensure that activities will be confined to the minimum areas required for the works • the timing of construction has been planned to avoid or limit disturbance during construction and operation best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements • habitats will, where practicable, be restored after construction works have finished • opportunities will be taken to enhance existing habitats rather than replace them, and where practicable, create new habitats of value within the site landscaping proposals. Where habitat creation is required as mitigation, compensation, or enhancement, the location and quality will be of key importance. In this regard habitat creation should be focused on areas where the most ecological and ecosystems benefits can be realised. • mitigations required as a result of legal protection of habitats or species will be complied with.	Consideration of mitigation measures adopted by the Project relevant to ornithological receptors is provided in **Section 13.4.3**.
NPS for Renewable Energy Infrastructure (EN-3)	
Paragraph 3.8.115: "Applicants must undertake a detailed assessment of the offshore ecological, biodiversity and physical impacts of their proposed development, for all phases of the lifespan of that development, in accordance with the appropriate policy for offshore wind farm EIAs, Habitat Regulation Assessments (HRAs) and Marine Conservation Zone (MCZ) assessments."	Consideration of the potential for significant effects (both positive and negative) on ornithological receptors is considered throughout this chapter as appropriate for all phases of the Project, in line with appropriate policy as set out in this section.
Paragraph 3.8.117: "Applicants should assess the potential of their proposed development to have net positive effects on marine ecology and biodiversity, as well as negative effects."	
Paragraph 3.8.118: "Applicants should consult at an early stage of pre-application with relevant statutory consultees, as appropriate, on the assessment methodologies, baseline data collection, and potential avoidance, mitigation and compensation options should be undertaken."	Prior to drafting of this chapter, the Applicant has engaged with key stakeholders to discuss assessment methodologies, baseline data collection, and potential avoidance, mitigation and compensation options as outlined within **Section 13.3** and through the ETG Meetings ETG4: Offshore Ornithology Compensation meetings. See **Chapter 7 Consultation** for further information.

NPS Reference and Requirement	How and Where Considered in the PEIR
Paragraph 3.8.120: "Any relevant data that has been collected as part of post-construction ecological monitoring from existing, operational offshore wind farms should be referred to where appropriate."	The results of post-construction monitoring from Offshore Wind Farm (OWF) developments for key receptors is summarised in **Section 13.6.4** for displacement and collision risk. Such information has been utilised by the Applicant to inform the approach for assessment and provide context to the certainty and confidence of effects predicted for the Project.
Paragraph 3.8.121: "A range of research programmes are ongoing to investigate impacts of offshore wind farm development, including, but not limited to: Department for Business, Energy and Industrial Strategy (BEIS) Strategic Environmental Assessment (SEA) Research Programme, Offshore Renewables Joint Industry Programme (ORJIP), Scottish Marine Energy Research (ScotMER), the Offshore Renewable Energy (ORE) Catapult and Offshore Wind Evidence and Change Programme (OWEC). Applicants should explain why their decisions on siting, design, and impact mitigation are proportionate and well-targeted, referring to relevant scientific research and literature."	Due consideration has been provided to the results of relevant scientific research and literature aimed at investigating the potential impacts from OWF on ornithological receptors within this chapter. Such literature has been used, and referenced, to inform the Applicant's approach to impact assessments presented within this chapter.
Paragraph 3.8.150: "Currently, cumulative impact assessments for ornithology are based on the consented Rochdale Envelope parameters of projects, rather than the 'as-built' parameters, which may pose a lower risk to birds."	Cumulative assessments presented within **Section 13.8** are based on the consented Rochdale Envelope parameters of projects, with the exception of where projects have undergone amendments to their applications for reduced parameters and ornithological impacts.
Paragraph 3.8.156: "Applicants should discuss the scope, effort and methods required for ornithological surveys with the relevant statutory advisor, taking into consideration baseline and monitoring data from operational windfarms."	As summarised within **Section 13.3**, the Project had engaged with key stakeholders discussing key elements such as baseline data collection and approach to assessment for PEIR.
Paragraph 3.8.157: "Applicants must undertake CRM, as well as displacement and population viability assessments for certain species of birds. Advice can be sought from Statutory Nature Conservation Bodies (SNCBs)."	The Project has undertaken CRM and displacement analysis in accordance with relevant best practice guidance (SNCBs 2022 & 2024) with impact predictions appropriately assessed within **Section 13.6.4** for the Project alone and **Section 13.8** cumulatively with other plans and projects. Project specific Population Viability Analysis (PVA) has not been completed for PEIR, though will be used where required to further conclude significance of predicted effects at ES stage.
Paragraph 3.8.158: "Where necessary, applicants should assess collision risk using survey data collected from the site at the pre-application EIA stage."	The Project has used site-specific Digital Aeiral Survey (DAS) data to inform monthly predicted density estimates for CRM of key seabirds, as detailed within **Volume 2, Appendix 13.3 Offshore Collision Risk Modelling Report**.
Paragraph 3.8.257: "Applicants should undertake a review of up-to-date research and all potential mitigation options presented. Aviation and navigation lighting should be minimised and / or on demand (as encouraged in EN-1 Section 5.5) to avoid attracting birds, taking into account impacts on safety. Subject to other constraints, wind turbines should be laid out within a site, in a way that minimises collision risk."	Consideration of mitigation measures adopted by the Project relevant to ornithological receptors is provided in **Section 13.4.3**.
Paragraph 3.8.258: "Turbine parameters should also be developed to reduce collision risk where the assessment shows there is a significant risk of collision (e.g. altering rotor height)."	

13.2.2 Other Policy and Legislation

9. Other policy and legislation relevant to the offshore and intertidal ornithology assessment is summarised in the following sections.

13.2.2.1 International

13.2.2.1.1 The Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the 'Ramsar Convention')

10. Under the Ramsar convention appropriate contracting parties can designate suitable wetlands within their territorial state for inclusion within the 'List of Wetlands of International Importance' for Wetlands with international significance in terms of ecology, botany, zoology, limnology or hydrology. the Ramsar Convention states that "*where a Contracting Party in its urgent national interest, deletes or restricts the boundaries of a wetland included in the List, it should as far as possible compensate for any loss of wetland resources, and in particular it should create additional nature reserves for waterfowl and for the protection, either in the same area or elsewhere, of an adequate portion of the original habitat*".

11. There is potential for designated ornithological features of Ramsar sites to interact with the Project whilst undertaking migratory flights between breeding and overwintering areas. The Project therefore poses a potential collision risk to such features. Consideration of the potential for collision risk at an EIA level to migratory species is considered within **Section 13.6.4**, whilst specific consideration to individual Ramsar sites where the potential for a likely significant effect cannot be ruled out is provided within the **RIAA** (document reference 5.3).

13.2.2.1.2 The Convention on the Conservation of Migratory Species of Wild Animals (the 'Bonn Convention')

12. The Bonn Convention provides for contracting parties to collaborate with the aim of conserving endanger migratory species (listed within Appendix I of the Convention) and functionally linked habitat via international cooperation.

13. There is potential for the Project to pose a risk of collision to such designated species under the Bonn Convention whilst undertaking migratory flights between breeding and overwintering areas. The Project therefore poses a potential collision risk to such features. Consideration of the potential for collision risk at an EIA level to migratory species is considered within **Section 13.6.4**.

13.2.2.1.3 The Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention')

14. The Bern Convention aims to ensure conservation and protection of wild plant and animal species and their natural habitats (listed in Appendices I and II of the Convention). It also aims to increase cooperation between contracting parties and regulate the exploitation of those species (including migratory species) listed in Appendix III.

15. There is potential for the Project to affect bird species which are protect under the Bern Convention. The potential effects on birds protected under the Bern Convention are assessed within **Section 13.6.4**.

13.2.2.2 National

13.2.2.2.1 The Conservation of Habitats and Species (Amendment) (European Union (EU) Exit) Regulations 2019 (known as the 'Habitats Regulations')

16. Following the UK's departure from the EU, the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (known as the 'Habitats Regulations') came into force at the end of the EU-UK transition period on 31 December 2020, replacing the 2017 Habitats Regulations. The 2019 Habitats Regulations delegates functions from the European Commission to the appropriate authorities within the UK, with all the processes or terms unchanged. The 2019 Habitats Regulations transpose aspects of the Birds Directive and the Habitats Directive into national law, covering all environments out to 12nm. The Habitats Regulations place an obligation on the 'competent authority' to carry out an appropriate assessment of any proposal likely to affect a designated site (Special Protection Area (SPA) in relation to bird species), to seek advice from Natural England and / or Joint Nature Conservation Committee (JNCC), and not to approve an application that would have an adverse effect (except under very tightly constrained conditions that involve decisions by the Secretary of State (SoS).

17. There is the potential for the Project to affect ornithological features of designated sites afforded protection under the Habitats Regulations. Consideration of the potential effects from the Project at an EIA level are presented within **Section 13.6.4**, whilst specific consideration to individual designated sites where the potential for a likely significant effect cannot be ruled out is provided within the **RIAA** (document reference 5.3).

18. Where there is the risk of a potential significant effect the Project will ensure mitigation or compensation measures are considered further to ensure an overall residual effect of non-significance.

13.2.2.2.2 The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) (known as the 'Offshore Marine Regulations')

19. The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) (known as the 'Offshore Marine Regulations') provide similar provisions to the 2017 Habitats Regulations in the offshore environment beyond 12 nm throughout the UK.

13.2.2.2.3 The Wildlife and Countryside Act 1981 (as amended)

20. The Wildlife and Countryside Act 1981 operates in conjunction with the Habitats Regulations and is the principal mechanism for the legislative protection of wildlife in the UK. It provides protection for all wild birds with the few exceptions being provided by a licensing system. The act establishes the system of site protection for species and habitats through the notification of a suite of Sites of Special Scientific Interest (SSSI). The SSSI designation underpins the protection provided for SPAs and Special Areas of Conservation (SACs) on land and down to Mean Low Water Springs (MLWS). The Wildlife and Countryside Act 1981 has also been amended following EU withdrawal so that species of wild birds found in or regularly visiting either the UK or the European territory of a Member State will continue to be protected on land and in intertidal areas down to MLWS.

21. There is the potential for the Project to affect ornithological features of designated sites afforded protection under the Wildlife and Countryside Act. Consideration of the potential effects from the Project at an EIA level are presented within **Section 13.6.4**, whilst specific consideration to individual designated sites where the potential for a likely significant effect cannot be ruled out is provided within the **RIAA** (document reference 5.3).

22. Where there is the risk of a potential significant effect the Project will ensure mitigation or compensation measures are considered further to ensure an overall residual effect of non-significance.

13.3 Consultation

23. Topic-specific consultation in relation to offshore and intertidal ornithology has been undertaken in line with the process set out in **Chapter 7 Consultation**. A Scoping Opinion from the Planning Inspectorate was received on 2nd August 2024, which has informed the scope of the assessment presented within this chapter (as outlined in **Section 13.4.2**), with responses addressed in **Volume 2, Appendix 13.1 Consultation Responses for Offshore and Intertidal Ornithology**.

24. Feedback received through the ongoing Evidence Plan Process (EPP) in relation to Expert Topic Group (ETG) meetings and wider technical consultation meetings with relevant stakeholders has also been considered in the preparation of this chapter. Details of technical consultation undertaken to date on offshore and intertidal ornithology are provided in **Table 13-2**.

Table 13-2 Technical Consultation Undertaken to Date on Offshore and Intertidal Ornithology

Meeting	Stakeholder(s)	Date(s) of Meeting / Frequency	Purpose of Meeting
ETG Meetings			
ETG6 (Onshore Ecology, Ornithology and Land Use)	• Natural England; • East Riding of Yorkshire Council; and • RSPB.	14/09/2023	• Discussion on approach to intertidal ornithology data gathering.
ETG2 (Offshore and Intertidal Ornithology) Meeting No. 1	• Natural England; • Marine Management Organisation (MMO); and • Hull City Council.	25/10/2023	• Approach to PEIR; • Offshore export cable corridor (ECC) assessment; • CRM and input parameters; • Displacement analysis; • Cumulative assessment; and • Seasonal definitions.
ETG2 (Offshore and Intertidal Ornithology) Meeting No. 2	• Natural England; • Royal Society for the Protection of Birds (RSPB); and • CEA Environmental.	23/05/2024	• Baseline data and detail on displacement sensitive species and collision sensitive species; • Guidance queries; and • HRA Apportionment.
ETG6 (Onshore Ecology, Ornithology and Land Use)	• Natural England; • East Riding of Yorkshire Council; and • RSPB	2/10/2024	• Confirm agreement with approach to intertidal ornithology data gathering.

Meeting	Stakeholder(s)	Date(s) of Meeting / Frequency	Purpose of Meeting
ETG2 (Offshore and Intertidal Ornithology) Meeting No. 3	• Natural England; • MMO; • RSPB; and • CEA Environmental.	21/10/2024	• 5 Year data vintage; • Intertidal ornithology data gathering and approach to assessment; • CRM; • Displacement assessment; • Cumulative assessment; • HPAI review; • Assessment of Greater Wash SPA; and • Scoping responses.
NatureScot introductory call	• NatureScot.	14/10/2024	• Project introduction; • Impact assessments to date; and • Kittiwakes on oil and gas platforms.
Other Technical Consultation			
Natural England Discretionary Advice Service	• Natural England.	11/08/2023	• Confirm methodology of overwintering and passage bird surveys.
Natural England Discretionary Advice Service	• Natural England.	04/11/2024	• Baseline data; • Intertidal ornithology; • Asymmetrical buffer; • White-billed diver (*Gavia adamsii*) and great northern diver (*Gavia immer*) assessment; and • Avian flu.

25. **Volume 2, Appendix 13.1 Consultation Responses for Offshore and Intertidal Ornithology** summarises how consultation responses received to date are addressed in this chapter.

26. Following statutory consultation on the PEIR, this chapter will be updated in full consideration of stakeholder feedback, and refinements to the Project's design envelope. The final results of the EIA will be presented in the ES. Full details of consultation undertaken throughout the EIA process will be presented in **Volume 2, Appendix 13.1 Consultation Responses for Offshore and Intertidal Ornithology**, which will be submitted with the DCO application.

13.4 Basis of the Assessment

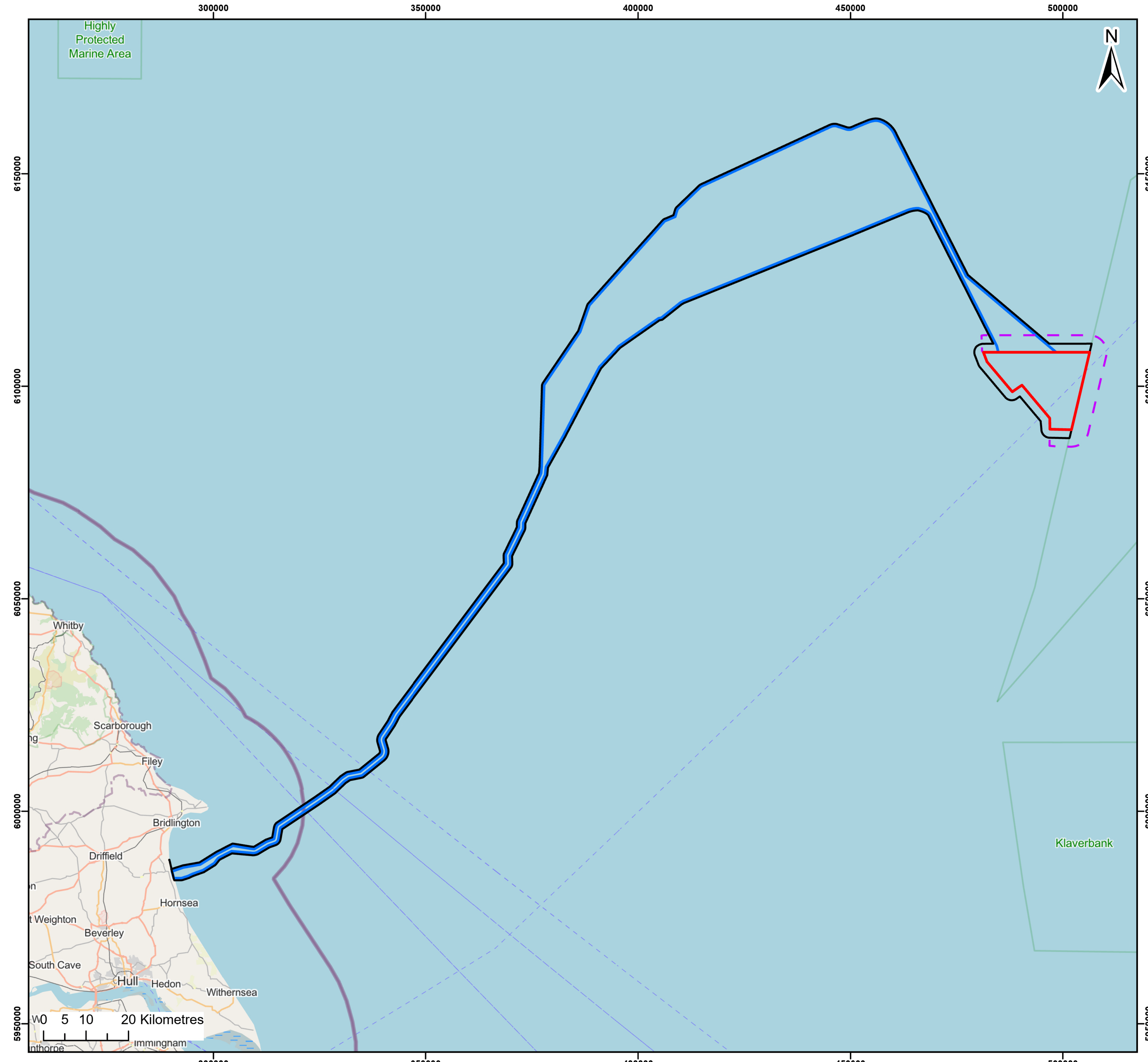
27. The following sections establish the basis of the assessment of likely significant effects, which is defined by the study area(s), assessment scope and realistic worst-case scenarios.

13.4.1 Study Area

28. The Offshore and Intertidal Ornithology Study Area has been defined as the Offshore Development Area together with the Zone of Influence (ZOI) for offshore ornithology. The ZOI for Offshore Ornithology is based on an area which is considered to represent a realistic maximum spatial extent of potential impacts on offshore ornithological receptors. The Study Area, and spatial scope, for the offshore ornithology assessment includes the Array Area with a 4km buffer, along with the offshore ECC (plus a 2km buffer) and overlaps with the Exclusive Economic Zone (EEZ). Justification around the choice of buffer is provided in **Volume 2, Appendix 13.4 Offshore Displacement Analysis Report**. The Study Area for Intertidal Ornithology is approximately from Ulrome in the north to Skirlington in the south, East Riding of Yorkshire, and includes the portion of the Onshore Development Area overlying intertidal habitat (Landfall, associated access routes) plus adjacent terrestrial and marine habitat.

29. Details of the location of the Project and the offshore elements (including the wind turbine sites operational footprint, Wind Turbine layout, inter-array cables and associated protection, and the spatial footprints of the construction or decommissioning works) are set out within **Chapter 4 Project Description**.

30. The Study Area for intertidal ornithology is presented in **Volume 2, Appendix 13.5 Intertidal Baseline Characterisation Report**. The Study Area for offshore ornithology is presented in **Figure 13-1**.



Legend:

- Dogger Bank D Array Area
- Offshore Development Area
- Offshore Export Cable Corridor
- Dogger Bank D plus 4km Asymmetrical Buffer

Project:

Dogger Bank D Offshore Wind Farm

DOGGER BANK WIND FARM

Title:

Offshore and Intertidal Ornithology Study Area

Figure:	13-1	Drawing No:	PC6250-RHD-XX-ON-DR-GS-0568

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
01	27/03/2025	AB	PT	A3	1:900,000

Co-ordinate system: WGS 1984 UTM Zone 31N

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13.4.2 Scope of the Assessment

13.4.2.1 Temporal Scope

31. The temporal scope of the assessment of offshore and intertidal ornithology is the entire lifetime of the Project, which therefore covers the construction, operation and maintenance, and decommissioning phases. The construction program is outlined within **Section 4.10** of **Chapter 4 Project Description**. The operational lifetime of the wind farm is currently expected to be 35 years and a decommissioning program will be required and agreed upon by the MMO and relevant authority prior to the Project construction.

13.4.2.2 Potential Receptors

32. Identification of the spatial and temporal scope of the assessment enables the identification of receptors which may experience a change as a result of the Project. As presented in **Volume 2, Appendix 13.2 Offshore Ornithology Baseline Characterisation Report** and **Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation Report** the following key receptors for offshore and intertidal ornithology were identified (**Table 13-3**), based on their presence within the Study Area during baseline surveys, desk study and wider literature review (**Section 13.6.4** identifies key receptors).

Table 13-3 Receptors Requiring Assessment for Offshore and Intertidal Ornithology

Receptor group	Receptors included within group
Bird species identified from site-specific offshore aerial digital surveys	• Great northern diver; • White-billed diver; • Kittiwake; • Lesser black-backed gull (*Larus fuscus*); • Herring gull (*Larus argentatus*); • Great black-backed gull (*Larus marinus*); • Guillemot (*Uria aalge*); • Razorbill (*Alca torda*); • Puffin (*Fratercula arctica*); and • Gannet (*Morus bassanus*).
Bird species identified through literature review, desk study and surveys in the intertidal area	• Red-throated diver (*Gavia stellata*); • Common scoter (*Melanitta nigra*); • Little gull (*Hydrocoloeus minutus*); • Common tern (*Sterna hirundo*); • Little tern (*Sternula albifrons*); • Sandwich tern (*Thalasseus sandvicensis*); • Sanderling (*Calidris alba*); and • Oystercatcher (*Haematopus ostralegus*)).
Migrating bird species and species groups identified with potential connectivity to the Study Area	• Based on literature review and recent projects within the southern North Sea, multiple migratory bird species are present and considered on the whole within migratory assessment.

13.4.2.3 Potential Effects

33. A number of impacts have been scoped out of the offshore and intertidal ornithology assessment. These impacts are outlined in **Volume 2, Appendix 6.2 Impacts Register**, along with supporting justification and are in line with the Scoping Opinion (discussed in **Section 13.3**) and the project description outlined in **Chapter 4 Project Description**.

34. Impacts scoped into the assessment relating to offshore and intertidal ornithology are outlined in **Table 13-4** and discussed further in **Section 13.7.**

35. A full list of impacts scoped in / out of the offshore and intertidal ornithology assessment is summarised in the Impacts Register provided in **Volume 2, Appendix 6.2 Impacts and Effects Register**. A description of how the Impacts and Effects Register should be used alongside the PEIR chapter is provided in **Chapter 6 Environmental Impact Assessment Methodology**.

Table 13-4 Offshore and Intertidal Ornithology – Impacts Scoped into the Assessment

Impact ID	Impact and Project Activity	Rationale
Construction		
ORN-C-01	Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall - intertidal and offshore from installation of offshore and landfall infrastructure	Disturbance and displacement reduce the amount of functional habitat available for foraging, resting and other activities and may therefore reduce survival or reproductive fitness of the birds involved.
ORN_C_02	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure - offshore (red-throated diver, gannet, auks) from installation of offshore and landfall infrastructure.	Disturbance and displacement reduce the amount of functional habitat available for foraging, resting and other activities and may therefore reduce survival or reproductive fitness of the birds involved.
ORN_C_05	Indirect impacts via habitats or prey availability - intertidal and offshore from construction activities e.g. installation of cables and foundations.	A reduction in prey availability may reduce the survival or reproductive fitness of the birds involved. Similarly, a reduction in size or quality of foraging habitat may reduce the survival or reproductive fitness of the birds involved. Reduction or degradation of foraging habitat may reduce prey availability with survival or fitness consequences as above. Reduction or degradation of resting habitat may affect daily energy budgets and reduce survival or reproductive fitness of the birds. Reduction or degradation of nesting habitat may reduce breeding success.
Operation and Maintenance		
ORN_O_01	Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall - intertidal and offshore from maintenance of wind turbines and other infrastructure.	Disturbance and displacement reduce the amount of functional habitat available for foraging, resting and other activities and may therefore reduce survival or reproductive fitness of the birds involved.
ORN_O_02	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure - offshore (red-throated diver, gannet, auks) from presence of wind turbines and other infrastructure.	Disturbance and displacement reduce the amount of functional habitat available for foraging, resting and other activities and may therefore reduce survival or reproductive fitness of the birds involved.
ORN_O_03	Barrier effect due to presence of wind turbines and other offshore infrastructure - offshore (including migratory non-seabirds) from presence of operational wind turbines.	A barrier effect increases energy expenditure involved in foraging or migratory movement and may reduce parental provisioning of dependent chicks. This may therefore reduce survival or reproductive fitness of birds involved.

Impact ID	Impact and Project Activity	Rationale	
ORN_O_05		Indirect impacts via habitats or prey availability - intertidal and offshore from presence of foundations in the seabed, cable / scour protection, pillars in the water column.	A reduction in prey availability may reduce the survival or reproductive fitness of the birds involved. Similarly, a reduction in size or quality of foraging habitat may reduce the survival or reproductive fitness of the birds involved. Reduction or degradation of foraging habitat may reduce prey availability with survival or fitness consequences as above. Reduction or degradation of resting habitat may affect daily energy budgets and reduce survival or reproductive fitness of the birds. Reduction or degradation of nesting habitat may reduce breeding success.
ORN_O_06		Collision risk - offshore (kittiwake, gannet, migratory non-seabirds) from presence of wind turbines.	Direct collisions with wind turbines are assumed to be fatal.
Decommissioning			
ORN_D_01	Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall - intertidal and offshore. Decommissioning activities not yet defined	Decommissioning impacts are scoped in; however, details of offshore decommissioning activities are not known at this stage. As discussed in **Section 13.7.3**, decommissioning impacts will be assessed in detail through the Offshore Decommissioning Programme (see **Table 13-5** Commitment ID CO21) where relevant, which will be developed prior to the commencement of offshore decommissioning works. In this assessment, it is assumed that most decommissioning activities would be the reverse of their construction counterparts, and that their impacts would be of similar nature to, and no worse than, those identified during the construction phase.	
ORN_D_02	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure - offshore (red-throated diver, gannet, auks). Decommissioning activities not yet defined		
ORN_D_05	Indirect impacts via habitats or prey availability - intertidal and offshore. Decommissioning activities not yet defined		

13.4.3 Embedded Mitigation Measures

36. The Project has made several commitments to avoid or reduce potential adverse environmental effects through mitigation measures embedded into the project design. These measures include actions that will be undertaken to meet other existing legislative requirements and those considered to be standard or best practice to manage commonly occurring environmental effects. The assessment of likely significant effects has therefore been undertaken on the assumption that these measures are adopted during the construction, operation and decommissioning phases. **Table 13-5** identifies proposed embedded mitigation measures that are relevant to the offshore and intertidal ornithology assessment.

37. Proposed commitments may evolve during the pre-application phase as the EIA progresses and in response to refinements to the Project's design envelope and stakeholder feedback. The final commitments will be confirmed in the Commitments Register submitted along with the DCO application.

38. Full details of all commitments made by the Project are provided within **Volume 2, Appendix 6.3 Commitments Register**. A description of how the Commitments Register should be used alongside the PEIR chapter is provided in **Chapter 6 Environmental Impact Assessment Methodology**.

13.4.4 Realistic Worst-Case Scenarios

39. To provide a precautionary, but robust, assessment at this stage of the Project's development process, a realistic worst-case scenario has been defined in **Table 13-6** for each impact scoped into the assessment (as outlined in **Section 13.4.2**). The realistic worst-case scenarios are derived from the range of parameters included in the design envelope. They ensure that the assessment of likely significant effects is based on the maximum potential impact on the environment, whilst retaining design flexibility. Should an alternative development scenario be taken forward in the final design of the Project, the resulting effects would not be greater in effect significance. Further details on the design envelope approach are provided in **Chapter 6 Environmental Impact Assessment Methodology**.

40. The realistic worst-case scenarios used to assess impacts on offshore and intertidal ornithology receptors are defined in **Table 13-6**. Following the PEIR publication, further design refinements will be made based on ongoing engineering studies and stakeholder feedback based on the outcomes of the impact assessments and methodologies presented within this Chapter. Therefore, realistic worst-case scenarios presented in the PEIR may be updated in the ES.

Table 13-5 Embedded Mitigation Measures Relevant to Offshore and Intertidal Ornithology

Commitment ID	Proposed Commitment	How the Commitment will be Secured	Relevance to Offshore and Intertidal Ornithology	Relevance to Impact ID
CO13	There will be a minimum blade tip clearance of at least 26m above highest astronomical tide, and 28m above lowest astronomical tide.	DCO Works	Increasing the air gap to a minimum of 26m above HAT, reduces the overlap between the rotor diameter and seabirds core flight height range, thus reducing the potential risk of collision.	ORN-O-02, ORN-O-06
CO18	A Vessel Traffic Management Plan (VMP) will be provided as part of the Project Environmental Management Plan (PEMP) and will aim to minimise, as far as reasonably practicable, encounters with marine mammals and common scoter and red-throated diver. The Vessel Management Plan will adhere to latest relevant guidelines for reducing risk of collision with relevant marine species.	DML Condition - Project Environmental Management Plan	The VMP aims to minimise potential disturbance within the offshore ECC by vessels committing to following existing shipping lanes, avoiding aggregations of rafting seabirds and reducing vessel speed in the presence of rafting seabirds.	ORN-C-01, ORN-O-01
CO19	An Ecological Clerk of Works (ECoW) will be present during construction works at the landfall to keep a watching brief for red-throated diver and common scoter. Should high densities of these species be observed during construction, mitigation measures will be adopted to reduce disturbance as needed, such as temporary stoppage of those construction activities causing disturbance.	DML Condition - Project Environmental Management Plan	Construction at the landfall is undertaken in suitable habitat for red-throated diver and common scoter. Observations during construction will determine whether these species are present in high densities prior to construction activities commencing and avoid such activities and the associated disturbance.	ORN-C-01, ORN-C-05
CO21	An Offshore Decommissioning Programme will be provided prior to the construction of the offshore works and implemented at the time of decommissioning, based on the relevant guidance and legislation.	DCO Requirement - Offshore Decommissioning Programme	The scope and methodology of offshore decommissioning works and appropriate mitigation measures in relation to offshore and intertidal ornithology will be detailed in the plan.	ORN-D-01, ORN-D-02, ORN-D-05
CO22	A piling Marine Mammal Mitigation Protocol (MMMP) will be provided in accordance with the Outline MMMP and will be implemented during construction. The piling MMMP will include details of the embedded mitigation, for the soft-start and ramp-up, as well as details of the proposed mitigation zone and any additional mitigation measures required in order to minimise potential impacts of any physical injury or permanent threshold shift (PTS), for example, the activation of an Acoustic Deterrent Device (ADD) prior to the soft-start, as much as is practicable.	DML Condition - Marine Mammal Mitigation Protocol	The MMMP will mitigate the potential for impact from underwater noise on diving seabirds. Whilst this is primarily a marine mammal mitigation, the measures included will also benefit some sound sensitive fish species and allows for pursuit diving species (such as guillemot and razorbill) to move away from the piling activities ahead of more intensive noise levels being reached.	ORN-C-02, ORN-O-01, ORN-O-02, ORN-O-06

Commitment ID	Proposed Commitment	How the Commitment will be Secured	Relevance to Offshore and Intertidal Ornithology	Relevance to Impact ID
CO25	A Project Environmental Management Plan (PEMP) will be provided in accordance with the Outline PEMP and will include: • A Marine Pollution Contingency Plan (MPCP), which will include plans to address the risks, methods and procedures to deal with any spills and collision incidents in relation to all activities carried out below Mean High Water Springs (MHWS) to safeguard the marine environment; • Best practice measures for the storage, use and disposal of lubricant and chemicals will be undertaken throughout the construction phase; • A Chemical Risk Assessment (CRA) to ensure any chemicals, substances and materials to be used will be suitable for use in the marine environment and in accordance with the Health and Safety Executive and the Environment Agency Pollution Prevention Control Guidelines or latest relevant available guidelines; • A marine biosecurity plan detailing how the risk of introduction and spread of invasive non-native species will be minimised; and • Details of waste management and disposal arrangements.	DML Condition - Project Environmental Management Plan	In the unlikely event of accidental pollution, the PEMP provides a clear action plan to effectively mitigate the potential impact of accidental pollution on seabirds.	ORN-C-02, ORN-O-01, ORN-O-02
CO30	An Ornithological Monitoring Plan (OMP) will be provided in accordance with the Outline OMP. The OMP will set out proposals for ornithological monitoring.	DML Condition - Ornithological Monitoring Plan	An OMP will be developed to address uncertainty, where it is possible and reasonable for such uncertainties to be monitored for the Project, specifically relating to ornithology.	ORN-C-01, ORN-O-01, ORN-C-02, ORN-O-02, ORN-O-03, ORN-C-05, ORN-O-05, ORN-O-06
CO92	Where construction works are undertaken within or adjacent to open field, wetland or foreshore habitat between November and January, a pre-construction survey will be undertaken as required by a suitably qualified ecologist to record the distribution and abundance of overwintering waterbird flocks in line with the Outline Ecological Management Plan (EcoMP), and the distribution of suitable habitat likely to be affected during the winter season within which construction works will be undertaken. The findings of these pre-construction surveys will determine whether mitigation measures to reduce disturbance to waterbird flocks would be required. During the construction works, should over-wintering waterbirds be present, a suitably qualified ecologist will be responsible for advising on the appropriate levels of mitigation such as watching briefs and toolbox talks to site personnel.	DCO Requirement - Ecological Management Plan	Construction at the landfall is undertaken in suitable habitat for overwintering intertidal and offshore birds. Pre-construction surveys and ECoW vigilance will detect these species if present at the landfall, and mitigation measures to reduce disturbance will need to apply to these species if present.	ORN-C-01, ORN-C-05

Table 13-6 Realistic Worst-Case Scenarios for Impacts on Offshore and Intertidal Ornithology

Impact ID	Impact and Project Activity	Realistic Worst-Case Scenario	Rationale
Construction			
ORN-C-01	Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall - intertidal and offshore from installation of offshore and landfall infrastructure	**Landfall:** • Number of jointing bays: 1. • Individual transition joint bay: excavation 104m^2. • Maximum number of landfall ducts: 3. • HDD temporary works compound area: 8,000 to 12,500m^2. • Maximum HDD horizontal length: 2,000m. • Minimum HDD horizontal length: 1,000m. • Indicative HDD depth: 5m to 10m under seabed. • Temporary access route size: 7m wide. • Total installation duration at landfall: 3 years. **Vessels:** Maximum total number of construction vessels in the offshore ECC at any one time = up to 55 vessels. Maximum total number of construction vessels in the DBD Array Area at any one time = up to 35 vessels. Maximum total number of construction vessels on site at any one time = up to 90 vessels. Maximum total number of round trips over construction period = 7,527.	For construction activities in the Array Area, the maximum estimated number of vessels operating concurrently would cause greatest disturbance to birds on site. For construction activities associated with the ECC, the assumption is that vessels would be *in situ* from start to finish so any disturbance events would be throughout the entire period. For construction activities associated with the landfall, the assumption is that vessels, plant and/or workers would be *in situ* from start to finish so any disturbance events would be throughout the entire period.
ORN-C-02	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure - offshore (red-throated diver, gannet, auks) from installation of offshore and landfall infrastructure	**Array Area:** • Deployment of wind turbines and other offshore infrastructure across the full Array Area (262.4km^2). **Wind turbines:** • Up to 113 wind turbines. **OP:** • 1 large or 2 smaller OP.	Displacement would be assumed from the entire Array Area that contains wind turbines and other associated structures, which maximises the potential for disturbance and displacement. Assessment of extent / varying displacement from Array Area and a buffer is species specific due to their sensitivity levels.
ORN-C-05	Indirect impacts via habitats or prey availability - intertidal and offshore from construction activities e.g. installation of cables and foundations	See Realistic Worst-Case Scenarios for the Fish and Shellfish Ecology assessment (**Chapter 11 Fish and Shellfish Ecology**) and for the Benthic and Intertidal Ecology assessment (**Chapter 10 Benthic and Intertidal Ecology**).	Indirect effects on birds could occur through changes to any of the species and habitats considered within the Fish and Shellfish Ecology or Benthic and Intertidal Ecology assessments. The maximum indirect impact on birds would result from the maximum direct impact on fish, shellfish and benthic species and habitats. The worst-case scenario is therefore as per justifications in **Table 10-7** in **Chapter 10 Benthic and Intertidal Ecology** and **Table 11-5** in **Chapter 11 Fish and Shellfish Ecology**.

Impact ID	Impact and Project Activity	Realistic Worst-Case Scenario	Rationale
Operation and Maintenance			
ORN-O-01	Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall - intertidal and offshore from maintenance of wind turbines and other infrastructure	**Service Operations Vessels (SOV)** • Up to three vessels with a maximum number of 39 vessel round trips per year. **Daughter Craft** • Up to four vessels. Round trips are not conducted for this vessel type as they are lifted onboard SOV when making trip to and from port. **Platform supply vessels** • Up to a single vessel with a maximum number of 12 vessel round trips per year. **Survey / research / offshore support / offshore construction** • Up to two vessels with a maximum number of seven vessel round trips per year. **Unmanned small survey vessels (as alternative to survey / research / offshore support / offshore construction)** • Up to six vessels with a maximum number of 12 vessel round trips per year. **Wind turbine installation / JUV / heavy lift / offshore construction** • Up to a single vessel with a maximum number of 10 vessel round trips over lifespan of project. **Offshore export cable laying** • Up to three vessels with a maximum number of 35 vessel round trips over lifespan of project. **Offshore support / offshore construction** • Up to a single vessel with a maximum number of four vessel round trips per year. **Fall pipe vessel / offshore support / offshore construction** • Up to a single vessel with a maximum number of four vessel round trips per year.	For operational and maintenance activities associated with upkeep and repair, the assumption is that vessels would be *in situ* from start to finish of such activities but that these would be limited in spatial extent and short lived. Any disturbance events would be temporary and from the limited spatial area at which repairs or maintenance occurred.
ORN-O-02	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure - offshore (red-throated diver, gannet, auks) from presence of wind turbines and other infrastructure	**Array Area** • Wind turbine deployment across the full Array Area (262.4km^2). **Wind turbines** • Up to 113 wind turbines. **OP** • 1 large or 2 smaller OPs.	Displacement would be assumed from the entire Array Area that contains wind turbines and other associated structures, which maximises the potential for disturbance and displacement. Assessment of extent / varying displacement from Array Area and a buffer is species specific due to their sensitivity levels.

Impact ID	Impact and Project Activity	Realistic Worst-Case Scenario	Rationale
ORN-O-03	Barrier effect due to presence of wind turbines and other offshore infrastructure - offshore (including migratory non-seabirds) from presence of operational wind turbines	**Array Area** • Wind turbine deployment across the full Array Area (262.4km^2). • Predicted deviation for birds of up to 30.4km travelling clockwise around the Array Area or 36.0km around the Array Area plus 2km buffer. • Predicted deviation for birds of up to 45.3km travelling anti-clockwise around the Array Area of 49.5km around the Array Area plus 2km buffer. **Wind turbines** • Up to 113 wind turbines. OP • 1 large or 2 smaller OPs.	The presence of the wind farm could potentially require birds to fly around the perimeter of the Array Area and associated buffers in order to continue with the proposed journey. Depending on which way round birds decide to navigate the barrier would mean two different paths would need to be considered (clockwise or anti-clockwise). The measurements are based on the longest possible route either way and therefore reflecting a) the maximum additional effort required for birds to fly around the Array Area from colonies during the breeding bio-season or whilst undertaking migratory flights.; and b) the maximum additional migration distance of migratory non-seabirds if assumed to be migrating on an east-west route.
ORN-O-05	Indirect impacts via habitats or prey availability - intertidal and offshore from presence of foundations in the seabed, cable / scour protection, pillars in the water column	See Realistic Worst-Case Scenarios for the Fish and Shellfish Ecology assessment (**Chapter 11 Fish and Shellfish Ecology**) and for the Benthic and Intertidal Ecology assessment (**Chapter 10 Benthic and Intertidal Ecology**).	Indirect effects on birds could occur through changes to any of the species and habitats considered within the Fish and Shellfish Ecology or Benthic and Intertidal Ecology assessments. The maximum indirect impact on birds would result from the maximum direct impact on fish, shellfish and benthic species and habitats. The worst-case scenario is therefore as per justifications in **Chapter 10 Benthic and Intertidal Ecology** and **Chapter 11 Fish and Shellfish Ecology**.
ORN-O-06	Collision risk - offshore (kittiwake, gannet, migratory non-seabirds) from presence of wind turbines	**Array Area** • Wind turbine deployment across the full Array Area (262.4km^2). **Wind turbines** • Up to 113 wind turbines. • Minimum height of lowest blade tip above Highest Astronomical Tide (HAT): 26m. • Rotor blade radius: 118m to 168.5m.	Within **Volume 2, Appendix 13.3 Offshore Collision Risk Modelling Report** two different turbine designs were modelled. The turbine design that produced the highest predicted mortality due to collisions has been concluded as the WCS taken forward and assessed within this Chapter.

Impact ID	Impact and Project Activity	Realistic Worst-Case Scenario	Rationale
Decommissioning			
ORN-D-01	Direct disturbance and displacement due to work activity	The final decommissioning strategy of the Project's offshore infrastructure has not yet been decided. For a description of potential offshore decommissioning works, refer to **Chapter 4 Project Description**. It is recognised that regulatory requirements and industry best practice change over time. Therefore, the details and scope of offshore decommissioning works will be determined by the relevant regulations and guidance at the time of decommissioning. Specific arrangements will be detailed in an Offshore Decommissioning Plan (see **Table 13-5**, Commitment ID CO21), which will be submitted and agreed with the relevant authorities prior to the commencement of offshore decommissioning works. For this assessment, it is assumed that decommissioning is likely to operate within the parameters identified for construction (i.e. any activities are likely to occur within the temporary construction working areas and require no greater amount or duration of activity than assessed for construction). The decommissioning sequence will generally be the reverse of the construction sequence. It is therefore assumed that decommissioning impacts would likely be of similar nature to, and no worse than, those identified during the construction phase. See Realistic Worst-Case Scenarios for the Fish and Shellfish Ecology assessment (**Chapter 11 Fish and Shellfish Ecology**) and for the Benthic and Intertidal Ecology assessment (**Chapter 10 Benthic and Intertidal Ecology**) regarding ORN-D-05.	For decommissioning activities in the Array Area, the maximum estimated number of areas within the Array Area with vessels operating concurrently would cause greatest disturbance to birds on site. For decommissioning activities, the assumption is that vessels would be *in situ* from start to finish so any disturbance events would be throughout the entire period.
ORN-D-02	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure		Displacement would be assumed from the entire Array Area that contains wind turbines and other associated structures, which maximises the potential for disturbance and displacement. Assessment of extent / varying displacement from Array Area and a buffer is species specific due to their sensitivity levels.
ORN-D-05	Indirect impacts via habitat or prey availability		Indirect effects on birds could occur through changes to any of the species and habitats considered within the Fish and Shellfish Ecology or Benthic and Intertidal Ecology assessments. The maximum indirect impact on birds would result from the maximum direct impact on fish, shellfish and benthic species and habitats. The worst-case scenario is therefore as per justifications in **Chapter 10 Benthic and Intertidal Ecology** and **Chapter 11 Fish and Shellfish Ecology**.

13.5 Assessment Methodology

13.5.1 Guidance Documents

41. The following guidance documents have been used to inform the baseline characterisation, assessment methodology and mitigation design for offshore and intertidal ornithology:

- The Guidelines for Ecological Impact Assessment in the UK and Ireland (Chartered Institute of Ecology and Environmental Management (CIEEM), 2024);
- Joint advice note from the Statutory Nature Conservation Bodies (SNCBs) regarding bird CRM for offshore wind developments (SNCBs, 2024a);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase III: Expectations for data analysis and presentation at examination for offshore wind applications (Parker *et al*., 2022c);
- Joint SNCB Interim Displacement Advice Note (SNCBs, 2022);
- Natural England Marine Site Detail Conservation Advice: Advice on Operations, to inform receptor sensitivity of Greater Wash SPA qualifying features (Natural England 2024a) and receptor sensitivity of assessed wader species (Natural England 2024b) to intertidal Project activities;
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards, Phase I: Expectations for pre-application baseline data for designated nature conservation and landscape receptors to support offshore wind applications (Parker *et al*., 2022a);
- BTO (British Trust for Ornithology) Wetland Bird Survey (WeBS) species threshold levels for national importance (BTO, 2024);
- BTO (Balmer *et al*., 2013) and European Ornithology Atlas Committee (EOAC, 1979) combined guidance on breeding evidence; and
- Natural England and Natural Resources Wales interim advice regarding demographic rates, EIA scale mortality rates and reference populations for use in offshore wind impact assessments (Natural England and Natural Resources Wales, 2024).

42. This PEIR chapter has been compiled with the attention to relevant guidance for conducting EIA level assessments. The CIEEM (2024) guidance has been followed in order to appropriately structure the chapter and to follow the approach for assessment as set out in the guidance.

43. Consideration has also been given to the latest guidance notes on impact assessments for CRM and displacement as well as the demographic information for populations that are being assessed against.

13.5.2 Data and Information Sources

13.5.2.1 Desk Study

44. A desk study has been undertaken to compile baseline information in the previously defined study area(s) (see **Section 13.4.1**) using the sources of information set out in **Table 13-7**. Further details are provided in **Volume 2, Appendix 13.2 Offshore Ornithology Baseline Characterisation Report** and **Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation Report** for offshore and intertidal ornithology, respectively.

Table 13-7 Desk-Based Sources for Offshore and Intertidal Ornithology Data

Data Source	Spatial Coverage	Year(s)	Summary of Data Contents
Dogger Bank C and Sofia Ornithology Technical Report (Burton *et al*., 2014)	Dogger Bank Zone	2010 - 2011	Boat-based surveys and aerial surveys of the Dogger Bank Zone providing species accounts.
Dogger Bank A and B Ornithology Technical Report (Burton *et al*., 2013)	Dogger Bank Zone	2010 - 2011	Boat-based surveys and aerial surveys of the Dogger Bank Zone providing species accounts.
Dogger Bank South (DBS) Offshore Wind farms PEIR and associated appendices (RWE, 2023a, b and c)	DBS Array Area at the south-west of the Dogger Bank Zone	2021 - 2022	Monthly digital aerial surveys providing abundance, density and spatial data for key species.
DBS ES and baseline ornithology surveys (Peak Ecology 2023, and 2024)	The DBS overwintering bird surveys and breeding bird survey transects as mapped in the ES Appendices and overlap with the intertidal part of the Offshore Development Area including landfall and proposed access routes.	2022/23 and 2023	Bird surveys were carried out on transects overlying and adjacent to the DBS proposed cable landfall between Ulrome and Atwick, East Riding of Yorkshire.

Data Source	Spatial Coverage	Year(s)	Summary of Data Contents
Greater Wash SPA wintering bird assessment (Lawson *et al.*, 2016)	Landfall Site	1989 - 2008	Eight seasons worth of aerial surveys of the Greater Wash SPA between 1989 / 90 to 2007 / 08 with species accounts for red-throated diver, little gull (*Hydrocoloeus minutus*) and common scoter.
Trektellen	Northernmost point of the scoping boundary of the offshore ECC	2020 - 2024	Bird migration counts providing peaks of each species of interest.
North and East Yorkshire Ecological Data Centre (NEYEDC) 2024	As part of the returned NEYEDC data package for the wider Onshore Development Area + 2km buffer, there are records from sites within the intertidal part of the Offshore Development Area.	Up to 2024	Local Environmental Record Centre data for the North and East Yorkshire counties, collating data from individuals, consultancies and regional or national wildlife surveys. Observations of all bird species are included in a Protected Species search return.
eBird Basic Dataset (2024)	An initial geographic search within eBird Species Maps for common waterbird species records in the area from regular submissions by eBird contributors from locations overlying the intertidal part of the Offshore Development Area including at least one submission in each calendar month August to May.	2019 - 2024	User-submitted observations of occurrence and often count data for bird species to the ornithological 'citizen science' platform eBird, administered by the Cornell Lab of Ornithology. (Used with required permission from eBird for commercial use.)

13.5.2.2 Site-Specific Surveys

45. In addition to desk-based sources, site-specific surveys were undertaken to provide detailed baseline information on offshore and intertidal ornithology. **Table 13-8** summarises surveys that have been completed or are planned to be undertaken to inform the ES which are relevant to the offshore and intertidal ornithology baseline characterisation (further information on surveys can be found in **Volume 2, Appendix 13.2 Offshore Ornithology Baseline Characterisation** and **Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation**).

Table 13-8 Site-Specific Survey Data for Offshore and Intertidal Ornithology

Survey	Spatial Coverage	Year(s)	Summary of Survey Data
Digital aerial surveys	Array Area plus 4km buffer	2021 - 2023	Digital aerial surveys carried out across 24 months based on a transect design at 2cm Ground Sampling Distance (GSD).
Intertidal ornithology surveys (BTO WeBS methodology)	Intertidal parts of the Development Area (landfall, access routes), adjacent sea area and terrestrial habitat	August 2024 to May 2025	2 visits a month undertaking high and low tide surveys following BTO Wetland Bird Survey (WeBS) methodology, recording waterbirds, seabirds, birds of prey and selected landbirds with intertidal or coastal ecology.

13.5.3 Impact Assessment Methodology

46. **Chapter 6 Environmental Impact Assessment Methodology** sets out the overarching approach to the impact assessment methodology. The topic-specific methodology for the offshore and intertidal ornithology assessment is described further in this section.

47. The impact assessment has been undertaken in line with the most recent guidance (CIEEM, 2024) and is informed by expert opinion where necessary. Key guidance documents on specific areas of the assessment, such as estimating operational phase displacement (SNCBs, 2022), collision risk (SNCBs, 2024a, Band, 2012; Wright *et al.*, 2012; Caneco and Humphries, 2022) and potential population level effects (Searle *et al.*, 2019), have been examined and referred to where appropriate. It is worth noting that PVA has not been conducted for PEIR and so evaluation of population-level effects is qualitative, however where appropriate, the ES will be updated with PVA outputs.

48. The assessment approach therefore follows the conceptual 'source-pathway-receptor' model. The conceptual model identifies likely environmental impacts on ornithology receptors resulting from the proposed construction, operation and maintenance, and decommissioning of the offshore infrastructure associated with the Project. This process provides an easy-to-follow assessment route between recognised potential impact sources and potentially sensitive receptors, ensuring a transparent impact assessment. The parameters of this conceptual model are defined as follows:

- Source – the origin of a potential impact (noting that one source may have several pathways and receptors) e.g. an activity such as offshore export cable installation and a resultant effect such as re-suspension of sediments;
- Pathway – the means by which the effect of the activity could impact a receptor e.g. for the example above, re-suspended sediment could settle and smother the seabed; and

- Receptor – the element of the receiving environment that is impacted e.g. for the above example, seabirds which are unable to forage effectively due to a reduction in benthic prey availability.

13.5.3.1 Impact Assessment Criteria

13.5.3.1.1 Conservation Value

49. The conservation value of a species is used to provide additional context to the impact assessment, and may be used to refine predictions, as appropriate. It is not a key input into the impact assessment process, as there is a tendency to underestimate potential impacts on receptors with a lower conservation value (Box *et al*., 2017). Conservation value and sensitivity are not necessarily linked for a particular impact. Therefore, each receptor's conservation value is considered using reasoned judgement when determining their overall sensitivity to any potential impact or effect. For example, a receptor could be of high conservation value (e.g. all qualifying feature of a SPA) but have a low or negligible physical / ecological sensitivity to an effect (or vice-versa), thus leading to an overall sensitivity value of low at most. Such reasoned judgement is an important part of the overall narrative used to determine potential impact significance and is used, where relevant, as a mechanism for modifying the sensitivity of an effect assigned to a specific receptor.

50. The conservation value of ornithological receptors is based on the population from which individuals are predicted to be drawn, reflected in the current understanding of the movements of bird species. Ranking, therefore, corresponds to the degree of connectivity predicted between the Project and protected populations. Using this approach, the conservation importance of a species seen at different times of year may fall into any of the defined categories. Population status is also taken into account in the assessment. For example, effects on a declining species may be of more concern than those on an increasing species.

51. Example definitions of the conservation value levels for ornithology receptors are given in **Table 13-9**. These are defined in relation to connectivity with populations that are protected as qualifying species of either internationally, nationally or local significance thresholds as dictated by appropriate legislation (**Section 13.2**).

Table 13-9 Conservation Values of Offshore and Intertidal Ornithology Receptors

Value	Definition
High	A species listed as a qualifying feature of an internationally designated site (e.g. SPA or Ramsar). Species populations present with sufficient conservation importance to meet criteria for SPA selection. Species listed under the UK Birds of Conservation Concern 5 (BoCC5) Red List or Amber list (Stanbury *et al.,* 2021; Stanbury *et al.,* 2024), or those afforded special protection under Schedule 1 of Wildlife and Countryside Act 1981, or Annex 1 of Birds Directive. For example, a receptor population for which all individuals at risk can be clearly connected to a particular conservation site of international or national importance.
Medium	A species listed as a notified feature of a nationally designated site (e.g. SSSI). Species populations present with sufficient conservation importance to meet criteria for SSSI selection. Species listed under BoCC5 (Stanbury *et al.,* 2021; Stanbury *et al.,* 2024), or afforded special protection under Schedule 1 or Annex 1. For example, a receptor population for which individuals at risk may be drawn from a mixture of conservation sites of international, national importance and other populations which may also contribute to individuals at risk.
Low	A species occurring within SPAs, Ramsar sites and SSSIs, but not crucial to the integrity of the site. Species populations present falling short of SSSI selection criteria but with sufficient conservation importance to likely meet criteria for selection as a local site. Species may be listed under BoCC5 (Stanbury *et al.,* 2021; Stanbury *et al.,* 2024), or afforded special protection under Schedule 1 or Annex 1, but not present in locally important numbers or likely to utilise the Array Area. For example, a receptor population for which individuals at risk have no known connectivity to conservation sites of international or national importance.
Negligible	All other species that are widespread and common and which are not present in locally important (or greater) numbers, and which are of low conservation concern, e.g. UK Birds of Conservation Concern 5 (BoCC5) Green List species (Stanbury *et al*., 2021; Stanbury *et al.,* 2024).

13.5.3.1.2 Receptor Sensitivity

52. The sensitivity of a receptor is an expression of the likelihood of change when a pressure (i.e. a predicted impact) is applied. It is defined by the tolerance (or lack thereof) to a particular impact, along with the capacity for recovery of the receptor. The judgement takes account of information available on the responses of birds to various stimuli (e.g. predators, noise and visual disturbance) and whether a species' ecology makes it vulnerable to potential impacts. For example, bird species that typically fly at heights that overlap with the rotor-swept area are considered to be more sensitive to collision risk with the moving blades of wind turbines than species that avoid the rotor-swept area.

53. Sensitivity can differ between similar species and between different populations of the same species. Thus, the behavioural responses of offshore ornithology receptors are likely to vary with both the nature and context of the stimulus and the experience of the individual bird. Sensitivity also depends on the activity of the bird.

54. In addition, individual birds of the same species will differ in their tolerance depending on the level of human disturbance that they regularly experience in a particular area, and have become habituated to (e.g. individuals that forage within close proximity to an area with high human activity levels may have a greater tolerance than those that occupy remote locations with little or no human presence).

55. Definitions of tolerance are presented in **Table 13-10**, whilst capacity for recovery definitions are presented in **Table 13-11**. A matrix showing how the definitions for tolerance and recovery can be combined to estimate receptor sensitivity is provided in **Table 13-12**. The majority of seabirds have a low capacity for recovery, given that they are long lived species with extensive maturation periods, low natural adult mortality levels and low fecundity. The majority of waders and other intertidal birds have medium capacity for recovery. Approximate definitions for overall sensitivity are provided in **Table 13-13**, using the example of disturbance due to construction activity.

Table 13-10 Definition of Tolerance for an Offshore Ornithology Receptor

Tolerance	Definition
High	No or minor adverse change (which may not be detectable against existing variation) in key functional and physiological attributes through direct effects, because the receptor can avoid / adapt to / accommodate it.
Medium	Moderate decline in key functional and physiological attributes through direct mortality, reduced reproductive success, or other effects impacting receptor fitness. The receptor is less able to avoid / adapt to / accommodate the pressure.
Low	Substantial decline in key functional and physiological attributes through direct mortality, reduced reproductive success, or other effects impacting receptor fitness. The receptor is not able to avoid / adapt to / accommodate the pressure.

Table 13-11 Definition of Recovery Levels for an Offshore Ornithology Receptor

Capacity	Definition
High	Short-lived receptor (up to five years), first breeding within approximately one year, high natural annual adult mortality (>25%), high annual reproductive output (> five chicks per pair).
Medium	Moderately short-lived receptor (approximately five to ten years), first breeding within two to three years, moderate natural annual adult mortality (15 to 25%), moderate annual reproductive output (two to five chicks per pair).
Low	Long-lived receptor (more than ten years), first breeding in excess of three years, low natural annual adult mortality (<15%), low annual reproductive output (< two chicks per pair).

Table 13-12 Matrix for the Determination of Sensitivity of Offshore Ornithology Receptors

	Low tolerance	Medium tolerance	High tolerance
Low recovery	High	Medium	Low
Medium recovery	Medium	Medium	Low
High recovery	Low	Low	Low

Table 13-13 Example Definitions of Different Levels of Behavioural Sensitivity for an Offshore Ornithology Receptor

Sensitivity	Definition
High	Receptor has very limited tolerance of a potential impact, e.g. strongly displaced by sources of disturbance such as noise, light, vessel movements and the presence of people.
Medium	Receptor has limited tolerance of a potential impact, e.g. moderately displaced by sources of disturbance such as noise, light, vessel movements and the presence of people.
Low	Receptor has some tolerance of a potential impact, e.g. partially displaced by sources of disturbance such as noise, light, vessel movements and the presence of people.
Negligible	Receptor is generally tolerant of a potential impact e.g. not displaced by sources of disturbance such as noise, light, vessel movements and the presence of people.

56. Species assessed for potential impacts are those which were recorded during the site-specific surveys and/or the desk-based studies, and which are considered to be at potential risk either due to their abundance, conservation importance and / or potential sensitivity to OWF impacts. Where appropriate, the assessment considers species which were not recorded during baseline surveys but are considered likely to use the Project and the habitats surrounding it (e.g. migratory birds).

57. Consideration of the level of behavioural sensitivity with regards to individual ornithology receptors is one of the core components of the assessment of potential impacts and their effects. The sensitivity of each offshore ornithological receptor to a given impact pathway has been estimated by information identified by literature review. The overall confidence in the information used to define the sensitivity of each seabird receptor has also been qualitatively assessed. This is a method adapted from Pérez-Domínguez *et al* (2016) and considers three aspects of an evidence base:

- Quality of information: highest quality information from peer-reviewed papers (either observation or experimental), or grey literature from reputable sources. Heavier reliance on grey literature and / or expert judgement is considered to represent a lower quality evidence base;
- Applicability of evidence: evidence based on the same impacts, arising from similar activities, on the same species, in the same geographical area, is considered to have the highest associated confidence, followed by similar pressures / activities / species in other areas, followed by proxy information; and
- Concordance: situations where available evidence is in broad agreement in terms of sensitivity and magnitude of impact results in a higher confidence compared to a situation where evidence is only in partial agreement, or not in agreement at all.

58. Using expert judgement (CIEEM, 2024, both the conservation value (**Table 13-9**) and behavioural sensitivity (**Table 13-13**) of a receptor are used to determine their overall sensitivity in the assessment. The evaluation of overall sensitivity for each ornithological receptor potentially impacted by the Project is detailed in **Table 13-26**.

13.5.3.1.3 Impact Magnitude

59. Impacts on receptors are judged in terms of their magnitude. Magnitude refers to the scale of an impact and is determined on a quantitative basis where possible. This may relate to the area of habitat lost to the development footprint in the case of a habitat feature or predicted loss of individuals in the case of a population of a species of bird. Magnitude is assessed within four levels, as detailed in **Table 13-14**.

Table 13-14 Definitions of Impact Magnitude for an Offshore Ornithology Receptor

Sensitivity	Definition
High	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that is predicted to irreversibly alter the population in the short to long-term and to alter the long-term viability of the population and / or the integrity of the protected site. Recovery from that change predicted to be achieved in the long-term (i.e. more than five years) following cessation of the development activity.
Medium	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that occurs in the short and long-term, but which is not predicted to alter the long-term viability of the population and / or the integrity of the protected site. Recovery from that change predicted to be achieved in the medium-term (i.e. no more than five years) following cessation of the development activity.
Low	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that is sufficiently small-scale or of short duration to cause no long-term harm to the feature / population. Recovery from that change predicted to be achieved in the short-term (i.e. no more than one year) following cessation of the development activity.
Negligible	Very slight change from the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site. Recovery from that change predicted to be rapid (i.e. no more than c. six months) following cessation of the development activity.
No change	No positive or negative change is predicted.

60. Knowledge of how rapidly the population or performance of a species is likely to recover following loss or disturbance (e.g. by individuals being recruited from other populations elsewhere) is also used to assess impact magnitude, where such information is available.

13.5.3.1.4 Effect Significance

61. The CIEEM guidelines (2024) use only two categories to classify effects: "**significant**" or "**not significant**". The significance of an effect is determined by considering the overall sensitivity (behavioural sensitivity and consideration of conservation value) of the receptor and the impact magnitude (see **Chapter 6 Environmental Impact Assessment Methodology** for further details) using a matrix-based approach (**Table 13-15**) and applying professional judgement as to whether the integrity of the receptor will be affected. Definitions of each level of significance are provided in **Table 13-16**.

62. This method is employed for this assessment and is guided by the matrix approach presented in **Table 13-15**, where determination of the level of any significance of effect is initially identified through the matrix and the use of expert judgement. Where a range of significance of effect is presented in **Table 13-15**, the final assessment for each effect is also based upon expert judgement.

63. The use of expert judgement is an important element of the impact assessment process as the matrix approach to determining the significance of any potential effects should only be used as a framework to aid understanding of how a judgement has been informed and reached for each specific receptor to any given impact being assessed.

Table 13-15 Offshore and Intertidal Ornithology Effect Significance Matrix

Sensitivity	Adverse Magnitude				Beneficial Magnitude			
	High	Medium	Low	Negligible	Negligible	Low	Medium	High
High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Table 13-16 Definitions of effect significance for an Offshore Ornithology Receptor

Sensitivity	Definition
Major	Large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision-making process.
Negligible	No discernible change in receptor condition.
No change	No impact, therefore, no change in receptor condition.

64. Wherever possible and practical, the assessments within this chapter for offshore ornithology are based upon quantitative and accepted criteria as well as methods and guidance from SNCBs (e.g. for CRM and analysis of displacement). Together, these practices provide for a balanced approach alongside the use of expert judgement and to allow for meaningful interpretation to establish to what extent an impact is significant for the Project.

65. The term integrity is used here in accordance with the definition adopted by the Office of the Deputy Prime Minister ('ODMP') Circular 06/2005 on Biodiversity and Geological Conservation whereby designated site integrity refers to "…*coherence of ecological structure and function…that enables it to sustain the habitat, complex of habitats and / or levels of populations of species for which is was classified*". Integrity, therefore, refers to the maintenance of the conservation status of a population of a species, a specific location or geographical scale.

66. Effects are more likely to be considered significant where they affect ornithological receptors of higher overall sensitivity or where the magnitude of the effect is high. Effects not considered to be significant would be those where the integrity of the receptor is not threatened, effects on receptors are of lower overall sensitivity, or where the magnitude of the impact is low. Potential receptors which are determined to be of low or negligible value are not considered further in this assessment.

67. Potential impacts are described using impact significance, followed by a statement of whether the impact significance is significant in terms of the EIA regulations, e.g. "**minor adverse** effects, **not significant** in EIA terms" or "**moderate adverse** effects, significant in EIA terms". Where the residual effect is classified as significant in EIA terms, appropriate mitigation is considered, where possible, in consultation with the regulatory authorities and relevant stakeholders. The aim of mitigation measures is to avoid or reduce the overall impact in order to determine a residual effect of non-significance upon a given receptor.

68. Following initial assessment, if the effect does not require additional mitigation (or none is possible), the residual effect would remain the same. If, however, additional mitigation is proposed, an assessment of the post-mitigation residual effect is provided.

13.5.4 Cumulative Effects Assessment Methodology

69. The Cumulative Effects Assessment (CEA) considers other plans and projects that may act collectively with the Project to give rise to cumulative effects on offshore and intertidal ornithology receptors. The general approach to the CEA for offshore and intertidal ornithology involves screening for potential cumulative effects, identifying a short list of plans and projects for consideration and evaluating the significance of cumulative effects. **Chapter 6 Environmental Impact Assessment Methodology** provides further details on the general framework and approach to the CEA.

70. For offshore ornithology, these activities include other OWF, marine aggregate extractions areas, oil and gas exploration and extraction, sub-sea cables and pipelines, and commercial shipping.

71. Further detail of the methodology considered for CEA is provided in **Section 13.8**.

13.5.5 Transboundary Effects Assessment Methodology

72. The transboundary effects assessment considers the potential for effects to occur as a result of the Project on offshore and intertidal ornithology receptors within the EEZ of other European Economic Area (EEA) member states or other interests of EEA member states. **Chapter 6 Environmental Impact Assessment Methodology** provides further details on the general framework and approach to the transboundary effects assessment.

73. For offshore and intertidal ornithology, the potential for transboundary effects has been identified in relation to the construction, operation and decommissioning phase. However, following the HRA screening of potential sites at risk, all transboundary sites were screened out on the basis of no likely significant effect (LSE) from the Project.

13.5.6 Assumptions and Limitations

74. The marine environment can be highly variable, both spatially and temporally, meaning that seabird numbers may fluctuate greatly between months, bio-seasons and between different years at any given location, lowering the probability of being able to detect consistent patterns, directional changes or to generate reliable population estimates. Therefore, the site-specific data presented in this PEIR chapter for the purpose of baseline characterisation of the Project (that were collected over a 24-month period) and the method used to collect these data (aerial digital still imagery) may be considered to represent a snapshot of each month.

75. However, the most recent survey data used for describing the baseline environment are consistent with data obtained from surveys conducted for other OWF applications in UK waters and are in general agreement with information from the desk study literature and previous surveys conducted within the existing area (Burton *et al.*, 2013 and 2014; RWE, 2023a, b and c; and Lawson *et al.*, 2016). Thus, these data are considered to be representative of the site for the purpose of baseline characterisation and should be considered to reduce any uncertainties within the impact assessment of the Project.

76. It is widely recognised that, the assessment process contains a wide range of potential sources of uncertainty (Searle *et al.*, 2023). These include the process of estimating seabird density and abundance estimates from baseline survey data, estimated values for seabird flight characteristics used in displacement modelling (e.g. displacement and mortality rates) and CRM (e.g. flight height distributions, avoidance rates, bird size, flight speeds, bird behaviour, and the parameters of the turbines), and demographic rates used in PVA (e.g. environmental and demographic variations in survival and productivity). This is not an exhaustive list.

77. The assumptions and limitations of the assessment are discussed throughout the Chapter where applicable.

13.6 Baseline Environment

13.6.1 Existing Baseline – Intertidal Ornithology

78. The existing baseline for the Intertidal Ornithology Study Area is provided in detail within **Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation Report** which consists of information from desk-based study and preliminary site-specific survey data for the receptors within the landfall area and offshore ECC. A summary of desk-based sources is provided in **Table 13-17** for context.

Table 13-17 Summary of Existing Baseline of Intertidal Avifauna for Landfall Area and Offshore ECC Derived from Desk Study

Source	Summary
NEYEDC	The bird species recorded for the overwintering and passage period as defined by Natural England in their DAS (August to mid-May) in and adjacent to the intertidal part of the Offshore Development Area were skylark (*Alauda arvensis*). The bird species recorded in the breeding period of March to August in and adjacent to the intertidal part of the Offshore Development Area were skylark and tree sparrow (*Passer montanus*).
eBird Basic Dataset (2024)	eBird data for overwintering and passage birds 2019 to 2024 was concentrated in August to October and March to early May inclusive, i.e. passage months, with significantly less coverage from core winter months. As a result of the distribution of effort and data, eBird data is of principal use in assessing occurrence and abundance of species during passage as opposed to winter months. Species included common scoter, red-throated diver, little gull, little tern, common tern and Sandwich tern associated with the adjacent Greater Wash SPA, all of which were recorded in potentially significant numbers in context of national (Great Britain, GB) population (Woodward *et al.*, 2020) as is expected within the SPA boundary. Peak count of sanderling was of similar order of magnitude to the 1% of GB population threshold and was recorded in the majority of overwintering and passage months. Whimbrel was recorded on several occasions in passage months (April, May, August and October) and the peak count exceeded the 1% of the (small) GB breeding population threshold, but was well below 1% of the GB (spring) passage population quoted in Wright et al (2012). The peak counts of a small number of other waterbird species, notably black-throated diver (*Gavia arctica*), ruff (*Philomachus pugnax*), greenshank (*Tringa nebularia*), spotted redshank (*T. erythropus*), green sandpiper (*T. ochropus*), wood sandpiper (*T. glareola*), curlew sandpiper (*Calidris ferruginea*), little stint (*C. minuta*), great white egret (*Ardea alba*), and spoonbill (*Platalea leucorodia*), are also suggested to be significant in the context of the national population. However, due to their small national populations these are not considered to be regularly occurring. The remaining waterbird and seabird species were recorded in significantly lower numbers than the threshold for 1% of national population. Peak counts for all landbirds were also significantly lower than the threshold for 1% of national population.

Source	Summary
	Species and breeding evidence recorded in and adjacent to the intertidal part of the Offshore Development Area in eBird data for 2019 to 2024 was: meadow pipit (*Anthus pratensis*) – Probable breeding status.
DBS baseline ornithology surveys (Peak Ecology 2023, and 2024)	The coverage of these surveys focused on core winter months (December to March) and spring passage months, and therefore the data from these surveys is complementary to the passage-focused coverage resulting from eBird effort described above. Thirty-three overwintering and passage waterbird, seabird or landbird species considered to be potential intertidal receptor species were recorded. The species recorded in highest volume were herring gull, common gull (*Larus canus*), and sanderling across the full survey period, plus sand martin (*Riparia riparia*) in passage or breeding months, and golden plover (*Pluvialis apricaria*), ringed plover (*Charadrius hiaticula*), red-throated diver, great black-backed gull, and great crested grebe (*Podiceps cristatus*) during core winter months. All species were recorded with peak counts significantly lower than the threshold for 1% of national population. Species and breeding evidence recorded in and adjacent to the intertidal part of the Offshore Development Area during DBS surveys were confirmed. Breeding by sand martin (*Riparia riparia*) and tree sparrow, and probable breeding by skylark was recorded. Non-breeding status was assigned to all waterbirds and seabirds observed during surveys based on migratory behaviour or unsuitability of habitat (oystercatcher (*Haematopus ostralegus*), redshank (*Tringa totanus*), herring gull, Arctic tern (*Sterna paradiseae*), common tern and Sandwich tern.
Trektellen	Of those species recorded within the Trektellen database for 2020 to 2024, the peak counts of Sandwich tern, common tern and Arctic skua exceed 1% of the GB breeding populations, though approximately half of Sandwich tern and all common tern and Arctic skua counted were on active migration. The peak count for little gull of 1,204 individuals in 2023 is likely to be over 1% of the UK population, however there is currently no population estimate for the UK (Lawson *et al*., 2016). The count exceeds 1% of the passage population given by Stienen et al (2007). The peak counts of common scoter were in June or July in three of the five data years.

79. The desk-based study of overwintering and passage waterbird, seabird and landbird intertidal receptors' use of the Development Area indicates that, while a wide range of species have been recorded in the previous five years, intertidal receptor species have largely occurred in numbers which are **not significant** in the context of national population. The overwintering and passage species recorded in potentially significant numbers are qualifying feature species of the Greater Wash SPA (i.e. common scoter, little gull, red-throated diver, little tern, common tern and Sandwich tern) and sanderling. Respectively, these reflect the designation of the adjacent sea area as part of the Greater Wash marine SPA, and the limited range of wader species expected to be regularly supported by the sandy beach habitat available within the Offshore Development Area.

80. The desk-based study of intertidal receptors' use of the Offshore Development Area in the breeding season indicates that breeding birds comprise only a small number of landbird species adjacent to the intertidal area. As no waterbird or seabird species were indicated to breed in or adjacent to the intertidal Study Area, breeding species are not considered further in this assessment and are assessed in **Chapter 23 Onshore Ecology and Ornithology**.

81. A total of 40 bird species were recorded during the intertidal surveys from August to December 2024 (**Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation Report**) (**Table 13-18**). The preliminary intertidal survey data to December 2024 supports the indication from the desk data that sanderling is a key species (recorded in greatest abundance/frequency within the intertidal part of the Development Area, adjacent sea area or adjacent terrestrial habitat relative to national (Great Britain, GB) population (Woodward *et al*., 2020)). Sanderling was recorded frequently at low tide from September onwards, initially at fewer than 10 individuals in September to October but counts exceeded 100 individuals in November and December (i.e. approaching 1% of national non-breeding population). Sanderling is taken forward for assessment. No other species occurred in numbers approaching or exceeding 1% of their national population, and little gull, little tern and common tern were not recorded. Among the species recorded alighted on the intertidal or sea area or adjacent terrestrial habitats rather than in flight-only, the most frequent and abundant were common gull, black-headed gull and herring gull. Oystercatcher and cormorant were frequently recorded but in low numbers. Ringed plover, golden plover and common scoter were all infrequently recorded but each occurred in numbers exceeding 50 individuals on one survey visit. All other species including red-throated diver were infrequent and occurred in relatively low numbers. Sandwich tern was recorded only flying past the site. Whimbrel, initially highlighted within the desk study, was recorded on one survey comprising a single bird in flight only.

Table 13-18 Bird Species Recorded in Site-Specific Intertidal (WeBS methodology) Surveys to Dec 2024

Divers and grebes	Geese, swans and ducks	Waders	Seabirds	Landbirds
Red-throated diver	Mute swan	Sanderling	Herring gull	Kestrel
Black-throated diver	Barnacle goose	Oystercatcher	Great black-backed gull	Hobby
Great crested grebe	Pink-footed goose	Avocet	Common gull	Yellow wagtail
	Common scoter	Ringed plover	Black-headed gull	Snow bunting
	Velvet scoter	Golden Plover	Kittiwake	
	Eider	Whimbrel	Sandwich tern	

Divers and grebes	Geese, swans and ducks	Waders	Seabirds	Landbirds
	Red-breasted merganser	Purple sandpiper	Guillemot	
	Goldeneye	Dunlin	Gannet	
	Scaup	Knot	Cormorant	
	Mallard	Turnstone	Shag	
	Teal			
	Shelduck			
	Wigeon			

82. Across both desk-based and preliminary survey data, red-throated diver and common scoter are indicated to use the sea area adjacent to intertidal parts of the Development Area. Evidence on the significance of abundance of these species is equivocal between desk and survey data, and the species are taken forward for assessment on a precautionary basis. Across the surveys and desk study, little gull is indicated to occur in nationally significant numbers, but on a short-term or unpredictable basis when their migratory passage is directed inshore by specific weather conditions. The species is taken forward for assessment on a precautionary basis. Common tern, little tern and Sandwich tern are indicated to potentially occur in notable numbers but are overwhelmingly recorded as birds actively on passage rather than using the intertidal parts of the Development Area for activities such as resting or foraging. These species are taken forward for assessment on a precautionary basis. Whimbrel is also indicated across all sources to occur chiefly as a passage migrant through the site rather than foraging or resting and is not considered to occur in significant numbers relative to national passage population (Wright *et al.*, 2012) which is the more appropriate reference population; therefore, the species is not taken forward for assessment.

13.6.1.1 Conservation Status of Intertidal Ornithology Receptors

83. Details of whether species recorded in surveys (or are indicated to be potential receptors based on desk-study data) are listed on Annex 1 of the EU Birds Directive, as well as their Birds of Conservation Concern status (BoCC, Stanbury *et al.*, 2021 and 2024) and Wildlife and Countryside Act (WCA) Schedule 1 status are provided in **Table 13-19**.

Table 13-19 Summary of Nature Conservation Value of Intertidal Species

Species	Conservation status
Red-throated diver	Schedule 1, Birds Directive Annex 1, Greater Wash SPA feature
Common scoter	Schedule 1, BoCC Red listed, Greater Wash SPA feature
Little gull	Schedule 1, Birds Directive Annex 1, Greater Wash SPA feature
Little tern	Schedule 1, Birds Directive Annex 1, BoCC Amber listed, Greater Wash SPA feature
Common tern	Birds Directive Annex 1, BoCC Amber listed, Greater Wash SPA feature
Sandwich tern	Birds Directive Annex 1, BoCC Amber listed, Greater Wash SPA feature
Black-throated diver	Schedule 1, Birds Directive Annex 1
Great crested grebe	(Birds Directive Migratory Species)
Mute swan	(Birds Directive Migratory Species)
Barnacle goose	Birds Directive Annex 1, BoCC Amber listed
Pink-footed goose	BoCC Amber listed
Velvet scoter	BoCC Red listed
Eider	BoCC Amber listed
Red-breasted merganser	BoCC Amber listed
Goldeneye	Schedule 1, BoCC Red listed
Scaup	Schedule 1, BoCC Red listed
Mallard	BoCC Amber listed
Teal	BoCC Amber listed
Shelduck	BoCC Amber listed
Wigeon	BoCC Amber listed
Sanderling	BoCC Amber listed
Oystercatcher	BoCC Amber listed

Species	Conservation status
Avocet	Schedule 1, Birds Directive Annex 1, BoCC Amber listed
Ringed plover	BoCC Red listed
Golden Plover	Birds Directive Annex 1
Whimbrel	Schedule 1, BoCC Red listed
Purple sandpiper	Schedule 1, BoCC Red listed
Dunlin	BoCC Red listed
Knot	BoCC Amber listed
Turnstone	BoCC5 Amber listed
Herring gull	BoCC5 Red listed
Great black-backed gull	BoCC addendum (Stanbury *et al*., 2024) Red listed
Common gull	BoCC addendum (Stanbury *et al*., 2024) Red listed
Black-headed gull	BoCC5 Amber listed
Kittiwake	BoCC5 Red listed
Guillemot	BoCC5 Amber listed
Gannet	BoCC5 Amber listed
Cormorant	(Birds Directive Migratory Species)
Shag	BoCC5 Amber listed
Kestrel	BoCC5 Amber listed
Hobby	Schedule 1
Yellow wagtail	BoCC5 Red listed
Snow bunting	Schedule 1, BoCC5 Amber listed

13.6.2 Existing Baseline – Offshore Ornithology

84. Within this PEIR chapter, a high-level summary of the characterisation of the baseline environment has been undertaken based on site-specific baseline surveys and supplemented with a desk study of relevant literature (**Table 13-20**). Full details of these surveys and the desk study are presented in **Volume 2, Appendix 13.2 Offshore Ornithology Baseline Characterisation Report**. These baseline surveys consisted of a programme of 24 months of high-resolution DAS, covering the Array Area and a surrounding 4km buffer. The incorporation of the size of the buffer within the DAS surveys was based on the types of impacts to be considered by the assessment and follows species specific guidance on displacement impacts (SNCBs, 2022). Due to Dogger Bank C (DBC) Array Area directly abutting DBD Array Area, asymmetrical buffers were considered to avoid double counting of displacement impacts. A detailed overview of the buffers used in assessment is provided in **Volume 2, Appendix 13.4 Offshore Displacement Analysis Report**.

Table 13-20 Summary of Existing Baseline of Offshore Ornithology for Project Survey Area Derived from Desk Study

<table>
<tr><th>Source</th><th>Summary</th></tr>
<tr><td>DBS Offshore Windfarms ES and associated appendices (RWE, 2023a, b and c)</td><td>Monthly DAS of the DBS Array Area and buffers were carried out between March 2021 and February 2023. Peak abundance estimates for three species exceeded 1% of the North Sea population (SNCBs, 2024b): kittiwake, guillemot and razorbill. Eight species occurred regularly in the survey area: fulmar (Fulmarus glacialis), gannet, great skua (Stercorarius skua), kittiwake, great black-backed gull, guillemot, razorbill, and puffin.</td></tr>
<tr><td>Seabird Tracking Database for Flamborough and Filey Coast, Forth Islands, Coquet Island and St Abb’s Head to Fast Castle SPAs (Seabird Tracking Database, 2023)</td><td>Tracking data for breeding kittiwake and gannet from SPAs within foraging range of the Project, recorded between 2010 and 2019, showed no overlap with the Project survey area.</td></tr>
<tr><td>Surveys of Greater Wash SPA (Lawson et al., 2016)</td><td>Surveys of red-throated diver, little gull and scoter in the Greater Wash SPA highlight that only red-throated diver distributions overlap with the offshore ECC.</td></tr>
<tr><td>Dogger Bank C (DBC) & Sofia ornithology technical report (Burton et al., 2014)</td><td rowspan="2">Monthly boat-based surveys and DAS were carried out between January 2010 and June 2012, covering the entire Dogger Bank Zone. Peak monthly abundance estimates for the following species exceeded 1% of the North Sea population estimates at the time (Skov et al., 1995): fulmar, gannet, kittiwake, lesser black-backed gull, great black-backed gull, guillemot, razorbill, little auk (Alle alle), and puffin.</td></tr>
<tr><td>Dogger Bank A (DBA) & B (DBB) ornithology technical report (Burton et al., 2013)</td></tr>
</table>

85. A total of 24 bird species were recorded during the 24 months survey programme (**Table 13-21**). The findings of the 24-month survey programme identified the following key species (recorded in greatest abundance / density within the DAS Array Area plus 4km buffer: great northern diver, white-billed diver, gannet, kittiwake, great black-backed gull, herring gull, lesser black-backed gull, guillemot, razorbill and puffin (see **Section 13.6.4** for further detail on key receptor identification)). Identification of key species and assessment of potential risk includes consideration of the species abundance in comparison to regional, national and international populations, sensitivity to OWF impacts and biological characteristics that make them susceptible to impacts, as detailed in **Table 13-26**.

Table 13-21 Bird Species Recorded in Site-Specific DAS of the Array Area Plus 4km Buffer (2021 - 2023)

Divers and pelagics	Gulls	Terns	Auks	Other
Gannet	Kittiwake	Arctic tern (*Sterna paradisaea*)	Guillemot	Velvet scoter (*Melanitta fusca*)
Fulmar	Common gull	Common tern (*Sterna hirundo*)	Razorbill	Curlew (*Numenius arquata*)
Manx shearwater (*Puffinus puffinus*)	Black-headed gull	Sandwich tern (*Thalasseus sandvicensis*)	Puffin	Jackdaw (*Coloeus monedula*)
White-billed diver	Mediterranean gull (*Ichthyaetus melanocephalus*)	N/A	Little auk	N/A
Great northern diver	Herring gull		N/A	
Great skua	Lesser black-backed gull			
Arctic skua (*Stercorarius parasiticus*)	Great black-backed gull			

86. Baseline data for the Offshore ECC is also presented within **Volume 2, Appendix 13.2 Offshore Ornithology Baseline Characterisation Report**. The Greater Wash SPA overlaps with the Offshore ECC and therefore, the designated features of the Greater Wash SPA were therefore considered to be part of the baseline environment for the ECC. The Lawson *et al* (2016) was identified as the most appropriate data source to define the ECC baseline as agreed during ETG2 Meeting 3 held on 21st October 2024 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**). The distribution maps presented within Lawson *et al* (2016), suggest only red-throated diver has a non-breeding distribution that may overlap with the offshore ECC and so this is the only ornithological receptor considered further for assessment within the offshore ECC.

13.6.2.1 Conservation Status of Offshore Ornithology Receptors

87. Details of whether the species taken forward for impact assessment are listed on Annex 1 of the Birds Directive as well as their Birds of Conservation Concern (BoCC) status are provided (**Table 13-22**).

Table 13-22 Summary of Nature Conservation Value of Species Considered at Potential Risk of Impacts

Species	Conservation status
Velvet scoter	BoCC Red listed, Schedule 1*, Birds Directive Migratory Species
Curlew	BoCC Red listed, Birds Directive Migratory Species
Kittiwake	BoCC Red listed, Birds Directive Migratory Species
Black-headed gull	BoCC Amber listed, Birds Directive Migratory Species
Mediterranean gull	BoCC Amber listed, Schedule 1, Birds Directive Annex 1
Common gull	BoCC Red listed, Birds Directive Migratory Species
Great black-backed gull	BoCC Red listed, Birds Directive Migratory Species
Herring gull	BoCC Red listed, Birds Directive Migratory Species
Lesser black-backed gull	BoCC Amber listed, Birds Directive Migratory Species
Sandwich tern	BoCC Amber listed, Birds Directive Annex 1
Common tern	BoCC Amber listed, Birds Directive Annex 1
Arctic tern	BoCC Red listed, Birds Directive Annex 1

Species	Conservation status
Great skua	BoCC Red listed, Birds Directive Migratory Species
Arctic skua	BoCC Red listed, Birds Directive Migratory Species
Little auk	Birds Directive Migratory Species
Guillemot	BoCC Amber listed, Birds Directive Migratory Species
Razorbill	BoCC Amber listed, Birds Directive Migratory Species
Puffin	BoCC Red listed, Birds Directive Migratory Species
Red-throated diver	Schedule 1, Birds Directive Annex 1
Great northern diver	BoCC Amber listed, Schedule 1*, Birds Directive Annex 1
White-billed diver	Schedule 1*, Birds Directive Migratory Species
Fulmar	BoCC Amber listed, Birds Directive Migratory Species
Manx shearwater	BoCC Amber listed, Birds Directive Migratory Species
Gannet	BoCC Amber listed, Birds Directive Migratory Species
Jackdaw	Birds Directive Migratory Species

*Table note: Velvet scoter, great northern diver and white-billed diver are listed under Schedule 1 of the Wildlife and Countryside Act 1989, however they do not breed in the UK, limiting the relevance.

88. An addendum to the fifth BoCC Red List assessment has been produced for breeding seabird species and so where the species have been considered, this is the default list of reference.

13.6.2.2 Biological Seasons, Populations and Demographics

89. Bird behaviour and abundance is recognised to differ across a calendar year dependent upon the bio-seasons that may be applicable to different seabird species. Separate bio-seasons are recognised in this PEIR chapter in order to establish the level of importance any seabird species has within the Project during any particular period of time. The biologically defined minimum population scales (BDMPS) bio-seasons are based on those in Furness (2015), hereafter referred to as BDMPS bio-seasons or bio-seasons (**Table 13-23**), which Natural England broadly agreed as appropriate within their Scoping Opinion response (see **Volume 2**, **Appendix 13.1 Consultation Responses for Offshore and Intertidal Ornithology**). The bio-seasons are defined within this PEIR chapter as: return migration, breeding, post-breeding migration, migration-free winter bio-seasons, breeding and non-breeding bio-seasons. These six bio-seasons can be applied to different periods within the annual cycle for most seabird species, though not all are applicable for all seabird species, with different combinations used depending on the biology and the life history of a species:

- Return migration: when birds are migrating to breeding grounds;
- Migration-free breeding: when birds are attending colonies, nesting and provisioning young;
- Post-breeding migration: when birds are either migrating to wintering areas or dispersing from colonies;
- Migration-free winter: when non-breeding birds are over-wintering in an area;
- Breeding and non-breeding: For some species, there is significant overlap between migratory, breeding and wintering periods between colonies and individuals, and so the above bio-seasons cannot be appropriately applied. Therefore, the two bio-seasons are defined:
    - Breeding from modal arrival to the colony at the beginning of breeding to modal departure from the colony; and
    - Non-breeding from modal departure from the colony at the end of breeding to modal return to the colony the following year.

Table 13-23 Species Specific Defined Bio-Seasons (Bold Highlights Bio-Seasons Taken Through for Impact Assessment)

Species	Return migration	Migration-free breeding	Post-breeding migration	Migration-free winter	Breeding	Non-breeding
Red-throated diver	February - April	May – August	September – November	December – January	March – August	**September – February**
Great northern diver	March – May	N/A	September – November	December – February	N/A	**September – May**
White-billed diver*	March – May	N/A	September – November	December – February	N/A	**September – May**
Gannet	**December – March**	April - August	**September – November**	N/A	**March – September**	October – February
Kittiwake	**January – April**	May - July	**August – December**	N/A	**March – August**	September – February
Herring gull	January – April	May - July	August - November	December	**March – August**	**September – February**
Great black-backed gull	January – April	May - July	August - November	December	**Late March - August**	**September – March**
Lesser black-backed gull	**March - April**	May - July	**August - October**	**November – February**	**April – August**	September – March
Guillemot	December – February	March – June	July - October	November	**March – July**	**August – February**
Razorbill	**January – March**	April – June	**August – October**	**November – December**	**April – July**	August – March
Puffin	March - April	May - June	Late July - August	September – February	**April – early August**	**Mid-August – March**

*Table Note: Great northern diver bio-seasons were used as a proxy for white-billed diver due to lack of species-specific information.

90. Impacts have been assessed in relation to relevant bio-seasons, as defined by Furness (2015), with additional consideration of evidence for any species-specific and / or site-specific variations in line with best practice (Parker *et al.,* 2022c). These are presented for relevant offshore ornithology receptors in **Table 13-23**. These seasonal definitions include overlapping months (in some instances) due to variation in the timing of migration for birds which breed at different latitudes (i.e. individuals from breeding sites in the north of the species' range may still be on spring migration when individuals farther south have already commenced breeding). Where the breeding bio-season overlaps other bio-seasons, impacts are apportioned to the breeding bio-season only unless otherwise stated. The reference populations for which impacts have been assessed against varies by bio-season and is discussed below.

91. A full overview of the bio-seasons considered for the impact assessments within this PEIR chapter is provided in the **Volume 2**, **Appendix 13.2 Offshore Ornithology Baseline Characterisation Report**, **Section 2.3.2**. **Volume 2, Appendix 13.2 Offshore Ornithology Baseline Characterisation Report** also provides species accounts which outline the utilisation of each species within the Offshore Development Area, therefore informing upon the appropriateness of the bio-seasons concluded for the assessments.

13.6.2.2.1 BDMPS Population Sizes

92. BDMPS population estimates for all bio-seasons are taken from the values recommended within Natural England and Natural Resources Wales interim advice note on demographic rates, EIA scale mortality rates and reference populations (Natural England & Natural Resources Wales, 2024) (**Table 13-24**). The annual BDMPS population estimate for each species is the same as the highest bio-seasonal population assigned to them. Total population sizes for the biogeographic population with connectivity to UK waters are also provided and assessed against for context based on the values presented within Furness (2015).

13.6.2.2.2 Demographics

93. Where feasible, quantitative assessments have been undertaken to assess the potential population level consequences and predicted additional mortality which may arise from the Project in relation to change in baseline mortality for the relevant bio-seasons and reference populations presented in **Table 13-23** and **Table 13-24**. The BDMPS for each species assessed is made up of differing age classes and therefore an average baseline mortality rate accounting for appropriate population size weighting of each individual age classes mortality rate is required to calculate the predicted bio-seasonal and annual BDMPS baseline mortality. Average baseline mortality across all age classes for each species are presented in **Table 13-25,** derived from recommended rates within The Natural England and Natural Resources Wales (2024) guidance on demographics.

Table 13-24 BDMPS Region, BDMPS Population Sizes and Biogeographic Population Sizes

Species	Return migration	Migration-free Breeding	Post-breeding migration	Migration-free winter	Breeding	Non-breeding	Annual BDMPS population	Annual biogeographic population
Red-throated diver (SW North Sea)	-	-	-	-	-	10,178	10,178	27,000
Great northern diver (UK North Sea and Channel)	-	-	-	-	-	1,200	1,200	430,000
White-billed diver (UK North Sea)*	-	-	-	-	-	Unknown	Unknown	Unknown
Gannet (UK North Sea and Channel)	248,385	-	456,299	-	400,326	-	456,299	1,180,000
Kittiwake (UK North Sea and Channel)	627,814	-	829,938	-	839,456	-	839,456	5,100,000
Herring gull (UK North Sea and Channel)	-	-	-	-	324,887	466,510	466,510	1,098,000
Great black-backed gull (UK North Sea)	-	-	-	-	25,917	91,398	91,398	235,000
Lesser black-backed gull (UK North Sea and Channel)	197,482	-	209,006	39,313	51,233	-	209,006	864,000
Guillemot (UK North Sea and Channel)	-	-	-	-	2,045,078	1,617,305	2,045,078	4,125,000
Razorbill (UK North Sea and Channel)	591,875	-	591,875	218,621	158,031	-	591,875	1,707,000
Puffin (UK North Sea and Channel)	-	-	-	-	868,689	231,958	868,689	2,370,000

* Table Note: Current UK North Sea population is unknown due to species being recognised historically as scarce migrant within UK waters.

Table 13-25 Average Baseline Mortality Rates of Key Species Assessed in this Report, where these are available.

Species	Average baseline mortality rate
Red-throated diver	0.2277
Great northern diver	0.1300
Gannet	0.1866
Kittiwake	0.1577
Herring gull	0.1724
Great black-backed gull	0.0969
Lesser black-backed gull	0.1237
Guillemot	0.1405
Razorbill	0.1302
Puffin	0.1190

94. In addition to assessment against the BDMPS population, assessment is also considered against the biogeographic population of each species which considers all birds with connectivity to UK water.

13.6.3 Predicted Future Baseline

95. The current baseline description above provides an accurate reflection of the current state of the baseline environment. The earliest possible date for the start of the offshore construction of the Project is no earlier than 2029, with an expected operational life of 35 years, and therefore there exists the potential for the baseline to evolve between the time of assessment and point of impact. Outside of short-term or bio-seasonal fluctuations, changes to the baseline in relation to offshore and intertidal ornithology usually occur over an extended period of time. Based on current information regarding reasonably foreseeable events over the next five years, the baseline is not anticipated to have fundamentally changed from its current state at the point in time when impacts occur.

96. The baseline environment for operational / decommissioning impacts is expected to evolve on a species by species basis. The future baseline is uncertain, however, should the Project be developed or not, then the likely evolution of the population of birds will follow the general UK North Sea and wider biogeographic trends. As cited within Burnell *et al* (2023), the most cited drivers of future population change in seabird considered within this chapter relates to predation and food availability, though such effects from these population drivers are too uncertain to reliably include within assessment.

97. With the outbreak of H5N1 strain of the Highly Pathogenic Avian Influenza (HPAI), certain key seabird species were negatively impacted. Colonies around the UK coast showed declines (RSPB, 2023), with the number of mortalities highlighting a conservation threat (Tremlett *et al.*, 2024). Gannet, guillemot, razorbill, puffin and kittiwake were all recorded as having been affected by the virus, with differing rates of infection and mortality between the species (DEFRA, 2022). The outbreak of HPAI coincided with the DAS data collection for the Project baseline and so a review of colony trends for key colonies with connectivity to Array Area was conducted within the **Volume 2, Appendix 13.2 Offshore Ornithology Baseline Characterisation Report**.

13.6.4 Evaluation of Potential Receptors

98. The assessment of impacts in this PEIR follows CIEEM guidelines (CIEEM, 2024) with regards to the emphasis being on "significant effects rather than all ecological effects". Therefore, potential receptors which are determined to be of low or negligible value are not considered further in this assessment. Significant effects on these species are not predicted given their infrequent occurrence in the survey area and / or low conservation status (see **Section 13.6.1** and **Section 13.6.2** for details on bird species presence within the Offshore Development Area for intertidal and offshore ornithology, respectively). The Applicant's justification for scoping in or out ornithological receptors is provided in **Table 13-26** and **Table 13-27** for offshore and intertidal ornithology receptors, respectively. It must be noted that consultation at ETG meetings on species taken forward for assessment, and the relevant impacts, has taken place. Details of this consultation can be found in **Volume 2, Appendix 13.1 Consultation Responses for Offshore and Intertidal Ornithology**. The methods that are followed when concluding evaluation of impacts are outlined in **Section 13.5**, with effect pathways outlined in **Section 13.7**. All receptors considered within the Offshore Development Area are outlined in **Section 13.6.1** and **Section 13.6.2**.

Table 13-26 Summary of Offshore Ornithological Receptors and Potential Impacts (Species highlighted green indicate those scoped in for further impact assessment)

Potential Receptor	Behavioural Sensitivity (Table 13-12; Bradbury *et al.*, 2014; Furness and Wade, 2012; Joint SNCB (SNCBs, 2022)		Conservation Value Rationale	Conservation Value (Table 13-9; Table 13-22)	Peak Abundance within Array Area / Array Area plus 4km buffer (individuals)	Frequency of months recorded within Array Area / Array Area plus 4km buffer	Overall sensitivity Value	Potential Impacts											
	Disturbance and Displacement	Collision Risk						Collision risk (ORN-O-06)			Disturbance and displacement (ORN-C/O/D-01) (ORN-C/O/D-02)			Barrier effects (ORN-O-03)			Indirect impacts via habitat and prey availability (ORN-C/O/D-05)		
								C	O / M	D	C	O / M	D	C	O / M	D	C	O / M	D
Velvet scoter	High	Low	Individuals recorded within the Offshore Project are not likely to be associated with any designated sites. Species recorded infrequently (during one survey) and is not likely to utilise the survey area. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	0 / 5	0 / 1	Low		xa		xa	xa	xa		xa		xa	xa	xa
Curlew	Low	Low	Migratory individuals are unlikely to be a qualifying feature of any designated site and recorded infrequently (one survey) but afforded species protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	61 / 61	1 / 1	Low		✓b		xa	xa	xa		xa		xc	xc	xc
Kittiwake	Low	High	Individuals recorded within the Offshore Project may be drawn from a mixture of conservation sites of international and national importance and other populations which may also contribute to individuals at risk. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	1,893 / 3,110	24 / 24	Medium		✓e		xd	xd	xd		✓f		✓g	✓g	✓g

Potential Receptor	Behavioural Sensitivity (Table 13-12; Bradbury *et al.*, 2014; Furness and Wade, 2012; Joint SNCB (SNCBs, 2022)		Conservation Value Rationale	Conservation Value (Table 13-9; Table 13-22)	Peak Abundance within Array Area / Array Area plus 4km buffer (individuals)	Frequency of months recorded within Array Area / Array Area plus 4km buffer	Overall sensitivity Value	Potential Impacts											
	Disturbance and Displacement	Collision Risk						Collision risk (ORN-O-06)			Disturbance and displacement (ORN-C/O/D-01) (ORN-C/O/D-02)			Barrier effects (ORN-O-03)			Indirect impacts via habitat and prey availability (ORN-C/O/D-05)		
								C	O / M	D	C	O / M	D	C	O / M	D	C	O / M	D
Black-headed gull	Low	High	Individuals not a qualifying feature of any designated site within species foraging range but afforded species protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021; Stanbury *et al.*, 2024).	Low	10 / 10	2 / 2	Low		✓b		xd	xd	xd		xd		xc	xc	xc
Mediterranean gull	Low	High		Low	5 / 5	1 / 2	Low		✓b		xd	xd	xd		xd		xc	xc	xc
Common gull	Low	High		Low	31 / 31	7 / 9	Low		✓b		xd	xd	xd		xd		xb	xb	xb
Great black-backed gull	Low	High	Individuals not a qualifying feature of any designated site within species foraging range but afforded species protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	10 / 10	4 / 4	Medium		✓e		xd	xd	xd		xd		✓g	✓g	✓g
Herring gull	Low	High		Medium	10 / 15	4 / 4	Medium		✓e		xd	xd	xd		xd		✓g	✓g	✓g
Lesser black-backed gull	Low	High	Individuals not a qualifying feature of any designated site within species foraging range and recorded infrequently but afforded species protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	15 / 20	2 / 4	Medium		✓e		xd	xd	xd		xd		✓g	✓g	✓g
Sandwich tern	Low	High	Migratory individuals unlikely to be a qualifying feature of any designated site within species foraging range and recorded infrequently but afforded species protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021; Stanbury *et al.*, 2024).	Low	10 / 10	1 / 1	Low		✓b		xd	xd	xd		xd		xa	xa	xa
Common tern	Low	High		Low	17 / 17	1 / 1	Low		✓b		xd	xd	xd		xd		xa	xa	xa
Arctic tern	Low	High		Low	86 / 273	2 / 2	Low		✓b		xd	xd	xd		xd		xa	xa	xa
Great skua	Low	High		Low	10 / 10	2 / 2	Low		✓b		xd	xd	xd		xd		xa	xa	xa
Arctic skua	Low	High		Low	0 / 5	0 / 1	Low		✓b		xd	xd	xd		xd		xa	xa	xa

Potential Receptor	Behavioural Sensitivity (Table 13-12; Bradbury *et al.*, 2014; Furness and Wade, 2012; Joint SNCB (SNCBs, 2022)		Conservation Value Rationale	Conservation Value (Table 13-9; Table 13-22)	Peak Abundance within Array Area / Array Area plus 4km buffer (individuals)	Frequency of months recorded within Array Area / Array Area plus 4km buffer	Overall sensitivity Value	Potential Impacts											
	Disturbance and Displacement	Collision Risk						Collision risk (ORN-O-06)			Disturbance and displacement (ORN-C/O/D-01) (ORN-C/O/D-02)			Barrier effects (ORN-O-03)			Indirect impacts via habitat and prey availability (ORN-C/O/D-05)		
								C	O / M	D	C	O / M	D	C	O / M	D	C	O / M	D
Little auk	Low	Low	Individuals recorded within the Offshore Project are not associated with any designated sites. Species recorded infrequently (during one survey) and although likely under-counted, not afforded special protection under Schedule 1 / Annex 1 or BoCC5.	Low	43 / 90	1 / 1	Low		xa		✓h	✓h	✓h		xd		xa	xa	xa
Guillemot	Medium	Low	Individuals recorded within the Offshore Project may be drawn from a mixture of conservation sites of international and national importance and other populations which may also contribute to individuals at risk. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	8,067 / 15,542	24 / 24	Medium		xi		✓j	✓j	✓j		xk		✓g	✓g	✓g
Razorbill	Medium	Low		Medium	1,231 / 2,218	24 / 24	Medium		xi		✓j	✓j	✓j		xk		✓g	✓g	✓g
Puffin	Medium	Low		Medium	119 / 161	11 / 13	Medium		xi		✓l	✓l	✓l		xk		✓g	✓g	✓g
Red-throated diver	High	Low	Individuals recorded within the ECC are qualifying features of the Greater Wash SPA. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	High	19 / 33*	N/A*	High		xi		✓m	✓m	✓m		xa		✓g	✓g	✓g
Great northern diver	Medium / High	Low	Individuals not a qualifying feature of any designated site with connectivity to the Offshore Project but afforded species protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	56 / 90	12 / 12	Medium		xi		✓j	✓j	✓j		xk		✓g	✓g	✓g

Potential Receptor	Behavioural Sensitivity (Table 13-12; Bradbury *et al.*, 2014; Furness and Wade, 2012; Joint SNCB (SNCBs, 2022)		Conservation Value Rationale	Conservation Value (Table 13-9; Table 13-22)	Peak Abundance within Array Area / Array Area plus 4km buffer (individuals)	Frequency of months recorded within Array Area / Array Area plus 4km buffer	Overall sensitivity Value	Potential Impacts											
	Disturbance and Displacement	Collision Risk						Collision risk (ORN-O-06)			Disturbance and displacement (ORN-C/O/D-01) (ORN-C/O/D-02)			Barrier effects (ORN-O-03)			Indirect impacts via habitat and prey availability (ORN-C/O/D-05)		
								C	O / M	D	C	O / M	D	C	O / M	D	C	O / M	D
White-billed diver	Medium	Low	Individuals not a qualifying feature of any designated site with connectivity to the Offshore Project. Species afforded special protection under Schedule 1 but does not breed in the UK and has only been recorded within the Offshore Project in the non-breeding bio-season.	Low	16 / 27	2 / 3	Low		xi		✓n	✓n	✓n		xk		xa	xa	xa
Fulmar	Low	Low	Individuals recorded within the Offshore Project may be drawn from a mixture of conservation sites of international and national importance and other populations which may also contribute to individuals at risk. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021), however risk of collision and displacement is low.	Low	278 / 434	21 / 24	Low		xi		xd	xd	xd		✓f		✓g	✓g	✓g
Manx shearwater	Low	Low	Migratory individuals unlikely to be a qualifying feature of any designated site within species foraging range and recorded infrequently but afforded species protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	5 / 5	1 / 1	Low		xi		xd	xd	xd		xk		xa	xa	xa

Potential Receptor	Behavioural Sensitivity (Table 13-12; Bradbury *et al.*, 2014; Furness and Wade, 2012; Joint SNCB (SNCBs, 2022)		Conservation Value Rationale	Conservation Value (Table 13-9; Table 13-22)	Peak Abundance within Array Area / Array Area plus 4km buffer (individuals)	Frequency of months recorded within Array Area / Array Area plus 4km buffer	Overall sensitivity Value	Potential Impacts											
	Disturbance and Displacement	Collision Risk						Collision risk (ORN-O-06)			Disturbance and displacement (ORN-C/O/D-01) (ORN-C/O/D-02)			Barrier effects (ORN-O-03)			Indirect impacts via habitat and prey availability (ORN-C/O/D-05)		
								C	O / M	D	C	O / M	D	C	O / M	D	C	O / M	D
Gannet	Medium	High	Individuals recorded within the Offshore Project may be drawn from a mixture of conservation sites of international and national importance and other populations which may also contribute to individuals at risk. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	932 / 1,425	24 / 24	Medium		✓e		✓o	✓o	✓o		✓f		✓g	✓g	✓g
Jackdaw	Low	Low	Terrestrial species. Migratory individuals recorded within the Offshore Project are not associated with any designated sites. Species recorded infrequently (one survey) and not afforded special protection under Schedule 1 / Annex 1 or BoCC5.	Low	20 / 20	1 / 1	Low		xa		xa	xa	xa		xa		xa	xa	xa

Scoping Conclusion references:

a - species recorded infrequently within site-specific surveys and / or in negligible abundance. Therefore, any potential impact from the Project would be indistinguishable from natural fluctuations in BDMPS baseline mortality, even when considering the worst-case level of effect.

b – potential connectivity with receptor limited to bi-annual migratory movements. General consideration of the potential risk of collision to migratory birds is provided within **Section 13.7.2.4.7**.

c – species not likely to utilise the survey area for foraging, therefore, impacts on prey availability are not applicable.

d – species classified as low behavioral sensitivity to disturbance / displacement / barrier effects, therefore potential for a significant effect can be confidently ruled out.

e - species classified as sensitive to collision risk impacts from OWF during the operational phase.

f – species considered for barrier effects due to connectivity in breeding bio-season to SPAs.

g -species may possibly use the Project area for foraging activities.

h - despite the species being classified as low vulnerability to disturbance and displacement, little auk are included as recommended at ETG2 meeting held on 21st October 2025 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**).

i – species considered to be at low risk of collision based on their flight behavior.

Potential Receptor	Behavioural Sensitivity (Table 13-12; Bradbury *et al.*, 2014; Furness and Wade, 2012; Joint SNCB (SNCBs, 2022)		Conservation Value Rationale	Conservation Value (Table 13-9; Table 13-22)	Peak Abundance within Array Area / Array Area plus 4km buffer (individuals)	Frequency of months recorded within Array Area / Array Area plus 4km buffer	Overall sensitivity Value	Potential Impacts											
	Disturbance and Displacement	Collision Risk						Collision risk (ORN-O-06)			Disturbance and displacement (ORN-C/O/D-01) (ORN-C/O/D-02)			Barrier effects (ORN-O-03)			Indirect impacts via habitat and prey availability (ORN-C/O/D-05)		
								C	O / M	D	C	O / M	D	C	O / M	D	C	O / M	D

j - species considered as having medium or high behavioral sensitivity to disturbance and displacement.

k – Species unlikely to forage within or beyond the Project area based on the species MMFR + 1SD from UK breeding colonies in the breeding bio-season and therefore, limited potential for a significant barrier effect to occur.

l - despite species being classified as low vulnerability to disturbance and displacement, puffin are included as recommended within the Joint SNCB guidance due to their moderate habitat specialisation (SNCBs, 2022).

m - Red-throated diver are classified as sensitive to disturbance from ECC construction activities. Therefore, this species has been considered further in relation to impacts from disturbance and displacement during construction.

n – Despite white-billed diver being recorded infrequently and in low numbers within the Project, species included for displacement assessment at the request of Natural England during the ETG2 meeting held on 21st October 2025 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**).

o - Whilst gannet are considered to be of low vulnerability to disturbance and displacement, they have been included in the assessment of potential displacement during all phases of the Project as a precautionary measure. This is to provide SNCBs with confidence that any potential effects from construction activities have been considered in a quantitative manner.

*Table note: Red-throated diver was only recorded within the ECC plus 2km buffer, with a mean abundance of 19 individuals and a maximum abundance of 33 individuals. None were recorded within the Array Area plus 4km buffer.

Table 13-27 Summary of Intertidal Ornithological Receptors and Potential Impacts. Species highlighted green indicate those scoped in for further impact assessment)

Potential Receptor	Conservation Value Rationale	Conservation Value (Table 13-9)	Peak Abundance alighted on Intertidal Study Area / Peak in Intertidal Study Area incl. in flight (individuals) (Aug – Dec 2024)	Total surveys recorded alighted on Intertidal Study Area / Total surveys where recorded incl. in flight (Aug – Dec 2024)	Potential Impacts Scoped In at Scoping Report (RHDHV, 2024a)					
					Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall (ORN-C/O/D-01)			Indirect impacts via habitats or prey availability (ORN-C/O/D-05)		
					C	O / M	D	C	O / M	D
Red-throated diver	Individuals recorded within the ECC or at landfall are qualifying features of the Greater Wash SPA. Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	High	32 / 32	4 / 4	✓a	✓a	✓a	✓b	✓b	✓b
Common scoter	Individuals recorded within the ECC or at landfall are qualifying features of the Greater Wash SPA. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	High	57 / 65	4 / 4	✓c	✓ c	✓ c	✓b	✓b	✓b
Little gull	Individuals recorded within the ECC or at landfall are qualifying features of the Greater Wash SPA. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	High	(Desk study flagged species)		xd	xd	xd	✓b	✓b	✓b
Little tern	Individuals recorded within the ECC or at landfall are qualifying features of the Greater Wash SPA. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	High	(Desk study flagged species)		xd	xd	xd	✓b	✓b	✓b
Common tern	Individuals recorded within the ECC or at landfall are qualifying features of the Greater Wash SPA. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	High	(Desk study flagged species)		xd	xd	xd	✓b	✓b	✓b
Sandwich tern	Individuals recorded within the ECC or at landfall are qualifying features of the Greater Wash SPA. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	High	0 / 27	0 / 1	xd	xd	xd	✓b	✓b	✓b
Black-throated diver	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	1 / 1	1 / 1	xe	xe	xe	xe	xe	xe

Potential Receptor	Conservation Value Rationale	Conservation Value (Table 13-9)	Peak Abundance alighted on Intertidal Study Area / Peak in Intertidal Study Area incl. in flight (individuals) (Aug – Dec 2024)	Total surveys recorded alighted on Intertidal Study Area / Total surveys where recorded incl. in flight (Aug – Dec 2024)	Potential Impacts Scoped In at Scoping Report (RHDHV, 2024a)					
					Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall (ORN-C/O/D-01)			Indirect impacts via habitats or prey availability (ORN-C/O/D-05)		
					C	O / M	D	C	O / M	D
Great crested grebe	Occurring within SPA but not crucial to the integrity of the site. Species recorded in potentially locally important numbers. Not afforded protection under Schedule 1 / Annex 1 and BoCC5 green listed (Stanbury *et al.*, 2021).	Low	20 / 20	5 / 5	xf	xf	xf	xf	xf	xf
Mute swan	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Not afforded protection under Schedule 1 / Annex 1 and BoCC5 green listed (Stanbury *et al.*, 2021).	Low	0 / 1	0 / 1	xe	xe	xe	xe	xe	xe
Barnacle goose	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	0 / 8	0 / 1	xe	xe	xe	xe	xe	xe
Pink-footed goose	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey) but afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	0 / 1400	0 / 1	xe	xe	xe	xe	xe	xe
Velvet scoter	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). but afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	1 / 1	1 / 1	xe	xe	xe	xe	xe	xe
Eider	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey) but afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	1 / 1	1 / 1	xe	xe	xe	xe	xe	xe
Red-breasted merganser	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey) but afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	2 / 2	1 / 1	xe	xe	xe	xe	xe	xe
Goldeneye	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	18 / 18	1 / 1	xg	xg	xg	xg	xg	xg

Potential Receptor	Conservation Value Rationale	Conservation Value (Table 13-9)	Peak Abundance alighted on Intertidal Study Area / Peak in Intertidal Study Area incl. in flight (individuals) (Aug – Dec 2024)	Total surveys recorded alighted on Intertidal Study Area / Total surveys where recorded incl. in flight (Aug – Dec 2024)	Potential Impacts Scoped In at Scoping Report (RHDHV, 2024a)					
					Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall (ORN-C/O/D-01)			Indirect impacts via habitats or prey availability (ORN-C/O/D-05)		
					C	O / M	D	C	O / M	D
Scaup	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	0 / 1	0 / 1	xe	xe	xe	xe	xe	xe
Mallard	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey) but afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	11 / 11	1 / 1	xe	xe	xe	xe	xe	xe
Teal	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently in low numbers, but afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	14 / 64	2 / 4	xg	xg	xg	xg	xg	xg
Shelduck	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during two surveys) but afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	0 / 1	0 / 2	xe	xe	xe	xe	xe	xe
Wigeon	Occurring within SPA but not crucial to the integrity of the site. Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	42 / 42	2 / 4	xg	xg	xg	xg	xg	xg
Sanderling	Occurring within SPA but not crucial to the integrity of the site. Species recorded frequently and peak counts approach threshold for national importance. Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	139 / 139	6 / 6	✓h	✓h	✓h	✓b	✓b	✓b
Oystercatcher	Occurring within SPA but not crucial to the integrity of the site. Potentially occurring in locally important numbers. Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	37 / 37	4 / 7	✓i	✓i	✓i	✓b	✓b	✓b
Avocet	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	3 / 4	1 / 1	xe	xe	xe	xe	xe	xe

Potential Receptor	Conservation Value Rationale	Conservation Value (Table 13-9)	Peak Abundance alighted on Intertidal Study Area / Peak in Intertidal Study Area incl. in flight (individuals) (Aug – Dec 2024)	Total surveys recorded alighted on Intertidal Study Area / Total surveys where recorded incl. in flight (Aug – Dec 2024)	Potential Impacts Scoped In at Scoping Report (RHDHV, 2024a)					
					Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall (ORN-C/O/D-01)			Indirect impacts via habitats or prey availability (ORN-C/O/D-05)		
					C	O / M	D	C	O / M	D
Ringed plover	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during two surveys). Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	53 / 53	2 / 2	xe	xe	xe	xe	xe	xe
Golden Plover	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during two surveys). Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	82 / 293	2 / 2	xe	xe	xe	xe	xe	xe
Whimbrel	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	0 / 1	0 / 1	xe	xe	xe	xe	xe	xe
Purple sandpiper	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	0 / 2	0 / 1	xe	xe	xe	xe	xe	xe
Dunlin	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently and in low numbers. Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	15 / 15	2 / 3	xe	xe	xe	xe	xe	xe
Knot	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	1 / 1	1 / 1	xe	xe	xe	xe	xe	xe
Turnstone	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	2 / 2	1 / 1	xe	xe	xe	xe	xe	xe
Herring gull	Occurring within SPA but not crucial to the integrity of the site. Species recorded in potentially locally important numbers. Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	187 / 187	9 / 10	xd	xd	xd	✓b	✓b	✓b

Potential Receptor	Conservation Value Rationale	Conservation Value (Table 13-9)	Peak Abundance alighted on Intertidal Study Area / Peak in Intertidal Study Area incl. in flight (individuals) (Aug – Dec 2024)	Total surveys recorded alighted on Intertidal Study Area / Total surveys where recorded incl. in flight (Aug – Dec 2024)	Potential Impacts Scoped In at Scoping Report (RHDHV, 2024a)					
					Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall (ORN-C/O/D-01)			Indirect impacts via habitats or prey availability (ORN-C/O/D-05)		
					C	O / M	D	C	O / M	D
Great black-backed gull	Occurring within SPA but not crucial to the integrity of the site. Species recorded in potentially locally important numbers. Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	15 / 15	8 / 9	xd	xd	xd	✓b	✓b	✓b
Common gull	Occurring within SPA but not crucial to the integrity of the site. Species recorded in potentially locally important numbers. Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	637 / 655	8 / 9	xd	xd	xd	✓b	✓b	✓b
Black-headed gull	Occurring within SPA but not crucial to the integrity of the site. Species recorded in potentially locally important numbers. Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Medium	133 / 144	6 / 9	xd	xd	xd	✓b	✓b	✓b
Kittiwake	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	1 / 1	1 / 2	xe	xe	xe	xe	xe	xe
Guillemot	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently in low numbers. Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	6 / 6	4 / 4	xe	xe	xe	xe	xe	xe
Gannet	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently in low numbers. Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	1 / 30	2 / 3	xe	xe	xe	xe	xe	xe
Cormorant	Occurring within SPA but not crucial to the integrity of the site. Species recorded in potentially locally important numbers. Not afforded protection under Schedule 1 / Annex 1 and BoCC5 green listed (Stanbury *et al.*, 2021).	Low	25 / 25	4 / 7	xe	xe	xe	xe	xe	xe
Shag	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during two surveys). Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al.*, 2021).	Low	2 / 2	2 / 2	xe	xe	xe	xe	xe	xe

Potential Receptor	Conservation Value Rationale	Conservation Value (Table 13-9)	Peak Abundance alighted on Intertidal Study Area / Peak in Intertidal Study Area incl. in flight (individuals) (Aug – Dec 2024)	Total surveys recorded alighted on Intertidal Study Area / Total surveys where recorded incl. in flight (Aug – Dec 2024)	Potential Impacts Scoped In at Scoping Report (RHDHV, 2024a)					
					Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall (ORN-C/O/D-01)			Indirect impacts via habitats or prey availability (ORN-C/O/D-05)		
					C	O / M	D	C	O / M	D
Kestrel	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during two surveys). Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al*., 2021).	Low	0 / 1	0 / 2	xe	xe	xe	xe	xe	xe
Hobby	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al*., 2021).	Low	0/1	0/1	xe	xe	xe	xe	xe	xe
Yellow wagtail	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently (during one survey). Species afforded special protection under Schedule 1 / Annex 1 and / or BoCC5 amber or red-listed (Stanbury *et al*., 2021).	Low	1 / 1	1 / 1	xe	xe	xe	xe	xe	xe
Snow bunting	Occurring within SPA but not crucial to the integrity of the site. Species recorded infrequently in low numbers. Species afforded special protection under Schedule 1 / Annex 1 and are either BoCC5 amber or red-listed (Stanbury *et al*., 2021).	Low	0 / 21	0 / 1	xe	xe	xe	xe	xe	xe

Scoping Conclusion references:

a - Red-throated diver is classified as highly sensitive to visual or noise disturbance from activities associated with intertidal aspects of the Project e.g. vessel movements (Fliessbach *et al*., 2019) and presence of works on the foreshore (Natural England, 2024a). The species has low tolerance and medium ability to recover, but high conservation value. Therefore, this species is classified as high sensitivity and considered further in relation to impacts from disturbance and displacement.

b – Species is known to use intertidal or inshore habitats and/or prey, through which indirect effects could occur (Birdlife International, 2025).

c – Common scoter is classified as having medium sensitivity to disturbance from activities associated with intertidal aspects of the Project e.g. vessel movements (Fliessbach *et al*., 2019) and presence of works on the foreshore (Natural England, 2024a). The species has medium tolerance and medium ability to recover, but high conservation value. Therefore, this species is classified as high sensitivity and considered further in relation to impacts from disturbance and displacement.

d – Gulls and terns show little to no sensitivity, to visual or noise disturbance and displacement by activities associated with intertidal aspects of the Project e.g. vessel movements (Cook & Burton 2010; Fliessbach *et al*., 2019); and presence of works on the foreshore (Natural England, 2024a), therefore potential for a significant effect can be confidently ruled out.

e - Species recorded infrequently within site-specific surveys and / or in negligible abundance (**Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation Report**). Therefore, any potential impact from the Project would be indistinguishable from natural fluctuations in BDMPS baseline mortality, even when considering the worst-case level of effect.

f – Species has no status of conservation concern under Schedule 1, Annex 1 or BoCC5 and was recorded in only locally important numbers (**Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation Report**), therefore the species is screened out for further consideration.

g - Species was recorded alighted on intertidal or adjacent habitat infrequently within site-specific surveys and / or in negligible abundance (**Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation Report**). Therefore, any potential impact from the Project would be indistinguishable from natural fluctuations in BDMPS baseline mortality, even when considering the worst-case level of effect.

Potential Receptor	Conservation Value Rationale	Conservation Value (Table 13-9)	Peak Abundance alighted on Intertidal Study Area / Peak in Intertidal Study Area incl. in flight (individuals) (Aug – Dec 2024)	Total surveys recorded alighted on Intertidal Study Area / Total surveys where recorded incl. in flight (Aug – Dec 2024)	Potential Impacts Scoped In at Scoping Report (RHDHV, 2024a)					
					Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall (ORN-C/O/D-01)			Indirect impacts via habitats or prey availability (ORN-C/O/D-05)		
					C	O / M	D	C	O / M	D

h – Sanderling was recorded frequently and, in some surveys, present in numbers approaching national importance (**Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation Report**) resulting in medium conservation value. The species is classified as having high tolerance to disturbance from construction activities (Cutts *et al*., 2013). The species has medium ability to recover. Therefore, sanderling is assessed as medium sensitivity and considered further in relation to impacts from disturbance and displacement. (Natural England (2024b) attributes high sensitivity to disturbance by noise and visual stimuli to sanderling, but the confidence of this assessment is low, with equivocation across studies which also included disturbance by dog-walking).

i – Oystercatcher was recorded frequently (**Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation Report**) in potentially locally important numbers. Conservation value is medium. The species is classified as having medium tolerance to disturbance from construction activities (Cutts *et al*., 2013) and has medium ability to recover. Therefore, oystercatcher is assessed as medium sensitivity and considered further in relation to impacts from disturbance and displacement. (Natural England (2024b) attributes high sensitivity to disturbance by noise stimuli oystercatcher but this assessment is not species-specific).

99. For species considered within **Table 13-26**, an overall sensitivity value is concluded following the approach detailed within **Section 13.5.3**. Overall sensitivity is derived based on the species behavioural sensitivity, conservation value and frequency and abundance recorded within the Project. Species that are known to be sensitive to disturbance and displacement and / or collision risk impacts but have been recorded in very low numbers during baseline data collection, are not considered further in the assessment. This is because the numbers of birds at risk from such impacts are so small that there is no possibility of a significant effect occurring following the method to determine significance laid out in **Section 13.5**.

13.7 Assessment of Effects

100. The likely significant effects to offshore and intertidal ornithology receptors that may occur during construction, operation and decommissioning of the Project are assessed in the following sections. The assessment follows the methodology set out in **Section 13.5** and is based on the realistic worst-case scenarios defined in **Section 13.4.4**, with consideration of embedded mitigation measures identified in **Section 13.4.3**.

13.7.1 Potential Effects during Construction

101. It should be noted here that Direct Disturbance and Displacement due to Work Activity (ORN-C-01) and Direct Disturbance and Displacement Due to Presence of Wind Turbines and Other Offshore Infrastructure (ORN-C-02) are considered together when conducting impact assessments for the Array Area and associated buffer. This is due to difficulty in separating each of these impacts.

13.7.1.1 Direct Disturbance and Displacement due to Work Activity (ORN-C-01): Landfall

102. Following the outcome of the screening process (**Table 13-26**), the receptors undergoing assessment for direct disturbance and displacement due to work activity at the landfall include:

- Red-throated diver;
- Common scoter;
- Sanderling; and
- Oystercatcher.

103. Construction activities associated with landfall may lead to disturbance and displacement of offshore and intertidal species in the intertidal or inshore habitats at the landfall and potentially within surrounding buffers to a lower extent.

13.7.1.1.1 Receptor Sensitivity

104. Sensitivities of receptors are derived with references in **Table 13-27**. Red-throated diver and common scoter both have overall **high sensitivity** to above-water noise or visual disturbance associated with construction at the landfall. Sanderling and oystercatcher at the landfall both have **medium sensitivity** to above-water noise or visual disturbance associated with construction at the landfall.

13.7.1.1.2 Impact Magnitude

105. Impact of above-water noise or visual disturbance and displacement to red-throated diver and common scoter (features of the Greater Wash SPA) and to sanderling and oystercatcher at the landfall could entail direct effects on foraging and therefore on energy budgets and body condition. Landfall construction will include:

- Site preparation activities, including vegetation and site clearance, topsoil stripping, junction and other traffic modification works, temporary fencing works, construction of the landfall construction compound and haul road;
- Landfall trenchless installation works; and
- Vessel presence at the landfall (vessel movements to and from landfall are covered in Section **13.7.1.2**.

106. Construction activities are expected to mainly take place during daylight hours, though trenchless installation at the landfall will also take place at night. Maximum noise level at source (L_{WA}) from activities at landfall is reported in **Volume 2, Appendix 25.3 Construction Noise and Vibration Assessment** to be 110dB when two drilling rigs are used during landfall trenchless installation works, and the landward entry pit will be set back in excess of 240m from the cliff edge. 100m to 300m from the noise sources, the maximum noise level experienced is modelled to be 63dB during site preparation and 49 dB during trenchless installation works (**Volume 2, Appendix 25.3 Construction Noise and Vibration Assessment**). The former is above and the latter is below the precautionary threshold of 60dB for sanderling and 55dB for oystercatcher, but both projected levels are well below the suggested acceptability threshold of 75dB for sanderling and 72dB for oystercatcher – and both species are reported to rapidly habituate to continuous anthropogenic activity (Cutts *et al.*, 2013). The widespread occurrence along the Holderness Coast of red-throated diver, common scoter, sanderling and oystercatcher in the desk study data indicate that any area from which works may cause displacement would not result in a significant reduction in the total area of available habitat for resting and foraging. Embedded mitigation includes preparation of the Vessel Management Plan to include navigation that minimises disturbance to rafting birds such as red-throated diver and common scoter including around the landfall. Pre-construction surveys will detect intertidal and offshore overwintering birds if present at the landfall, to enable final mitigation measures to be planned and prepared before construction commences. Resulting disturbance would be localised, short-term, intermittent and reversible. Following application of embedded mitigation measures, there is **low** adverse magnitude of impact.

13.7.1.1.3 Effect significance

107. Overall, the sensitivity of sanderling and oystercatcher is **medium** and the magnitude of impact is **low**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

108. Overall, the sensitivity of red-throated diver and common scoter is **high** and the magnitude of impact is **low**. The effect is therefore of **moderate adverse** significance, which is **significan**t in EIA terms.

13.7.1.1.4 Additional Mitigation and Residual Effects

109. Additional mitigation measures to further reduce impact on common scoter and red-throated diver could include restricting tasks requiring the presence of vessels at the landfall to spring months, to avoid the key periods when the species are present and daily energy budgets are most limited by colder air temperatures.

110. Ecological Clerk of Works (ECoW) oversight during construction will identify whether high densities of red-throated diver and common scoter in particular are present, allowing further mitigation measures to reduce disturbance to be applied to this species, such as temporary stoppage if internationally important numbers are unexpectedly present (see commitment ID CO19 and CO92, **Table 13-5**; and further wording in the **Outline PEMP** (document reference 8.6)).

111. If additional mitigation such as the above is applied, magnitude of impact on red-throated diver and common scoter would be **negligible** and significance of residual effect would be **minor adverse**, which is **not significant** in EIA terms.

13.7.1.2 Direct Disturbance and Displacement due to Work Activity (ORN-C-01): Offshore Export Cable Corridor

112. Following the outcome of the screening process (**Table 13-26**), the receptors undergoing assessment for direct disturbance and displacement due to work activity in the Offshore ECC include:

- Red-throated diver.

113. Construction activities associated with offshore ECC installation may lead to disturbance and displacement of species within the offshore ECC and potentially within surrounding buffers to a lower extent.

114. There is evidence of a concentration of red-throated diver within the area of the Greater Wash SPA (Lawson *et al.*, 2016) that has overlap with the offshore ECC. A mean density of 0.25 and a maximum density of 0.45 birds per km^2 were recorded in the area through which the offshore ECC is planned to run. Full methods of how the densities were derived for red-throated diver within the area of ECC overlap with the Greater Wash SPA are provided within the **Volume 2, Appendix 13.4 Offshore Displacement Analysis Report**. Abundance estimates for the area of overlap between the offshore ECC and the Greater Wash SPA plus a 2km buffer were estimated by multiplying the density by the area, which gave and mean estimate of 19 individuals (18.9). This estimate has been taken through for impact assessment.

115. The use of the Lawson *et al* (2016) data was discussed at the ETG2 meeting held on 21st October 2024 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**). The Applicant and Natural England discussed the age of the data, and in the absence of any more recent publicly available data at the time of drafting, this was the only source that could be used.

116. The laying of the export cable between the Array Area and landfall area would be undertaken across an approximate 18-month period, involving a total of 376 vessel movements. There is therefore potential for construction activities associated with seabed preparation and offshore export cable laying, namely the physical presence of the installation vessels, to lead to disturbance and displacement of red-throated diver present within the offshore ECC should works occur during the non-breeding period.

13.7.1.2.1 Displacement Rate Evidence Base for Red-Throated Diver

117. Red-throated diver have been shown to be sensitive to human activities in marine areas, with the species flushing from approaching vessels at a distance of >1km (Schwemmer *et al*., 2011; Bradbury *et al*., 2014). Similarly, a ship-traffic Disturbance Vulnerability Index (DVI) concluded that red-throated diver was the most sensitive, of the seabird species studied, to vessel disturbance. With birds often leaving an area with vessel presence, even when the vessel is located at a relatively large distance away (Fliessbach *et al*., 2019).

118. Considering the high sensitivity of red-throated divers to disturbance and displacement, an approach to assessment has been agreed with SNCBs (agreement following ETG2 held on 21st October 2024 - see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**) that for this project, the displacement rate to be used should be 90% to 100%.

13.7.1.2.2 Effect of Displacement on Red-Throated Diver Mortality

119. When considering the likely consequence of displacement in relation to an increase in red-throated diver's mortality rate, it is key to consider how displacement will affect their typical foraging behaviour. During the winter bio-season, red-throated divers are known to exhibit two different foraging strategies, individuals tend to either consistently occupy a particular area of optimal foraging habitat each year or remain continually mobile throughout the winter period (Dierschke *et al*., 2017). As presented in the Lawson *et al* (2016) data based on the eight-wintering bio-seasons of monitoring for the Greater Wash SPA, red-throated divers utilise the majority of the surveyed area, though significant congregations occur at the centre and south of the SPA. The areas of high concentrations likely infer the most optimal foraging habitat, in contrast to the remainder of the SPA. The offshore ECC does not overlap with these areas of high concentration and therefore is likely to only interact with more mobile individuals in less optimal habitat, the overall consequence of being temporarily displaced from parts of the offshore ECC is likely to be insignificant.

120. On the basis of the above information, a mortality rate of 1% has been considered for the Applicant's approach. For comparison, the SNCBs maximum precautionary rate of 10% mortality has also been considered, as agreed during ETG2 Meeting 1 held on 25th October 2023 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**).

13.7.1.2.3 Red-Throated Diver

13.7.1.2.3.1. Receptor Sensitivity

121. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **high**.

13.7.1.2.3.2. Impact Magnitude

122. When considering the Applicant's approach the annual estimated mortality (when considering a 90% to 100% displacement rate and a 1% mortality rate) for red-throated diver resulting from disturbance and displacement during construction is less than a single (0.17 - 0.19) individual. This is further broken down into relevant bio-seasons in **Table 13-28**.

Table 13-28 Red-Throated Diver Bio-Season Displacement Estimates for the Project During the Construction Phase

Bio-season (months)	**Seasonal Abundance (ECC overlap plus 2km buffer)**	**Regional Baseline Populations and Baseline Mortality Rates**		**Estimated Number of Red-throated Divers Subject to Mortality (individuals per annum)**		**Increase in Baseline Mortality (%)**	
		Population (individuals)	**Baseline Mortality (individuals per annum)**	**90% - 100% Disp; 1% Mort**	**90% - 100% Disp; 10% Mort**	**90% - 100% Disp; 1% Mort**	**90% - 100% Disp; 10% Mort**
Breeding (March – August)	-	-	-	-	-	-	-
Non-breeding (September – February)	19	10,178	2,318	0.17 – 0.19	1.71 – 1.90	0.007 – 0.008	0.074 – 0.082
Annual (BDMPS)	19	10,178	2,318	0.17 – 0.19	1.71 – 1.90	0.007 – 0.008	0.074 – 0.082
Annual (Biogeographic)	19	27,000	6,148	0.17 – 0.19	1.71 – 1.90	0.003 – 0.003	0.028 – 0.031

123. The presence of red-throated diver within the offshore ECC and 2km buffer is assessed against the non-breeding bio-season only, due to the absence of available data for the breeding bio-season and expected absence of red-throated diver within the breeding bio-season. The absence of red-throated diver during the breeding bio-season is to be expected given that the species breeding distribution within the UK is limited to Northern Scotland (Balmer *et al*., 2013).

124. A non-breeding / annual displacement matrix for red-throated diver within the ECC plus 2km buffer is also presented in **Table 13-29**.

125. For the non-breeding bio-season and for all bio-seasons combined, the estimated number of red-throated divers subject to mortality due to displacement from the ECC overlap with the Greater Wash SPA plus 2km buffer is less than a single (0.17 - 0.19) individual per annum. Using the largest UK North Sea BDMPS population of 10,178 individuals (**Table 13-24**) as a proxy for the total BDMPS population across the year, with an average baseline mortality rate of 0.2277 (**Table 13-25**), the natural predicted mortality across all bio-seasons is 2,318 individuals per annum. The addition of less than one predicted mortality would increase baseline mortality rate by 0.007% to 0.008%.

126. This magnitude of impact is therefore considered to be **negligible** annually, as it represents no material change to baseline conditions due to the addition of less than one individual subject to potential mortality as a result of displacement.

127. When considering the SNCB upper range approach to displacement, the number of red-throated divers subject to mortality due to displacement from the ECC overlap with the Greater Wash SPA plus 2km buffer is less than two (1.71 – 1.90) individuals per annum when considering a displacement rate of 90% to 100% and a mortality rate of 10% (**Table 13-29**). Using the largest UK North Sea BDMPS population of 10,178 individuals (**Table 13-24**) as a proxy for the total BDMPS population across the year, the addition of less two predicted mortalities would increase baseline mortality by 0.074% to 0.082%.

128. This magnitude of impact is therefore considered to be **negligible** at both the UK North Sea BDMPS and the biogeographic scale, as it represents no material change to baseline conditions due to the addition of approximately two individuals subject to potential mortality as a result of displacement.

13.7.1.2.3.3. Effect Significance

129. Overall, for the Applicant's and SNCB approach, it is predicted that sensitivity of the receptor is **high** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**). Although following the matrix approach the effect significance is classified as minor, when taking into account expert judgement, the non-materiality of such a minimal predicted impact and short-term timeframe of the potential effect, a more appropriate significance conclusion would be **negligible** overall.

13.7.1.2.3.4. Additional Mitigation and Residual Effects

130. The Project has committed to minimise, as far as reasonably practicable, encounters with red-throated divers via the production of a VMP (CO18 as per **Table 13-5**). This further reduces the potential for any effect pathway to arise, thus providing further confidence to the conclusion of a **negligible significance** overall.

13.7.1.3 Direct Disturbance and Displacement Due to Presence of Wind Turbines and Other Offshore Infrastructure (ORN-C-02): Array Area

131. Following the outcome of the screening process (**Table 13-26**), the receptors undergoing assessment for direct disturbance and displacement due to the presence of wind turbines and other offshore infrastructure in the Array Area include:

- Great northern diver;
- Guillemot;
- Razorbill;
- Puffin; and
- Gannet.

132. Disturbance and subsequent potential displacement of seabirds during the construction phase is primarily centred around when and where construction vessels and piling activities are planned to occur. Such activities may displace individuals that would normally forage, loaf and / or moult within and around the area of sea where the DBD Array Area is proposed to be developed.

133. This displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could theoretically lead to the mortality of individuals (Searle *et al*., 2018), though this is unlikely during the construction phase of an OWF as construction vessels and piling activities are spatially and temporally restricted.

134. Evidence suggests that some species are more susceptible than others to disturbance from OWF construction activities, which may lead to subsequent displacement. Dierschke *et al* (2016) noted both avoidance and attraction to varying degrees depending upon the species in question.

135. A screening process was undertaken for the Project to identify those species which are considered to be sensitive to disturbance and displacement from OWF construction activities (**Table 13-26**).

Table 13-29 Red-Throated Diver Winter Bio-Season Displacement Matrix for ECC Overlap with Greater Wash SPA Plus 2km Buffer

Red-throated diver annual displacement matrix (based on abundance of 19 for the ECC overlap with Greater Wash SPA plus 2km buffer)																
Displacement (%)	**Mortality (%)**															
	0	**1**	**2**	**3**	**4**	**5**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**89**	**90**	**100**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	1	1	1	1	1	2	2	2
20	0	0	0	0	0	0	0	1	1	2	2	2	3	3	3	4
30	0	0	0	0	0	0	1	1	2	2	3	3	4	5	5	6
40	0	0	0	0	0	0	1	2	2	3	4	5	5	6	7	8
50	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10
60	0	0	0	0	0	1	1	2	3	5	6	7	8	9	10	11
70	0	0	0	0	1	1	1	3	4	5	7	8	9	11	12	13
80	0	0	0	0	1	1	2	3	5	6	8	9	11	12	14	15
90	0	0	0	1	1	1	2	3	5	7	9	10	12	14	15	17
100	0	0	0	1	1	1	2	4	6	8	10	11	13	15	17	19

136. An assessment of displacement has been carried out for relevant species, with methods and results based on the following set of scenarios that recognise construction activities will be temporally and spatially restricted:

- Construction activities being undertaken will be localised to the portion of the Array Area where construction is occurring at any one time; and
- Construction activities are temporally restricted to approximately 43 months (**Chapter 4 Project Description**).

137. **Section 13.7.2.1** presents the results of the operational displacement assessments for the Array Area. All operation displacement assessments were concluded as non-significant in EIA terms. Given that potential disturbance activities during the construction phase are both temporally and spatially restricted compared to the operation phase, the overall potential impact is also highly likely to be lower during the construction phase. Therefore a conclusion of non-significance is also appropriately concluded for all construction phase assessments. Because of this, the assessments for the construction phase are presented in a succinct manner, to reduce repetition with information already captured in **Section 13.7.2.1**.

138. Few studies have provided definitive empirical displacement rates for the construction phase of OWF developments. Krijgsveld *et al* (2011) demonstrated higher flight paths of gannets next to operating vs non-operating wind turbines. Displacement rates for auks during construction have been shown to be either significantly lower or comparable to the operation phase (Royal HaskoningDHV, 2013; Vallejo *et al*., 2017). These studies suggest that although the level of disturbance from construction activities can be high it is focussed around a spatially restricted area within the development. Therefore, displacement rates will be localised to construction areas including areas where built non-operational wind turbines are present and reduced displacement rates will apply to the Array Area where construction is not taking place.

139. As actual rates of displacement during the construction phase are difficult to determine from the available studies, the following methodology has been applied to determine potential impact levels. Given that construction activity is limited both spatially and temporarily within the Offshore Development Area and that any potential effects are unlikely to reach the same level as during the operation, the level to be used is a 50% reduction in the displacement rate used for operational phase assessments, as agreed upon with Natural England during the Project ETG2 meetings (21st October 2024 - see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**).

140. The evidence for displacement rates and appropriate buffer zones is discussed in detail in the operational phase assessment, as most evidence has been sourced from operational projects (**Section 13.7.1.4**). The level of displacement assessed for each species during the construction phase is provided below:

- For guillemot, razorbill and puffin, operational phase displacement assessment considered for the Array Area and 2km buffer is a displacement rate of 50% for the Applicant's Approach and of 30% to 70% for the SNCB approach (**Section 13.7.2.1**). The displacement rate will be reduced by 50% for the construction phase for the reasons described above. This therefore equates to a construction phase displacement rate of 25% for the Applicant's approach and 15% to 35% for the SNCB approach;
- For gannet the operational displacement assessment considered for the Array Area and 2km buffer is a displacement rate of 60% to 80% for both the Applicant's and SNCB approach (**Section 13.7.2.1**). This displacement rate will be reduced by 50% for the construction phase for the reasons described above. This therefore equates to a construction phase displacement rate of 30% to 40%;
- For great northern diver and white-billed diver, operational phase displacement assessment considered for the Array Area plus 4km buffer is a displacement rate of 90% of the Applicant's Approach and 100% for the SNCB approach (**Section 13.7.2.1**). These displacement rates will be reduced by 50% for the construction phase for the reasons described above. This therefore equates to a construction phase displacement rate of 45% for the Applicant's approach and 50% for the SNCBs approach; and
- To ensure that assessments represent a robust, yet precautionary approach for all species, the mortality rates considered for the construction phase remain the same as those used for operational phase impacts (please refer to **Section 13.7.2.1** for justification of mortality rates applied throughout this section). However, it should be noted that due to construction phase displacement impacts being both temporally and spatially restricted, it's highly likely that any associated consequential mortality rate will be less than that from operational impacts, therefore this approach is highly precautionary.

13.7.1.3.1 Great Northern Diver

13.7.1.3.1.1. Receptor Sensitivity

141. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **medium**.

13.7.1.3.1.2. Impact Magnitude

142. The annual estimated mortality for great northern diver resulting from disturbance and displacement during construction varies from less than a single (0.24 – 0.27) individual per annum for the Applicant's approach, to between two and three (2.39 - 2.65) individuals for the SNCB approach (**Table 13-30**). This results in an annual BDMPS baseline mortality increase of 0.153% to 0.170% for the Applicant's / SNCB lower range approach, and an increase of 1.529% to 1.699% for the SNCB upper range (**Table 13-30**).

Table 13-30 Great Northern Diver Bio-Season Displacement Estimates for the Project During the Construction Phase

Bio-season (months)	Seasonal Abundance (Array Area plus 4km buffer)	Regional Baseline Populations and Baseline Mortality Rates		Estimated Number of Great Northern Divers Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
		Population (individuals)	Baseline Mortality (individuals per annum)	45% - 50% Disp; 1% Mort	45% - 50% Disp; 10% Mort	45% - 50% Disp; 1% Mort	45% - 50% Disp; 10% Mort
Breeding (June – August)	-	-	-	-	-	-	-
Non-breeding (September – May)	53	1,200	156	0.24 – 0.27	2.39 - 2.65	0.153 – 0.170	1.529 - 1.699
Annual (BDMPS)	53	1,200	156	0.24 – 0.27	2.39 - 2.65	0.153 – 0.170	1.529 - 1.699
Annual (Biogeographic)	53	430,000	55,900	0.24 – 0.27	2.39 - 2.65	<0.001	0.004 - 0.005

143. Notwithstanding the lack of evidence to support the use of a 10% mortality rate for diver species, when considering construction activities are both temporally and spatially restricted this is highly unlikely to lead to a long-term population consequence. As such this magnitude of impact is therefore considered to be **negligible** to **low** at the UK North Sea and Channel BDMPS, as it represents only a small number of individuals subject to potential mortality even when considering the SNCB worst case scenario as a result of displacement.

13.7.1.3.1.3. Effect Significance

144. Overall, for the Applicant's approach it is predicted that sensitivity of the receptor is **medium** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

145. Following, the SNCB approach, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of impact is **low**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.1.3.2 Guillemot

13.7.1.3.2.1. Receptor Sensitivity

146. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **medium**.

13.7.1.3.2.2. Impact Magnitude

147. The annual estimated mortality for guillemot resulting from disturbance and displacement during construction is approximately 36 (35.69) individuals per annum for the Applicant's approach and between 21 (21.42) to 500 (499.70) individuals for the SNCB approach (**Table 13-31**). This results in an annual BDMPS baseline mortality increase of 0.012% for the Applicant's approach and an increase of 0.007% to 0.174% for the SNCB approach.

Table 13-31 Guillemot Bio-Season Displacement Estimates for the Project During the Construction Phase

Bio-season (months)	Seasonal Abundance (Array Area plus 2km asymmetrical buffer)	Regional Baseline Populations and Baseline Mortality Rates		Estimated Number of Guillemots Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
		Population (individuals)	Baseline Mortality (individuals per annum)	25% Disp; 1% Mort	15-35% Disp; 1-10% Mort	25% Disp; 1% Mort	15-35% Disp; 1-10% Mort
Breeding (March – July)	6,872	2,045,078	287,333	17.18	10.31 – 240.52	0.006	0.004 – 0.084
Non-breeding (August – February)	7,406	1,617,305	227,231	18.52	11.11 – 259.21	0.008	0.005 – 0.114
Annual (BDMPS)	14,277	2,045,078	287,333	35.69	21.42 – 499.70	0.012	0.007 – 0.174
Annual (Biogeographic)	14,277	4,125,000	579,563	35.69	21.42 – 499.70	0.006	0.004 – 0.086

148. Considering the Applicant's and lower range of the SNCB approach the magnitude of impact is determined as **negligible** as there is no material change from the baseline.

149. The upper range of the SNCB approach is deemed as highlight precautionary based on the evidence outlined in **Section 13.7.2.3.4**. Although there is an estimate of 500 mortalities, when considering the increase in baseline mortality the magnitude of impact is considered to be **low** at the UK North Sea and Channel BDMPS.

13.7.1.3.2.3. Effect Significance

150. Overall, when considering the Applicant's and the SNCB approach it is predicted that sensitivity of the receptor is **medium** and the magnitude of impact is **negligible** to **low**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.1.3.3 Razorbill

13.7.1.3.3.1. Receptor Sensitivity

151. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **medium**.

13.7.1.3.3.2. Impact Magnitude

152. The annual estimated mortality for razorbill resulting from disturbance and displacement during construction is approximately eight (7.70) individuals per annum for the Applicant's approach and between five (4.62) to 108 (107.77) individuals for the SNCB approach (**Table 13-32**). This results in an annual BDMPS baseline mortality increase of 0.010% for the Applicant's approach and an increase of 0.006% to 0.140% for the SNCB approach.

Table 13-32 Razorbill Bio-Season Displacement Estimates for the Project During the Construction Phase

Bio-season (months)	**Seasonal Abundance (Array Area plus 2km asymmetrical buffer)**	**Regional Baseline Populations and Baseline Mortality Rates**		**Estimated Number of Razorbills Subject to Mortality (individuals per annum)**		**Increase in Baseline Mortality (%)**	
		Population (individuals)	Baseline Mortality (individuals per annum)	25% Disp; 1% Mort	15-35% Disp; 1-10% Mort	25% Disp; 1% Mort	15-35% Disp; 1-10% Mort
Breeding (April – July)	749	158,031	20,576	1.87	1.12 – 26.22	0.009	0.005 – 0.127
Post-breeding migration (August – October)	282	591,875	77,062	0.71	0.42 – 9.87	0.001	0.001 – 0.013
Winter (November – December)	588	218,621	28,464	1.47	0.88 – 20.58	0.005	0.003 – 0.072
Return migration (January – March)	1,461	591,875	77,062	3.65	2.19 – 51.14	0.005	0.003 – 0.066
Annual (BDMPS)	3,079	591,875	77,062	7.70	4.62 – 107.77	0.010	0.006 – 0.140
Annual (Biogeographic)	3,079	1,707,000	222,251	7.70	4.62 – 107.77	0.003	0.002 – 0.048

153. Considering the Applicant's and lower range of the SNCB approach the magnitude of impact is determined as **negligible** as there is no material change from the baseline.

154. The upper range of the SNCB approach is deemed as highlight precautionary based on the evidence outlined in **Section 13.7.2.3.4**. Although there is an estimate of 108 mortalities, when considering the increase in baseline mortality the magnitude of impact is considered to be **low** at the UK North Sea and Channel BDMPS.

13.7.1.3.3.3. Effect Significance

155. Overall, when considering the Applicant's approach, it is predicted that sensitivity of the receptor is **medium** and the magnitude of impact is **negligible**. The effect is therefore of **minor** significance, which is **not significant** in EIA terms (**Table 13-15**).

156. When considering the SNCB approach, it is predicted that the sensitivity of the receptor is **medium,** and the magnitude of impact is **negligible** to **low**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.1.3.4 Puffin

13.7.1.3.4.1. Receptor Sensitivity

157. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **medium**.

13.7.1.3.4.2. Impact Magnitude

158. The annual estimated mortality for puffin resulting from disturbance and displacement during construction is approximately less than a single (0.34) individual per annum for the Applicant's approach and between less than one (0.20) and five (4.69) individuals for the SNCB approach (**Table 13-33**). This results in an annual BDMPS baseline mortality increase of less than 0.001% for the Applicant's approach and an increase of less than 0.001% to 0.005% for the SNCB approach.

Table 13-33 Puffin Bio-Season Displacement Estimates for the Project During the Construction Phase

Bio-season (months)	Seasonal Abundance (Array Area plus 2km asymmetrical buffer)	Regional Baseline Populations and Baseline Mortality Rates		Estimated Number of Puffins Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
		Population (individuals)	Baseline Mortality (individuals per annum)	25% Disp; 1% Mort	15-35% Disp; 1-10% Mort	25% Disp; 1% Mort	15-35% Disp; 1-10% Mort
Breeding (April – July)	111	868,689	103,374	0.28	0.17 – 3.89	<0.001	<0.001 – 0.004
Non-breeding (August – March)	24	231,958	27,603	0.06	0.04 – 0.84	<0.001	<0.001 – 0.003
Annual (BDMPS)	134	868,689	103,374	0.34	0.20 – 4.69	<0.001	<0.001 – 0.005
Annual (Biogeographic)	134	2,370,000	282,030	0.34	0.20 – 4.69	<0.001	<0.001 – 0.002

159. The magnitude of impact is therefore considered to be **negligible** at the UK North Sea and Channel BDMPS, as it represents only a small number of individuals subject to potential mortality even when considering the SNCB worst case scenario as a result of displacement.

13.7.1.3.4.3. Effect Significance

160. Overall, when considering the Applicant's and the SNCB approach, it is predicted that sensitivity of the receptor is **medium** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.1.3.5 Gannet

13.7.1.3.5.1. Receptor Sensitivity

161. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **medium**.

13.7.1.3.5.2. Impact Magnitude

162. The annual estimated mortality for gannet resulting from disturbance and displacement during construction is approximately three (3.34) to five (4.45) individuals per annum for the Applicant's approach and between 33 (33.39) and 45 (44.52) individuals for the SNCB approach (**Table 13-34**). This results in an annual BDMPS baseline mortality increase of less than 0.004% to 0.005% for the Applicant's approach and an increase of less than 0.039% to 0.052% for the SNCB approach.

Table 13-34 Gannet Bio-Season Displacement Estimates for the Project During the Construction Phase

Bio-season (months)	Seasonal Abundance (Array Area plus 2km asymmetrical buffer)	Regional Baseline Populations and Baseline Mortality Rates		Estimated Number of Gannets Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
		Population (individuals)	Baseline Mortality (individuals per annum)	30 - 40% Disp; 1% Mort	30 - 40% Disp; 10% Mort	30 - 40% Disp; 1% Mort	30 - 40% Disp; 10% Mort
Breeding (June – August)	217	400,326	74,701	0.65 – 0.87	6.51 - 8.68	0.001 – 0.001	0.009 - 0.012

Bio-season (months)	Seasonal Abundance (Array Area plus 2km asymmetrical buffer)	Regional Baseline Populations and Baseline Mortality Rates		Estimated Number of Gannets Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
		Population (individuals)	Baseline Mortality (individuals per annum)	30 - 40% Disp; 1% Mort	30 - 40% Disp; 10% Mort	30 - 40% Disp; 1% Mort	30 - 40% Disp; 10% Mort
Post-breeding migration (October-November)	813	456,299	85,145	2.44 – 3.25	24.39 - 32.52	0.003 – 0.004	0.029 - 0.038
Return migration (December – February)	85	248,385	46,349	0.26 – 0.34	2.55 - 3.40	0.001 – 0.001	0.006 - 0.007
Annual (BDMPS)	1,113	456,299	85,145	3.34 – 4.45	33.39 - 44.52	0.004 – 0.005	0.039 - 0.052
Annual (Biogeographic)	1,113	1,180,000	220,188	3.34 – 4.45	33.39 - 44.52	0.002 – 0.002	0.015 - 0.020

163. The magnitude of impact is therefore considered to be **negligible to low** at the UK North Sea and Channel BDMPS, as it represents only a small number of individuals subject to potential mortality even when considering the SNCB worst case scenario as a result of displacement.

13.7.1.3.5.3. Effect Significance

164. Overall, when considering the Applicant's approach, it is predicted that sensitivity of the receptor is **medium** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

165. When considering the SNCB approach, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.1.4 Indirect Impacts via Habitat or Prey Availability (ORN-C-05): Landfall

166. During the construction phase of the Project there is the potential for indirect effects on intertidal and offshore birds (red-throated diver, common scoter, common tern, Sandwich tern, little tern, little gull, herring gull, black-headed gull, great black-backed gull, common gull, sanderling, oystercatcher) via degradation of habitats used by birds or their prey; displacement of prey species due to increased disturbance; or reduction in prey accessibility due to increased suspended sediment and physical disturbance to the seabed. Underwater noise may cause fish and mobile invertebrates to avoid the construction area and also affect their physiology and behaviour. Suspended sediments may cause fish and mobile invertebrates to avoid the construction area, may smother and hide immobile benthic prey, or may change light transmission and water clarity for visual foraging. These mechanisms may result in less habitat and/or prey being available within the construction area to offshore and intertidal ornithology receptors.

13.7.1.4.1 Receptor Sensitivity

167. Supporting habitats of the Greater Wash SPA in vicinity of the landfall (intertidal sand, subtidal sand, water column) have **medium sensitivity** to introduction of hydrocarbons and polycyclic aromatic hydrocarbons (PAH) and introduction of other substances (solid, liquid, gas) (Natural England, 2024a). These impacts are expected to be avoided through embedded mitigation and are not considered further. Intertidal sand, subtidal sand and water column have **medium sensitivity** to extraction, abrasion or penetration of the substrate, and to changes in light transmission and water clarity from suspension of solids, smothering and siltation associated with trenchless cable installation works (Natural England, 2024a). The water column habitat has **low sensitivity** to vibration from trenchless cable installation works.

168. Common tern, little tern, Sandwich tern and little gull have **high sensitivity** to changes in light transmission and water clarity for foraging. Red-throated diver has **medium sensitivity** to changes in light transmission and water clarity, and sensitivity is unknown for common scoter due to a lack of evidence concerning the species (Natural England, 2024a). All six species are assigned **high sensitivity** to indirect effects via habitat and prey on a precautionary basis as they are SPA qualifying features (therefore high conservation value) and are largely visual foragers of mobile prey that can be displaced.

169. Common gull, black-headed gull, herring gull, great black-backed gull, sanderling and oystercatcher are assessed by expert judgement to have medium tolerance of impacts on resting habitat, foraging habitat or prey. There could be a moderate decline in a physiological attribute of individuals through decreased rest or food intake per unit time). The species are not able to completely avoid / adapt to / accommodate the pressure. These species are also assessed by expert judgement to have medium capacity to recover from this impact. Therefore, they have **medium sensitivity** to indirect effects via habitat and prey.

13.7.1.4.2 Impact Magnitude

170. As assessed in **Chapter 10 Benthic and Intertidal Ecology** and **Chapter 11 Fish and Shellfish Ecology**, no significant effects are considered to occur on invertebrate or fish species (which form the food supply for birds in the intertidal area) due to construction phase related effects of the Project. As assessed in **Chapter 20 Air Quality and Dust**, effect of construction dust and fine particulate matter emissions on the Greater Wash SPA is non-significant. Impact magnitude on supporting habitats of the Greater Wash SPA is assessed to be **negligible**.

171. Common tern, little tern, Sandwich tern and little gull have rarely been recorded foraging or alighted on habitat at the landfall during baseline surveys or in desk data, instead typically undertaking active migration when recorded (**Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation Report**). Therefore, the indirect impact through habitats and prey of these species from construction is assessed to be **negligible**.

172. Construction works in habitats of the Greater Wash SPA supporting red-throated diver and common scoter, and in supporting intertidal habitat for gulls, sanderling and oystercatcher, will be limited to onshore site preparation and plant access, construction of the link boxes, presence of vessels and trenchless installation techniques. Construction activities will be localised to the narrow cable corridor relative to the total intertidal habitat.

173. Impact on red-throated diver and common scoter is assessed to be **negligible**, in that no significant effects were identified to potential prey species (fish or benthic) or on the habitats that support them in the assessments on fish and benthic ecology (**Chapter 11 Fish and Shellfish Ecology** and **Chapter 10 Benthic and Intertidal Ecology**, respectively). The widespread occurrence along the Holderness Coast of red-throated diver and common scoter in the desk study data (see **Section 13.5.2.1**) indicate that effects on water clarity and light transmission for foraging at the landfall, or localised changes to habitat at the landfall, would represent an extremely low proportion of the total area of available habitat for resting and foraging, and negligible proportion of the SPA area. Any change from the baseline size or extent of distribution of red-throated diver or common scoter in the SPA will be very slight.

174. Impact on common gull, black-headed gull, herring gull and great black-backed gull is assessed to be **low adverse**, in that the assemblage of gulls occupying the landfall may change in the size or extent of distribution but at sufficiently small scale and duration to cause no long-term harm to the receptor. Recovery from that change is predicted to be achieved in the short-term (no more than one year) following cessation of construction.

175. Impact on sanderling and oystercatcher is assessed to be **low adverse**, in that the populations of these species occupying the landfall may change in the size or extent of distribution but at sufficiently small scale and duration to cause no long-term harm to the receptor. Recovery from that change is predicted to be achieved in the short-term (no more than one year) following cessation of construction. The widespread occurrence along the Holderness Coast of sanderling and oystercatcher in the desk study data (see **Section 13.5.2.1**) indicate that localised changes to habitat at the landfall, would represent an extremely low proportion of the total area of available habitat for resting and foraging.

13.7.1.4.3 Effect Significance

176. It is predicted that sensitivity of supporting habitats of the Greater Wash SPA is **medium** and magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

177. It is predicted that sensitivity of common tern, little tern, Sandwich tern and little gull is **high**, and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

178. It is predicted that sensitivity of red-throated diver and common scoter is **high**, and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

179. It is predicted that sensitivity of common gull, black-headed gull, herring gull, great black-backed gull, sanderling and oystercatcher is **medium**, and magnitude of impact is **low** adverse. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

13.7.1.5 Indirect Impacts via Habitat or Prey Availability (ORN-C-05): Offshore ECC

180. During the construction phase of the Project there is the potential for indirect effects arising from the displacement of prey species due to increased disturbance, or to disturbance of habitats from increased suspended sediment and physical disturbance to the seabed. Underwater noise may cause fish and mobile invertebrates to avoid the construction area and also affect their physiology and behaviour. Suspended sediments may cause fish and mobile invertebrates to avoid the construction area and may smother and hide immobile benthic prey. These mechanisms may result in less prey being available within the construction area to foraging seabirds.

13.7.1.5.1 Receptor Sensitivity

181. Red-throated diver have low habitat use flexibility, meaning they are highly sensitive to change in the foraging habitat through changes such as increased sediment or reduced prey availability (Fliessbach *et al.*, 2019; Cook and Burton, 2010). This receptor is classified as having an overall sensitivity to indirect impacts via habitat or prey availability of **high**.

13.7.1.5.2 Impact Magnitude

182. As no significant effects were identified to potential prey species (fish or benthic) or on the habitats that support them in the assessments on fish and benthic ecology (**Chapter 11 Fish and Shellfish Ecology** and **Chapter 10 Benthic and Intertidal Ecology**, respectively) then there is no potential for any indirect effects of an adverse significance to occur on ornithology receptors within the Offshore ECC. Therefore, the magnitude of impact is considered to be **negligible**.

13.7.1.5.3 Effect Significance

183. Overall, it is predicted that sensitivity of the receptor is **high** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.1.6 Indirect Impacts via Habitat or Prey Availability (ORN-C-05): Array Area

184. During the construction phase of the Project there is the potential for indirect effects arising from the displacement of prey species due to increased noise and disturbance, or to disturbance of habitats from increased suspended sediment and physical disturbance to the seabed. Underwater noise may cause fish and mobile invertebrates to avoid the construction area and also affect their physiology and behaviour. Suspended sediments may cause fish and mobile invertebrates to avoid the construction area and may smother and hide immobile benthic prey. These mechanisms may result in less prey being available within the construction area to foraging seabirds.

13.7.1.6.1 Receptor Sensitivity

185. Of the receptors scoped in for indirect impacts via habitat or prey availability in the Array Area (**Table 13-26**), there is variability in sensitivity to this impact. The seabird species being assessed have medium to large foraging ranges (Woodward *et al*., 2019) meaning that they are able to utilise areas not impacted by any disturbance to prey or habitat. Similarly, when assessed against habitat use flexibility (Fliessbach *et al*., 2019), the receptors have a good degree of flexibility in habitat they are able to utilise. Great northern diver has not been considered for such sensitivity, but using red-throated diver as a proxy here, the species has low flexibility in habitat use. The receptors are therefore classified as having an overall sensitivity to indirect impacts via habitat or prey availability of **low** to **medium**, with great northern diver having a **high** sensitivity.

13.7.1.6.2 Impact Magnitude

186. As no significant effects were identified to potential prey species (fish or benthic) or on the habitats that support them in the assessments on fish and benthic ecology (**Chapter 11 Fish and Shellfish Ecology** and **Chapter 10 Benthic and Intertidal Ecology**, respectively) then there is no potential for any indirect effects of an adverse significance to occur on offshore and intertidal ornithology receptors. Therefore, the magnitude of impact is considered to be **negligible**.

13.7.1.6.3 Effect Significance

187. Overall, it is predicted that the sensitivity of receptor is **low** to **high** and the magnitude of impact is **negligible**. The effect is therefore of **negligible** to **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.2 Potential Effects during Operation

188. It should be noted here that Direct Disturbance and Displacement due to Work Activity (ORN-O-01) and Direct Disturbance and Displacement Due to Presence of Wind Turbines and Other Offshore Infrastructure (ORN-O-02) are considered together when conducting impact assessments for the Array Area. This is due to difficulty in separating each of these impacts.

13.7.2.1 Direct disturbance and displacement due to work activity (ORN-O-01): Landfall

189. Maintenance activities associated with landfall may lead to disturbance and displacement of offshore and intertidal species (red-throated diver, common scoter, sanderling, oystercatcher) in the intertidal or inshore habitats at the landfall and potentially within surrounding buffers to a lower extent.

13.7.2.1.1 Receptor Sensitivity

190. Sensitivities of receptors are derived with references in **Table 13-27**. Red-throated diver and common scoter both have overall **high sensitivity** to above-water noise or visual disturbance associated with maintenance at the landfall. Sanderling and oystercatcher at the landfall both have **medium sensitivity** to above-water noise or visual disturbance associated with maintenance at the landfall.

13.7.2.1.2 Impact Magnitude

191. Impact of above-water noise or visual disturbance and displacement to the red-throated diver and common scoter in inshore waters at the landfall and to sanderling and oystercatcher at the landfall could entail direct effects on foraging and therefore on energy budgets and body condition. However, above-water noise and visual presence of plant and workers above ground and presence of vessels at the landfall would be confined to routine and ad hoc maintenance work. The majority of these activities will necessarily take place at mid to low tide (when intertidal habitat for birds will incidentally be least restricted and inshore waterbirds will be further from the MHWS) for suitable access, safety and substrate conditions. Maintenance activities are expected to generally take place during daylight hours, and will be localised to the narrow cable corridor relative to the total intertidal habitat. Furthermore, the widespread occurrence along the Holderness Coast of red-throated diver, common scoter, sanderling and oystercatcher in the desk study data indicates that any area from which works may cause displacement would not result in a significant reduction in the total area of available habitat for resting and foraging. Associated disturbance would therefore be localised, short-term, intermittent and reversible. The magnitude of impact is **negligible**.

13.7.2.1.3 Effect Significance

192. Overall, the sensitivity of sanderling and oystercatcher is **medium** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

193. Overall, the sensitivity of red-throated diver and common scoter is **high** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

13.7.2.2 Direct disturbance and displacement due to work activity (ORN-O-01): Offshore ECC

194. During the Operation and Maintenance phase ad hoc maintenance may be required within the ECC which could lead to disturbance and displacement of red-throated diver.

13.7.2.2.1 Receptor Sensitivity

195. As detailed in **Section 13.6.4**, red-throated diver is classified as having an overall sensitivity to disturbance and displacement of **high**.

13.7.2.2.2 Impact Magnitude

196. As detailed within **Section 4.6.14** of **Chapter 4 Project Description** ad hoc maintenance may be required within the ECC. Over the lifespan of the Project, such activities are considered to occur for a total duration of three months and involve up to three vessels at any one time. Such activities are therefore highly spatially and temporally limited and unlikely to result in a material reduction in habitat utilised for loafing and foraging. As presented within **Table 13-28**, the predicted abundance of red-throated diver within the ECC is low, thus further limiting the potential for any population effect to occur as a consequence of displacement from ad hoc maintenance. The magnitude of impact on red-throated diver is considered to be **negligible**.

13.7.2.2.3 Effect Significance

197. Overall, it is predicted that sensitivity of the receptor is **high** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**). When taking into account expert judgement, the non-materiality of such a minimal predicted impact and short-term timeframe of the potential effect, a more appropriate significance conclusion would be **negligible** overall.

13.7.2.3 Direct Disturbance and Displacement due to Presence of Wind Turbines and Other Offshore Infrastructure (ORN-O-02): Array Area

198. Following the outcome of the screening process (**Table 13-26**), the receptors undergoing assessment for direct disturbance and displacement due to the presence of wind turbines and other offshore infrastructure in the Array Area include:

- Little auk;
- Guillemot;
- Razorbill;
- Puffin;
- Great northern diver;
- White-billed diver; and
- Gannet.

199. The presence of wind turbines has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea where the Project is proposed to be developed. This potentially reduces the area available to those seabirds to forage, loaf and / or moult that currently occur within and around the Project and may be susceptible to displacement from such a development. Displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals.

200. Seabird species vary in their response to the presence of operational infrastructure associated with OWF, such as wind turbines and vessel traffic related to maintenance activities. OWF are a relatively new feature in the marine environment and as a result there is uncertainty as to the effects of disturbance and displacement by operational infrastructure in the long-term.

201. Garthe and Hüppop (2004) developed a scoring system for such disturbance factors, which has been widely applied in North Sea OWF EIAs. Furness and Wade (2012) developed a similar system with disturbance ratings for particular species that was applied alongside scores for habitat flexibility and conservation importance to define an index value that highlights the sensitivity of each species to disturbance and displacement. Bradbury *et al* (2014) provided an update to the Furness and Wade (2012) paper to consider seabirds in English waters.

202. Natural England and JNCC issued a joint Interim Displacement Advice Note (SNCBs, 2017), which provides recommendations for presenting information to enable the assessment of displacement effects in relation to OWF developments. This has been superseded more recently by a joint SNCB interim displacement advice note (SNCBs, 2022), which provides the latest advice for UK development applications on how to consider, assess and present information and potential consequences of seabird displacement from OWF. These guidance notes have shaped the following assessment.

203. Some species are more susceptible than others to disturbance from OWF operation, which may lead to subsequent displacement. Dierschke *et al* (2016) noted both displacement and avoidance to varying degrees by some seabird species while others were attracted to OWF. A screening process was undertaken for the Project to identify those species that may be more susceptible than others and therefore which species may be considered for further assessment (**Table 13-26**).

204. The five species that were scoped in for quantitative assessment for disturbance and displacement are guillemot, razorbill, puffin, great northern diver and gannet, as adequate data on populations and mortality rates is available for such assessment. Due to data limitations, a qualitative assessment has been provided for little auk and white-billed diver at the request of Natural England (**Section 13.3**).

205. An assessment of displacement was carried out for the Project, with detailed methods and results presented in **Volume 2, Appendix 13.4 Offshore Ornithology Displacement Analysis Report**, to provide information for the five seabird species of interest that have been identified as potentially at risk.

206. With respect to the most suitable displacement and mortality rates for assessment, the Applicant has reviewed latest available evidence with respect to the six seabirds scoped in for assessment as detailed below. The findings of this review have been used to inform the Applicant's approach to disturbance and displacement assessment, ensuring that the approach taken reflects the current research and scientific data. The SNCB recommended displacement and mortality rates have also been provided for each assessment.

13.7.2.3.1 Qualitative Assessment of Little Auk and The Effects of Displacement

207. Following an ETG2 meeting held on the 23rd May 2024 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**), Natural England requested that little auk be considered for disturbance and displacement impact assessment. It is worth noting that within the Project DAS, only a single survey had records of little auk, with a raw count of 23 birds.

208. Little auk breeds in the High Arctic (Wojczulanis-Jakubas *et al*., 2022), leaving the breeding grounds of Svalbard and heading south towards the North Sea for the non-breeding bio-season. Within UK waters, little auk are scarce migrants and winter visitors, with records occurring along the Scottish coast and the east coast of England. Little auks are typically present in UK waters between November and March in relatively low densities (Kober *et al.,* 2010) (**Figure 13-2**). Due to the low numbers of little auk in UK waters, they are currently Green listed under the UK BOCC.

209. Fort *et al* (2013) describe how little auks usually concentrate in hotspots in the Greenland Sea and in the north-west Atlantic. The presence of little auk in UK waters, specifically within English waters, is often linked to adverse winter conditions and strong storm events (Dufour *et al*., 2021) that force the birds south of the usual non-breeding areas.

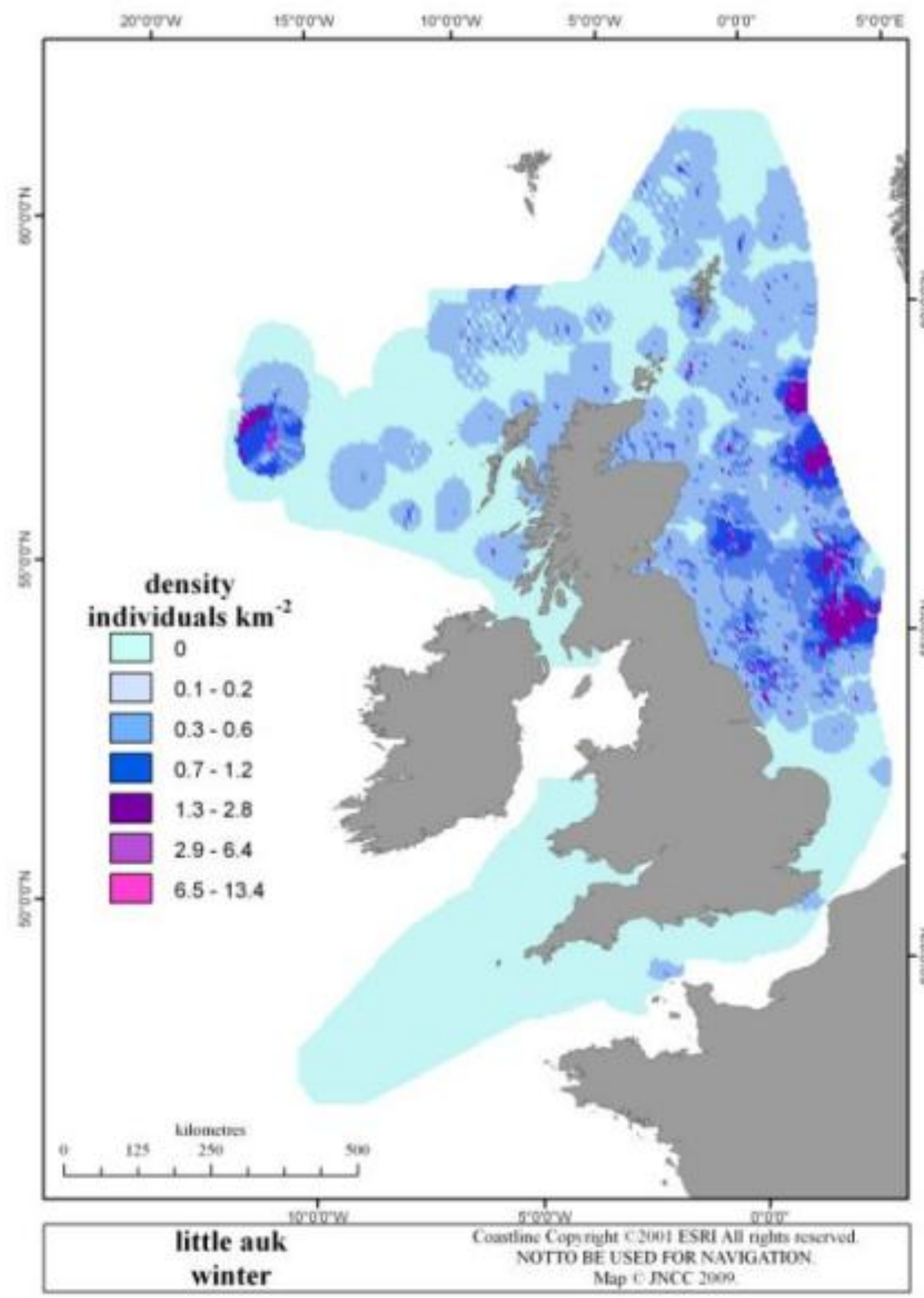


Figure 13-2 Distribution and Density of Little Auk in UK Waters (Kober et al., 2010)

210. Compared to the late 1990s and early 2000s, the number of little auks recorded in the UK has decreased (JNCC, 2020; Trektellen, 2025; Burton *et al*., 2013). Hedd *et al* (2011) suggest that little auks are sensitive to large-scale climatic and oceanographic alterations as this impacts their prey distribution and consequently their winter behaviour. Stable isotope analysis has indicated that little auks feed on molluscs, small fish and are specialised with zooplankton, specifically copepods (*Calanus* ssp.) and amphipods (*Themisto* ssp.) (Fisk *et al*., 2001) and in order to satisfy their daily energy demand, little auks must catch tens of thousands of zooplankton individuals per day (Mosbech *et al*., 2018). Patches of substantial copepods are found in areas where air temperature ranges from zero to five degrees Celsius (Fort *et al*., 2013) and so when conditions are correct, it is possible that they follow zooplankton and ichthyoplankton assemblages south and into the North Sea and the English north coasts (Neven *et al*., 2024). However, with ever increasing sea surface temperatures, the likelihood of optimal forage fish habitat conditions will decrease.

211. As the presence of little auks in UK waters is linked to their prey distribution and strongly affected by climate change, coupled with the fact that there is a low density of copepods within the Dogger Bank area (Deschamps *et al*., 2024) little auks have less requirement or need to travel further south within the non-breeding bio-season. When considering the Dogger Bank area of sea, records for the other OWF projects in the area highlight the decrease in little auks over time. This is likely, as previously mentioned, due to climatic changes (**Table 13-35**).

Table 13-35 Little Auk Densities within the Dogger Bank Area

Project	Peak abundance	Peak density (individuals / km²)	Month
DBA (Burton *et al*., 2013)*	1,719	2.72	January 2010
DBB (Burton *et al*., 2013)*	2,141	2.99	January 2010
DBC (Burton *et al*., 2014)*	2,492	3.68	December 2010
Sofia (Burton *et al*., 2014)*	2,632	3.71	December 2010
DBS East (RWE, 2023b)**	N/A	0.05	December 2021 / 22
DBS West (RWE, 2023b)**	N/A	0.08	December 2021 / 22
DBS West (RWE, 2023b)**	N/A	1.08	December 2021 / 23
DBD	90	0.18	January 2023

* Table note: Values are absolute peaks.

**Table notes: Values are mean monthly values across 2 years.

212. When considering displacement assessments, little auks are thought to have relatively low sensitivity (Bradbury *et al*., 2014). In addition, there is no further guidance on how this species should be regarded in terms of displacement and mortality rates. The species on a whole are relatively data deficient in terms of disturbance and displacement impact assessment.

13.7.2.3.1.1. Receptor Sensitivity

213. Considering the literature review above and as detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **low**.

13.7.2.3.1.2. Impact Magnitude

214. Considering the reduction in little auk records within the Dogger Bank area, the very few numbers within the Array Area plus a 4km buffer and the data deficiency around disturbance and displacement assessment for the species, the magnitude of impact on little auk is considered to be **negligible**.

13.7.2.3.1.3. Effect Significance

215. Overall, it is predicted that sensitivity of the receptor is **low** and the magnitude of impact is **negligible**. The effect is therefore of **negligible adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.2.3.2 Qualitative assessment of white-billed diver and the effects of displacement

216. Following an ETG2 meeting held on 23rd May 2024 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**), Natural England requested that white-billed diver be considered for disturbance and displacement impact assessment. It is worth noting early on that within the Project DAS, no white-billed divers were recorded within the first year of surveys for Array Area plus 4km buffer. In addition, within the second year of DAS, only nine individuals were recorded within the Array Area plus 2km buffer.

217. White-billed divers breed in lakes and pools of the high-Arctic in Russia, Canada and Alaska (British Birds, 2020), wintering off the north-west Atlantic, north-west Pacific and in the North Sea. Within UK waters, white-billed divers are scarce migrants (BTO, 2025a) and winter visitors (British Birds, 2020), with the majority of records occurring along the Scottish coast with fewer records off the east coast of England.

218. The presence of white-billed divers in UK waters, specifically within English waters, is relatively unknown, with most offshore observations detected through surveys conducted for other OWF including DBA, DBB, DBC and Sofia (Burton *et al*., 2013 & 2014).

219. When considering the Dogger Bank area of sea, surveys for DBA, DBB, DBC and Sofia recorded an abundance estimate of 80 individuals across the surveys conducted between November and April 2010 to 2011. These are comparatively high compared to the mean peak abundance of 14 white-billed diver recorded in the DAS of the Array Area plus 4km buffer. In addition, only one of the two survey years recorded any white-billed divers within the Array Area plus 4km buffer. Similarly, the DBS surveys did not record any white-billed divers. Considering the Dogger Bank area, it is likely that birds using the area show plasticity in the utilisation of the area available for foraging in winter. The difference in records for the Project’s survey years reflects this. The differences in numbers between various OWF projects and the different years could also highlight fluctuations in area usage between years.

220. When considering displacement assessments, white-billed divers are thought to have high sensitivity (Bradbury *et al*., 2014). However, there is no further guidance on how this species should be regarded in terms of displacement and mortality rates. The species is relatively data deficient in terms of disturbance and displacement impact assessment.

13.7.2.3.2.1. Receptor Sensitivity

221. Considering the literature review above and as detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **low**.

13.7.2.3.2.2. Impact Magnitude

222. Considering the natural fluctuations within the Dogger Bank area, the very few numbers within the Array Area plus a 4km buffer and the data deficiency around disturbance and displacement assessment for the species, the magnitude of impact on white-billed diver is considered to be **negligible**.

13.7.2.3.2.3. Effect Significance

223. Overall, it is predicted that sensitivity of the receptor is **medium** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**). Although following the matrix approach the effect significance is classified as minor, when taking into account expert judgement and the non-materiality of such a minimal predicted impact, a more appropriate significance conclusion of **negligible** is concluded overall.

13.7.2.3.3 Great Northern Diver

13.7.2.3.3.1. Great northern-diver displacement rate and mortality rate evidence base

224. There is currently limited empirical evidence in relation to recorded behavioural responses of great northern divers in response to OWF. In the absence of empirical evidence, the recommended displacement and mortality rates for red-throated diver have been used as a proxy for great northern diver. Based on expert opinion, this is considered to be a highly precautionary approach as great northern diver are generally considered more tolerant to anthropogenic activities, given their tendency to forage within areas of high activity, such as harbours and ferry terminals (Goodship & Furness, 2022). Red-throated diver have a tendency to avoid human activity around piers, harbours and ferry terminals, whereas great northern divers are often observed in such areas, foraging under piers and around harbours (Ruddock and Whitfield, 2007).

225. When considering buffer zones, great northern diver have been recorded as utilising a buffer zone of approximately 100m to 350m during the non-breeding bio-season compared to red-throated diver that have a buffer zone of approximately 1000m (Goodship & Furness, 2022). This highlights that great northern diver are less sensitive by three to five fold, when compared to red-throated diver.

226. When birds are displaced, it is assumed that they relocate to habitat with an equivalent quality to which they were displaced from. This would increase the density of birds within these suitable areas, however, there is no evidence of density dependant mortality in wintering diver populations (Scottish Power Renewables, 2012). For DBD, there are 53 birds that are predicted to be displaced, which would relocate to equivalent quality habitat. This is unlikely to significantly increase competition for resource for this species, especially when as previously highlighted, there is no evidence for density dependant mortality in wintering divers.

227. When considering the required habitat for the species, great northern divers typically forage in the top five metres of the water column but are capable of diving up to 60 metres. Areas of deeper water are often used for preening and roosting (Daub, 1989). The required habitat for the species will be provided in other areas of the wintering range. Due to the depth of sea in which the Project is located, it is likely that great northern diver are using the area for preening, but will go elsewhere for foraging.

228. For the purpose of this assessment, the Applicant's preferred displacement rate of 90% to 100% and mortality rate of 1% was applied to each bio-season based on evaluation of the published literature and expert judgement. Additional consideration is provided by reference to the SNCBs preferred method of assessing potential impacts from displacement using a range of between 90% to 100% displacement and a 10% mortality rates (SNCBs, 2022) as presented in **Table 13-36**. The main focus of impact assessment is based on the Applicant's approach.

229. A complete range of displacement matrices are presented in **Volume 2, Appendix 13.4 Offshore Displacement Analysis Report**, whilst **Table 13-36** has been populated with data for great northern divers during the breeding and non-breeding bio-season within the Array Area as well as out to an asymmetrical 4km buffer. An annual displacement matrix for great northern diver within the Array Area plus 4km buffer is also presented in **Table 13-37**.

13.7.2.3.3.1. Receptor Sensitivity

230. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **medium**.

13.7.2.3.3.1. Impact Magnitude

231. The presence of great northern diver within the Array Area was limited to the non-breeding bio-season only, due to the absence of records during the breeding bio-season. The absence of records during the breeding bio-season is to be expected given that the species is not classified as a UK breeding bird (Balmer *et al.*, 2013). The assessment presented in **Table 13-36**, is therefore limited to the non-breeding bio-season only, when considering the predicted abundance for the Array Area as well as out to an asymmetrical 4km buffer.

Table 13-36 Great Northern Diver Bio-Season Displacement Estimates for the Project (Operation)

Bio-season (months)	Seasonal Abundance (Array Area plus 4km asymmetrical buffer)	Regional Baseline Populations and Baseline Mortality Rates		Estimated Number of Great Northern Divers Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
		Population (individuals)	Baseline Mortality (individuals per annum)	90% - 100% Disp; 1% Mort	90% - 100% Disp; 10% Mort	90% - 100% Disp; 1% Mort	90% - 100% Disp; 10% Mort
Breeding (June – August)	0	N/A	N/A	N/A	N/A	N/A	N/A
Non-breeding (September – May)	53	1,200	156	0.48 – 0.53	4.77 - 5.30	0.306 – 0.340	3.058 - 3.397
Annual (BDMPS)	53	1,200	156	0.48 – 0.53	4.77 - 5.30	0.306 – 0.340	3.058 - 3.397

Bio-season (months)	Seasonal Abundance (Array Area plus 4km asymmetrical buffer)	Regional Baseline Populations and Baseline Mortality Rates		Estimated Number of Great Northern Divers Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
		Population (individuals)	Baseline Mortality (individuals per annum)	90% - 100% Disp; 1% Mort	90% - 100% Disp; 10% Mort	90% - 100% Disp; 1% Mort	90% - 100% Disp; 10% Mort
Annual (Biogeographic)	53	430,000	55,900	0.48 – 0.53	4.77 - 5.30	0.001 – 0.001	0.009 - 0.009

232. A non-breeding / annual displacement matrix for great northern diver within the Array Area plus 4km asymmetrical buffer is also presented in **Table 13-37**.

233. During the non-breeding bio-season and annually, the mean peak abundance for great northern diver is 53 individuals within the Array Area plus 4km asymmetrical buffer. When considering the Applicant's preferred approach of a displacement rate of 90% to 100% and mortality rate of 1%, this would result in less than a single (0.48 – 0.53) great northern diver being subject to mortality. The UK North Sea and Channel BDMPS for the non-breeding bio-season is defined as 1,200 individuals (**Table 13-24**) and, using the average baseline mortality rate of 0.13 (**Table 13-25**), the natural predicted mortality in the non-breeding bio-season is 156 individuals per annum. The addition of less than a single predicted mortality would increase baseline mortality by 0.306% to 0.340%.

234. This magnitude of impact is therefore considered to be **negligible** during the non-breeding bio-season, as it represents an impact contribution of less than a single individual per annum which would almost certainly be indistinguishable from natural fluctuations in the population.

235. When considering the SNCB approach to displacement, the number of great northern divers subject to mortality due to displacement from the Array Area plus 4km asymmetrical buffer is a maximum of five (4.77 - 5.30) individuals per annum when considering a displacement rate of 90% to 100% and a mortality rate of 10% (**Table 13-36**). The addition of five predicted mortalities would increase baseline mortality by 3.058% to 3.397% at the BDMPS. Although such a predicted impact increases the baseline mortality rate by over 1%, such a level of predicted impact is considered highly unlikely. This is because usage of the Array Area by great northern divers is restricted to the non-breeding bio-season and their abundance was primarily much lower (abundance of five to 10 individuals) than the peaks used to inform assessment. This variation may be linked to prey availability, and it indicates that there are potential alternative areas of foraging habitat for this species. Therefore, the possible high behavioural plasticity in this population would allow them to exploit changes in prey availability. Furthermore, there is no empirical evidence to support the use of a 10% mortality rate in diver species as a result of displacement.

236. This magnitude of impact is therefore considered to be **low** at the UK North Sea and Channel BDMPS, as it represents only a small number of individuals subject to potential mortality even when considering the SNCB worst case scenario as a result of displacement.

13.7.2.3.3.2. Effect Significance

237. Overall, it is predicted that the sensitivity of the receptor is **medium** and the Applicant's approach magnitude of impact is **negligible**, when considering the Applicant's preferred approach to displacement. The effect is therefore concluded as **minor** significance, which is **not significant** in EIA terms (**Table 13-15**).

238. When considering the SNCB approach the sensitivity of the receptor is **medium** and the magnitude of impact is **low**. The effect is therefore concluded as **minor** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.2.3.4 Auk species – Displacement Rate Evidence Base

239. Displacement impacts from OWF post-consent monitoring studies were first reviewed by Dierschke *et al* (2016). The review concluded that the most common response, to the presence of turbines, for auks was 'weak displacement' but with a few exceptions such as for the Dutch and Belgium OWF which suggested displacement rates of 60-75%. However, auk abundance within these studies tends to be low and re-analyses of the data using INLA suggested displacement effects could be lower than 50% or shown to be not statistically significant (Zuur, 2018; Vanermen *et al.*, 2019). There have been further displacement studies on auks (APEM, 2017; Webb *et al.*, 2017; Vanermen *et al.*, 2019; Peschko *et al.*, 2020; MacArthur Green, 2021) which have been summarised as part of a more recent comprehensive review on auk displacement responses to OWF (APEM, 2022a).

Table 13-37 Great Northern Diver Non-Breeding Bio-Season / Annual Displacement Matrix for the Array Area Plus 4km Asymmetrical Buffer

Great northern diver non-breeding bio-season / annual displacement matrix (based on abundance of 53 individuals for the Array Area plus 4km asymmetrical buffer)																
Displacement (%)	**Mortality (%)**															
	0	**1**	**2**	**3**	**4**	**5**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**89**	**90**	**100**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	1	1	1	2	4	6	8	11	13	15	17	19	21
50	0	0	1	1	1	1	3	5	8	11	13	16	19	21	24	27
60	0	0	1	1	1	2	3	6	10	13	16	19	22	25	29	32
70	0	0	1	1	1	2	4	7	11	15	19	22	26	30	33	37
80	0	0	1	1	2	2	4	8	13	17	21	25	30	34	38	42
90	0	0	1	1	2	2	5	10	14	19	24	29	33	38	43	48
100	0	1	1	2	2	3	5	11	16	21	27	32	37	42	48	53

240. APEM (2022a) provides an extensive analysis of empirical data from multiple OWF expanding and updating the review by Dierschke *et al* (2016). The review concluded that auk displacement varied considerably between study sites showing attraction, no significant effect, or a displacement effect. For example, the studies on guillemot included: one OWF with positive displacement effects, eight OWF with no significant effects or weak displacement effects, three with inferred displacement effects (but not statistically tested), and eight with negative displacement effects. The displacement effects from those studies which provided a defined displacement rate ranged from +112% to -75%. The number of studies on razorbill are considerably less but show a similar range of displacement responses from three studies suggesting no significant effects and three studies indicating a displacement rate which range from 30% to 80%. For puffin there has been little empirical studies of displacement rates for OWF, in the review by Dierschke *et al* (2016) a response class for displacement was not allocated to this species due to lack of data. However, disturbance susceptibility for puffin have been estimated to be less than guillemot and razorbill (Bradbury *et al*., 2018) therefore in the absence of species -specific displacement rates for puffin, rates used for guillemot and razorbill would be reasonable. Although displacement rates of 50% or more were concluded for some of these studies these were only observed in the non-breeding season. Review of the analysis methods and quality of the datasets for these studies, found that some studies have not utilised the most appropriate statistical modelling methods for the data collected. These studies were coincidentally found to have high displacement rates due to low abundance and high numbers of zero counts, making displacement rate prediction highly problematic given natural spatial and temporal variation in auk abundance and distribution. As such, the displacement effects reported in these studies are most likely over precautionary. The conclusion from the APEM (2022a) literature review suggested that a displacement rate of up to 50% for the Array Area and 2km buffer would be the most evidence-based approach for UK OWF, whilst still being suitably precautionary for assessment. Lamb *et al* 2024 conducted a meta-analysis to assess the likelihood of detecting a response from seabirds to OWF. The analysis concluded that the presence and rate of distributional change reported in studies was dependent on study design criteria and wind farm characteristics, suggesting displacements rates are likely to be site specific.

241. Further evidence that an auk displacement rate of 50% is precautionary comes from studies that indicate auk habituation to OWF. This was recently demonstrated at Thanet OWF, where auk displacement was shown to be statistically significant, but only in the short term, with abundances increasing within the wind farm from year two post-construction suggesting some level of habituation after one year of operation. Indeed, year two and three displacement rates for auks fell from a range of 75% to 85% in the first year of operation to a low of 31% to 41% within year two and three of operations (Royal HaskoningDHV, 2013). There is also further emerging evidence as additional post-construction monitoring of OWF continues, with reports of auk numbers increasing and observations of foraging behaviour within the wind farm itself (Leopold & Verdaat, 2018). This includes evidence of habituation within OWF of the Belgium wind farm concession zone which previously concluded displacement rates of over 70% now reporting higher numbers within the wind farm than outside (Degraer *et al*., 2021). This would suggest that displacement rates are expected to diminish over the operational life of OWF.

242. The most recent evidence in relation to auk behavioural responses to OWF in the UK comes from the post-construction monitoring of Beatrice OWF, which indicated higher abundances of guillemot and razorbill within the Beatrice OWF compared to pre-construction surveys (MacArthur Green, 2021). Specifically, results indicated that there were significant increases in overall auk abundance following post-construction. Results from the second year of post-consent monitoring suggested no indication of avoidance of the OWF or individual turbines and in some cases higher densities of auks were recorded in proximity to turbines (MacArthur Green, 2023). Overall, it was concluded that no displacement effects on auks were detected from the two years of post-consent monitoring for the Beatrice OWF (Trinder *et al*., 2024).

243. The only studies that demonstrate significant and robust displacement effects are reported for OWF in the German North Sea. Peschko *et al* (2020), reported displacement effects of 44% in the breeding season although with a 95% CI of 8 to 66% suggesting considerable uncertainty. Later studies on displacement effects during the non-breeding season reported that only during the post breeding migration did displacement within the OWF and response radius reach 79%. For the winter period the displacement effect was reported at 51% within the OWF and response radius (Peschko *et al*., 2024). However, as Lamb *et al* (2024) concluded, reported displacement responses are likely to be site specific especially between different wind farm designs and distant geographical locations.

244. Therefore, in conclusion, there is strong evidence to support an Applicant's approach auk displacement rate of 50% within OWF wind farm sites and out to a 2km buffer. This would be considered as precautionary as displacement effects of 50% or higher have not been concluded in the breeding season in any study and significant displacement effects of 70% or higher have only been concluded during autumn passage and only within one study area outside UK waters that see large numbers of guillemot pass through this area (Peschko *et al*., 2024). This does not align with the SNCB guidance approach that suggests the use of up to 70% displacement for all seasons. Both approaches will be provided in the impact assessments for all three auk species.

13.7.2.3.5 Effects of Displacement on Auk Mortality

245. Current evidence suggests that the response of seabirds to OWF varies depending on the species and life stage of the individual birds. The levels both spatially and temporally to which birds may avoid OWF are likely to be based on key factors such as competition levels within the wider area and prey abundance within the OWF. The consequence of such avoidance may result in reduced foraging areas available to individuals. Mortalities are likely to correlate strongly with the quality of the area within the OWF that some individuals are displaced from but conversely may offer increased foraging efficiency for those still entering the OWF area. If the OWF area is considered to be a key foraging area and the area outside of the OWF is close to carrying capacity, then higher mortality rates may theoretically occur (Busche and Garthe, 2016; SNCBs, 2017). Conversely, if birds are being displaced into an area of optimal habitat and closer to breeding colonies, then this could result in a positive impact due to species having a reduction in energy expenditure foraging (Searle *et al*., 2020).

246. For auk species, SNCBs current guidance is to present and consider assessing displacement impacts using a mortality rate of up to 10% (SNCBs, 2022), the appropriateness of using mortality rates as high as 10% is unclear given the lack of evidence. Furthermore recent guidance from NatureScot does not advocate mortality rates as high as 10% for displacement assessment (NatureScot, 2023). However, since the interim guidance on displacement (SNCBs, 2022) was published there have been two detailed studies that modelled the predict consequence of displaced seabirds using IBMs, including auks, from OWF (Searle *et al*., 2014 and 2018; and van Kooten *et al*., 2019). IBMs incorporate biological parameters such wind farm location in relation to relevant seabird colonies, seabird utilisation density maps energetic requirements and prey distributions to model a more evidence-based fate of displaced birds.

247. Van Kooten *et al* (2019) determined the cost of birds avoiding areas based on energy-budget models for two scenarios; using habitat utilisation maps and a fixed 10% mortality rate. The results demonstrated that an additional 1% mortality for displaced auks is a more appropriate evidenced-based rate, in comparison to the overly precautionary 10% mortality rate.

248. Searle *et al* (2014; 2018) assessed the effects displacement and barrier effects have on breeding seabirds. The study was based on time and energy budget models being created to estimate the displacement impacts on the breeding population of seabirds, including auks during the chick rearing period. The models provided evidence that displacement has the potential to impact on future survival prospects of an auk due to changes in time and energy budgets. The model simulations consistently yielded estimated OWF project alone effects that corresponded to additional declines in SPA adult survival of less than 1% for auks.

249. A key factor determining the effects of displacement is the importance of the array area (such as prey abundance) in the context of the surrounding area. However, OWF site selection process avoids areas of known high density usage by seabirds reducing impacts from potential displacement. This assumes that areas of higher prey availability are available within foraging distance outside the array area for displaced birds. Based on the best available evidence from the IBM simulation studies, it is suggested that mortality rates for displaced birds are considerably less than 10%. Indeed, Searle *et al* (2020) demonstrated that modelled estimates of additional mortality at SPAs to combined OWF footprint displacement can be lower than 1%.

250. Further anecdotal evidence of negligible additional mortality rates as a consequence of displacement comes from the post consent monitoring of the Helgoland auk colony in the German North Sea. OWF have been in operation in the area since 2014 and a displacement rate for auks was reported of 44 and 63% in the breeding season and spring periods, respectively (Peschko *et al*., 2020). The OWF have therefore been in operation long enough for any correlations between colony demographics and operation of the OWF to be identified. The latest breeding population status on Helgoland shows a continued increase for both razorbill and guillemot over the latest five-year period, which has remained unchanged compared to long-term data (Gerlach *et al*., 2019), supporting an inferred conclusion that high mortality rates due to displacement are not occurring at the colony.

251. Therefore, a matrix approach using a broad range of mortality rates can be refined using estimations based on available evidence from IBM studies (Van Kooten *et al* (2019); Searle *et al* (2014; 2018; 2022), which suggest additional mortality rates for displaced seabirds are unlikely to exceed 1% for SPA birds especially at the limit of their foraging range and given that OWF site selection avoids areas preferred and utilised by seabirds. Therefore, based on best available evidence from IBM studies the Applicant's approach considers a mortality rate of 1% to be sufficiently precautionary for assessment of consequential displacement mortality. This is different to the SNCB guidance approach that suggests the use of up to 10% mortality. Both approaches will be provided in the impact assessments for all three auk species.

252. In summary, the different approaches considered for auk displacement assessment are as follows:

- Applicant's approach using 50% displacement rate and 1% mortality rate; and
- SNCB approach using 30% to 70% displacement rate and 1% to 10% mortality rate.

13.7.2.3.6 Guillemot

253. In light of the above evidence presented in **Section 13.7.2.3.4** and **Section 13.7.2.3.5**, the Applicant's approach is focused on a displacement rate of 50% and mortality rate of 1%. Additional consideration is provided by reference to the SNCBs preferred method of assessing potential impacts from displacement using a range of 30% to 70% displacement and range of between 1% and 10% mortality rates (SNCBs, 2022) as presented in **Table 13-38**.

Table 13-38 Guillemot Bio-Season Displacement Estimates for the Project (Operation)

Bio-season (months)	Seasonal Abundance (Array Area plus 2km asymmetrical buffer)	Regional Baseline Populations and Baseline Mortality Rates		Estimated Number of Guillemots Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
		Population (individual)	Baseline Mortality (individuals per annum)	50% Disp; 1% Mort	30%-70% Disp; 1-10% Mort	50% Disp; 1% Mort	30%-70% Disp; 1-10% Mort
Breeding (March – July)	6,872	2,045,078	287,333	34.36	20.62 – 481.04	0.012	0.007 – 0.167
Non-breeding (August – February)	7,406	1,617,305	227,231	37.03	22.22 – 518.42	0.016	0.010 – 0.228
Annual (BDMPS)	14,277	2,045,078	287,333	71.39	42.83 – 999.39	0.025	0.015 – 0.348
Annual (Biogeographic)	14,277	4,125,000	579,563	71.39	42.83 – 999.39	0.012	0.007 – 0.172

254. A complete range of displacement matrices are presented in **Volume 2, Appendix 13.4 Offshore Ornithology Displacement Analysis Report**, whilst **Table 13-38** has been populated with data for guillemots during the breeding and non-breeding bio-season within the Array Area as well as out to an asymmetrical 2km buffer. An annual displacement matrix for guillemot within the Array Area plus 2km asymmetrical buffer is also presented in **Table 13-39**.

13.7.2.3.6.1. Receptor Sensitivity

255. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **medium**.

13.7.2.3.6.2. Impact Magnitude

256. The annual estimated mortality (when considering a displacement rate of 50% and a mortality rate of 1%) as a consequence of displacement during the operation and maintenance phase of the Project for guillemot is 71 (71.39) individuals. This is further broken down into relevant bio-seasons in **Table 13-38**.

257. During the breeding bio-season, the mean peak abundance for guillemot is 6,872 individuals within the Array Area plus 2km asymmetrical buffer. When considering a displacement and mortality rate of 50% and 1%, this would result in approximately 34 (34.36) guillemots being subject to mortality per annum. During the breeding bio-season the total guillemot regional baseline population is estimated to be 2,045,078 individuals (**Table 13-24**). Using the average baseline mortality rate of 0.1405 (**Table 13-25**), the natural predicted mortality of guillemots in the breeding bio-season is 287,333 individuals per annum. The addition of 34 predicted mortalities would increase baseline mortality by 0.012%.

258. This magnitude of impact is therefore considered to be **negligible** during the breeding bio-season, as it represents no material change to baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

259. During the non-breeding bio-season, the mean peak abundance for guillemot is 7,406 individuals within the Array Area plus 2km asymmetrical buffer. When considering a displacement and mortality rate of 50% and 1%, this would result in approximately 37 (37.03) guillemots being subject to mortality per annum. The UK North Sea and Channel BDMPS for the non-breeding bio-season is defined as 1,617,305 individuals (**Table 13-38**) and, using the average baseline mortality rate of 0.1405 (**Table 13-25**), the natural predicted mortality in the non-breeding bio-season is 227,231 individuals per annum. The addition of 37 predicted mortalities would increase baseline mortality by 0.016%.

Table 13-39 Guillemot Annual Displacement Matrix for the Array Area Plus 2km Asymmetrical Buffer

Guillemot annual displacement matrix (based on abundance of 14,277 individuals for the Array Area plus 2km asymmetrical buffer)																
Displacement (%)	**Mortality (%)**															
	0	**1**	**2**	**3**	**4**	**5**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**89**	**90**	**100**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	3	4	6	7	14	29	43	57	71	86	100	114	128	143
10	0	14	29	43	57	71	143	286	428	571	714	857	999	1,142	1,285	1,428
20	0	29	57	86	114	143	286	571	857	1,142	1,428	1,713	1,999	2,284	2,570	2,855
30	0	43	86	128	171	214	428	857	1,285	1,713	2,142	2,570	2,998	3,426	3,855	4,283
40	0	57	114	171	228	286	571	1,142	1,713	2,284	2,855	3,426	3,998	4,569	5,140	5,711
50	0	71	143	214	286	357	714	1,428	2,142	2,855	3,569	4,283	4,997	5,711	6,425	7,139
60	0	86	171	257	343	428	857	1,713	2,570	3,426	4,283	5,140	5,996	6,853	7,710	8,566
70	0	100	200	300	400	500	999	1,999	2,998	3,998	4,997	5,996	6,996	7,995	8,995	9,994
80	0	114	228	343	457	571	1,142	2,284	3,426	4,569	5,711	6,853	7,995	9,137	10,279	11,422
90	0	128	257	385	514	642	1,285	2,570	3,855	5,140	6,425	7,710	8,995	10,279	11,564	12,849
100	0	143	286	428	571	714	1,428	2,855	4,283	5,711	7,139	8,566	9,994	11,422	12,849	14,277

260. This magnitude of impact is therefore considered to be **negligible** during the non-breeding bio-season, as it represents no material change to baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

261. The estimated annual number of guillemots subject to mortality due to displacement from the Array Area plus 2km asymmetrical buffer is 71 (71.39) individuals per annum. Using the largest UK North Sea and Channel BDMPS population of 2,045,078 individuals (**Table 13-24**), the addition of 71 predicted mortalities would increase baseline mortality by 0.025% per annum.

262. This magnitude of impact annually is therefore considered to be **negligible**, as it represents no material change to baseline conditions as a result of displacement.

263. When considering the SNCB approach to displacement, the number of guillemots subject to mortality due to displacement from the Array Area plus 2km asymmetrical buffer ranges from 43 (42.83) to 999 (999.39) individuals per annum when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10% (**Table 13-38**). Using the largest UK North Sea and Channel BDMPS population of 2,045,078 individuals (**Table 13-24**) as a proxy for the total BDMPS population across the year, the addition of 43 to 999 predicted mortalities would increase baseline mortality by 0.015% to 0.348%.

264. When considering the evidence presented within **Section 13.7.2.3.4** and **Section 13.7.2.3.5**, the SNCB upper range of 70% displacement and 10% mortality rate is considered unrealistically high and not reflective of current available evidence in contrast to the Applicant's and SNCB lower range approach.

265. This magnitude of impact annually when considering the SNCB approach varies from **negligible** to **low**, as it represents only a minor difference to baseline conditions even when considering the SNCB upper range of displacement and mortality rates.

13.7.2.3.6.3. Effect Significance

266. Overall, it is predicted that the sensitivity of the receptor is **medium** and the Applicant's approach magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

267. When considering the SNCB approach, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of impact is **negligible** to **low**. The effect is therefore of **minor adverse** significance which is **not significant** in EIA terms (**Table 13-15**).

13.7.2.3.7 Razorbill

268. When considering the evidence presented in **Section 13.7.2.3.4** and **Section 13.7.2.3.5**, the Applicant's approach is focussed on a displacement rate of 50% and mortality rate of 1%. Additional consideration is provided by reference to the SNCBs preferred method of assessing potential impacts from displacement using a range of 30% to 70% displacement and a range of between 1% and 10% mortality rates (SNCBs, 2021) as presented in **Table 13-40**.

Table 13-40 Razorbill Bio-Season Displacement Estimates for the Project (Operation)

Bio-season (months)	Seasonal Abundance (Array Area plus 2km asymmetrical buffer)	Regional Baseline Populations and Baseline Mortality Rates		Estimated Number of Razorbills Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
		Population (individual)	Baseline Mortality (individuals per annum)	50% Disp; 1% Mort	30%-70% Disp; 1-10% Mort	50% Disp; 1% Mort	30%-70% Disp; 1-10% Mort
Breeding (April – July)	749	158,031	20,576	3.75	2.25 – 52.43	0.018	0.011 – 0.255
Post-breeding migration (August – October)	282	591,875	77,062	1.41	0.85 – 19.74	0.002	0.001 – 0.026
Winter (November – December)	588	218,621	28,464	2.94	1.76 – 41.16	0.010	0.006 – 0.145
Return migration (January – March)	1,461	591,875	77,062	7.31	4.38 – 102.27	0.009	0.006 – 0.133
Annual (BDMPS)	3,079	591,875	77,062	15.40	9.24 – 215.53	0.020	0.012 – 0.280
Annual (Biogeographic)	3,079	1,707,000	222,251	15.40	9.24 – 215.53	0.007	0.004 – 0.097

269. A complete range of displacement matrices are presented in **Volume 2, Appendix 13.4 Offshore Displacement Analysis Report**, whilst **Table 13-40** has been populated with data for razorbills during the breeding, post-breeding migration, winter and return migration bio-seasons within the Array Area as well as out to an asymmetrical 2km buffer. An annual displacement matrix for razorbill within the wind farm plus 2km asymmetrical buffer is also presented in **Table 13-41**.

13.7.2.3.7.1. Receptor Sensitivity

270. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **medium**.

13.7.2.3.7.2. Impact Magnitude

271. The annual estimated mortality (when considering a displacement rate of 50% and a mortality rate of 1%) as a consequence of displacement during the operation and maintenance phase of the Project for razorbill is 15 (15.40) individuals. This is further broken down into relevant bio-seasons in **Table 13-40**.

272. During the return migration bio-season, the mean peak abundance for razorbill is 1,461 individuals within the Array Area plus 2km asymmetrical buffer. When considering a displacement and mortality rate of 50% and 1%, respectively, this would result in approximately seven (7.31) razorbills being subject to mortality. The UK North Sea and Channel BDMPS for the return migration bio-season is defined as 591,875 individuals (**Table 13-24**) and, using the average baseline mortality rate of 0.1302 (**Table 13-25**), the natural predicted mortality of razorbills in the return migration bio-season is 77,062 individuals per annum. The addition of seven predicted mortalities would increase baseline mortality by 0.009%.

273. This magnitude of impact is therefore considered to be **negligible** during the return migration bio-season, as it represents no material change to baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

274. During the breeding bio-season, the mean peak abundance for razorbill is 749 individuals within the Array Area plus 2km asymmetrical buffer. When considering a displacement and mortality rate of 50% and 1%, respectively, this would result in approximately four (3.75) razorbills being subject to mortality. During the breeding bio-season the total razorbill regional baseline population is estimated to be 158,031 individuals (**Table 13-24**). Using the average baseline mortality rate of 0.1302 (**Table 13-25**), the natural predicted mortality of razorbills in the breeding bio-season is 20,576 individuals per annum. The addition of four predicted mortalities would increase baseline mortality by 0.018%.

275. This magnitude of impact is therefore considered to be **negligible** during the breeding bio-season, as it represents no material change to baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

276. During the post-breeding migration bio-season, the mean peak abundance for razorbill is 282 individuals within the Array Area plus 2km asymmetrical buffer. When considering a displacement and mortality rate of 50% and 1%, respectively, this would result in approximately one (1.41) razorbill being subject to mortality. The UK North Sea and Channel BDMPS for the post-breeding migration bio-season is defined as 591,875 individuals (**Table 13-24**) and, using the average baseline mortality rate of 0.1302 (**Table 13-25**), the natural predicted mortality in the post-breeding migration bio-season is 77,062 individuals per annum. The addition of one predicted mortality would increase baseline mortality by 0.002%.

277. This magnitude of impact is therefore considered to be **negligible** during the post-breeding migration bio-season, as it represents no material change to baseline conditions due to the addition of approximately one individual subject to potential mortality as a result of displacement.

278. During the winter bio-season, the mean peak abundance for razorbill is 588 individuals within the Array Area plus 2km asymmetrical buffer. When considering a displacement and mortality rate of 50% and 1%, respectively, this would result in approximately three (2.94) razorbills being subject to mortality. The UK North Sea and Channel BDMPS for the winter bio-season is defined as 218,621 individuals (**Table 13-24**) and, using the average baseline mortality rate of 0.1302 (**Table 13-25**), the natural predicted mortality in the winter bio-season is 28,464 individuals per annum. The addition of three predicted mortalities would increase baseline mortality by 0.010%.

279. This magnitude of impact is therefore considered to be **negligible** during the winter bio-season, as it represents no material change to baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

280. For all bio-seasons combined, the estimated number of razorbills subject to mortality due to displacement from the Array Area plus 2km asymmetrical buffer is 15 (15.40) individuals per annum. Using the largest UK North Sea and Channel BDMPS population of 591,875 individuals (**Table 13-24**), the addition of 15 predicted mortalities would increase baseline mortality by 0.020%.

281. This magnitude of impact annually is therefore considered to be **negligible**, as it represents no material change to baseline conditions as a result of displacement.

Table 13-41 Razorbill Annual Displacement Matrix for the Array Area Plus 2km Asymmetrical Buffer

Razorbill annual displacement matrix (based on abundance of 3,079 for the Array Area plus 2km asymmetrical buffer)																
Displacement (%)	**Mortality (%)**															
	0	**1**	**2**	**3**	**4**	**5**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**89**	**90**	**100**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	1	1	1	2	3	6	9	12	15	18	22	25	28	31
10	0	3	6	9	12	15	31	62	92	123	154	185	216	246	277	308
20	0	6	12	18	25	31	62	123	185	246	308	369	431	493	554	616
30	0	9	18	28	37	46	92	185	277	369	462	554	647	739	831	924
40	0	12	25	37	49	62	123	246	369	493	616	739	862	985	1,108	1,232
50	0	15	31	46	62	77	154	308	462	616	770	924	1,078	1,232	1,386	1,540
60	0	18	37	55	74	92	185	369	554	739	924	1,108	1,293	1,478	1,663	1,847
70	0	22	43	65	86	108	216	431	647	862	1,078	1,293	1,509	1,724	1,940	2,155
80	0	25	49	74	99	123	246	493	739	985	1,232	1,478	1,724	1,971	2,217	2,463
90	0	28	55	83	111	139	277	554	831	1,108	1,386	1,663	1,940	2,217	2,494	2,771
100	0	31	62	92	123	154	308	616	924	1,232	1,540	1,847	2,155	2,463	2,771	3,079

282. When considering the SNCB approach to displacement, the number of razorbills subject to mortality due to displacement from the Array Area plus 2km asymmetrical buffer ranges from nine (9.24) to 216 (215.53) individuals per annum when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10% (**Table 13-40**). Using the largest UK North Sea and Channel BDMPS population of 591,875 individuals (**Table 13-24**) as a proxy for the total BDMPS population across the year, the addition of nine to 216 predicted mortalities would increase baseline mortality by 0.012% to 0.280%.

283. When considering the evidence presented within **Section 13.7.2.3.4** and **Section 13.7.2.3.5**, the SNCB upper range of 70% displacement and 10% mortality rate is considered unrealistically high and not reflective of current available evidence in contrast to the Applicant's and SNCB lower range approach.

284. This magnitude of impact annually when considering the SNCB approach varies from **negligible** to **low**, as it represents only a minor difference to baseline conditions even when considering the SNCB upper range of displacement and mortality rates.

13.7.2.3.7.3. Effect Significance

285. Overall, it is predicted that the sensitivity of the receptor is **medium** and the Applicant's approach magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

286. When considering the SNCB approach, it is predicted that the sensitivity of the receptor is **high** and the magnitude of impact is **negligible** to **low**. The effect is therefore of **minor adverse** significance which is **not significant** in EIA terms (**Table 13-15**).

13.7.2.3.8 Puffin

287. When considering the evidence presented in **Section 13.7.2.3.4** and **Section 13.7.2.3.5**, the Applicant's approach is focussed on a displacement rate of 50% and mortality rate of 1%. Additional consideration is provided by reference to the SNCBs preferred method of assessing potential impacts from displacement using a range of 30% to 70% displacement and a range of between 1% and 10% mortality rates (SNCBs, 2021) as presented in **Table 13-42**.

288. A complete range of displacement matrices are presented in **Volume 2, Appendix 13.4 Offshore Displacement Analysis Report**, whilst **Table 13-42** has been populated with data for puffin during the breeding and non-breeding bio-season within the Array Area as well as out to an asymmetrical 2km buffer. An annual displacement matrix for puffin within the Array Area plus 2km asymmetrical buffer is also presented in **Table 13-43**.

Table 13-42 Puffin Bio-Season Displacement Estimates for the Project (Operation)

Bio-season (months)	Seasonal Abundance (Array Area plus 2km asymmetrical buffer)	Regional Baseline Populations and Baseline Mortality Rates		Estimated Number of Puffins Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
		Population (individuals)	Baseline Mortality (individuals per annum)	50% Disp; 1% Mort	30%-70% Disp; 1-10% Mort	50% Disp; 1% Mort	30%-70% Disp; 1-10% Mort
Breeding (April – July)	111	868,689	103,374	0.56	0.33 – 7.77	0.001	<0.001 – 0.008
Non-breeding (August – March)	24	231,958	27,603	0.12	0.07 – 1.68	<0.001	<0.001 – 0.006
Annual (BDMPS)	134	868,689	103,374	0.67	0.40 – 9.38	0.001	<0.001 – 0.009
Annual (Biogeographic)	134	2,370,000	282,030	0.67	0.40 – 9.38	<0.001	<0.001 – 0.003

13.7.2.3.8.1. Receptor Sensitivity

289. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **medium**.

13.7.2.3.8.2. Impact Magnitude

290. The annual estimated mortality (when considering a displacement rate of 50% and a mortality rate of 1%) as a consequence of displacement during the operation and maintenance phase of the Project for puffin is less than one (0.67) individual. This is further broken down into relevant bio-seasons in **Table 13-42**.

Table 13-43 Puffin Annual Displacement Matrix for the Array Area Plus 2km Asymmetrical Buffer

Puffin annual displacement matrix (based on abundance of 134 for the Array Area plus 2km asymmetrical buffer)																
Displacement (%)	**Mortality (%)**															
	0	**1**	**2**	**3**	**4**	**5**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**89**	**90**	**100**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
10	0	0	0	0	1	1	1	3	4	5	7	8	9	11	12	13
20	0	0	1	1	1	1	3	5	8	11	13	16	19	21	24	27
30	0	0	1	1	2	2	4	8	12	16	20	24	28	32	36	40
40	0	1	1	2	2	3	5	11	16	21	27	32	38	43	48	54
50	0	1	1	2	3	3	7	13	20	27	34	40	47	54	60	67
60	0	1	2	2	3	4	8	16	24	32	40	48	56	64	72	80
70	0	1	2	3	4	5	9	19	28	38	47	56	66	75	84	94
80	0	1	2	3	4	5	11	21	32	43	54	64	75	86	96	107
90	0	1	2	4	5	6	12	24	36	48	60	72	84	96	109	121
100	0	1	3	4	5	7	13	27	40	54	67	80	94	107	121	134

291. During the breeding bio-season, the mean peak abundance for puffin is 111 individuals within the Array Area plus 2km asymmetrical buffer. When considering a displacement and mortality rate of 50% and 1%, respectively, this would result in less than a single (0.56) puffin being subject to mortality. During the breeding bio-season the total puffin regional baseline population is estimated to be 868,689 individuals (**Table 13-24**). Using the average baseline mortality rate of 0.119 (**Table 13-25**), the natural predicted mortality of puffins in the breeding bio-season is 103,374 individuals per annum. The addition of less than a single predicted mortality would increase baseline mortality by 0.001%.

292. This magnitude of impact is therefore considered to be **negligible** during the breeding bio-season, as it represents no material change to baseline conditions due to the addition of less than one individual subject to potential mortality as a result of displacement.

293. During the non-breeding bio-season, the mean peak abundance for puffin is 24 individuals within the Array Area plus 2km asymmetrical buffer. When considering a displacement and mortality rate of 50% and 1%, respectively, this would result in less than a single (0.12) puffin being subject to mortality. The UK North Sea and Channel BDMPS for the non-breeding bio-season is defined as 231,958 individuals (**Table 13-24**), using the average baseline mortality rate of 0.119 (**Table 13-25**), the natural predicted mortality in the non-breeding bio-season is 27,603 individuals per annum. The addition of less than one predicted mortality would increase baseline mortality by less than 0.001%.

294. This magnitude of impact is therefore considered to be **negligible** during the non-breeding bio-season, as it represents no material change to baseline conditions due to the addition of less than one individual subject to potential mortality as a result of displacement.

295. For all bio-seasons combined, the estimated number of puffins subject to mortality due to displacement from the Array Area plus 2km asymmetrical buffer is approximately less than a single (0.67) individual per annum. Using the largest UK North Sea and Channel BDMPS population of 868,689 individuals (**Table 13-24**) as a proxy for the total BDMPS population across the year, the addition of less than one predicted mortality would increase baseline mortality by 0.001%.

296. This magnitude of impact annually is therefore considered to be **negligible**, as it represents no material change to baseline conditions due to the addition of less than one individual subject to potential mortality as a result of displacement.

297. When considering the SNCB approach to displacement, the number of puffins subject to mortality due to displacement from the Array Area plus 2km asymmetrical buffer is between less than one to nine (0.40 - 9.38) individuals per annum when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10% (**Table 13-42**). Using the largest UK North Sea and Channel BDMPS population of 868,689 individuals (**Table 13-24**) as a proxy for the total BDMPS population across the year, the addition of less than one to nine predicted mortalities would increase baseline mortality by less than 0.001% to 0.009%.

298. When considering the evidence presented within **Section 13.7.2.3.4** and **Section 13.7.2.3.5**, the SNCB upper range of 70% displacement and 10% mortality rate is considered unrealistically high and not reflective of current available evidence in contrast to the Applicant's and SNCB lower range approach.

299. This magnitude of impact annually when considering the SNCB approach is concluded as **negligible**, even when considering the SNCB upper range, as it represents no material change to baseline conditions due to the addition of less than one individual subject to potential mortality as a result of displacement.

13.7.2.3.8.3. Effect Significance

300. Overall, it is predicted that the sensitivity of the receptor is **medium** and the Applicant's and SNCB approach magnitude of impact is **negligible** The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.2.3.9 Gannet

13.7.2.3.9.1. Gannet Displacement Rate Evidence Base and Consequent Mortality

301. Gannets show a low level of sensitivity to ship and helicopter traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012). A study by Krijgsveld *et al* (2011) using radar and visual observations to monitor the post-construction effects of the Offshore Wind farm Egmond aan Zee (OWEZ) established that 64% of gannets avoided entering the wind farm (macro-avoidance). The results of the post-consent monitoring surveys for Thanet OWF found that gannet densities reduced within the site in the third year, but the report did not quantify this (Royal HaskoningDHV, 2013). Evidence from a recent review undertaken by APEM (2022b), which has collated and critically appraised studies from 25 OWF, suggests that gannet behavioural response to OWF varies bio-seasonally with data suggesting displacement rates of 40% to 60% during the breeding bio-season and 60% to 80% during the non-breeding bio-season.

302. More recent studies in relation to gannet responses to OWF comes from the Beatrice OWF post-construction monitoring data, which suggested displacement rates, although not quantified directly, in the upper range described above for the breeding season (MacArthur Green, 2021 and 2023), as only 12 gannets were recorded within the OWF during 2021.

303. Therefore, for the purpose of this assessment, a precautionary approach has been taken and the level of displacement considered across all bio-seasons is between 60% to 80%.

304. Furthermore, in accordance with the joint advice note regarding bird collision risk modelling for offshore wind developments (SNCBs, 2024), it is recommended that CRM for gannet should include consideration of macro-avoidance. This behaviour is similar to displacement but affects flying birds only, reducing the number of birds entering an OWF site compared to what might be expected in the absence of the OWF (SNCBs, 2024). No specific advice is provided within the joint guidance note (SNCBs, 2024) however the Natural England commissioned a review of gannet macro-avoidance rates which is recommended as guidance (Pavat *et al.,* 2023). Utilising both the evidence gathered within the APEM (2022b) and Natural England commissioned review (Pavat *et al*., 2023) a macro-avoidance rate of 70% was selected based on the 60% - 80% displacement range identified in the APEM (2022b) review and empirical data analysed from nine literature sources in Pavat *et al* (2023) which suggested a lower and upper CI for avoidance of 53% - 97%.

305. SNCB current guidance is to present and consider assessing displacement impacts using a mortality rate of up to 10% (SNCBs, 2022) the appropriateness of using mortality rates as high as 10% is unclear given the lack of evidence. A mortality rate of 1% was selected for this assessment, based on expert judgement supported by the evidence that suggests that gannet have a large mean max (315km) and maximum (709km) foraging range during the breeding season (Woodward *et al*., 2019) and during the non-breeding season can travel 200 km to 400 km per day (Garthe *et al*., 2007). Gannet can switch to different prey depending on availability, feeding on a variety of different prey items including mackerel (*Scomber scombrus*), sandeels (*Ammodytes sp*.), immature herring (*Clupea harrengus*) and sprat (*Sprattus sprattus*) (Forrester *et al*., 2007; Hamer *et al*., 2007) which provide sufficient alternative foraging opportunities despite any potential reduced foraging within the Array Area. Therefore, despite the displacement responses likely by gannets to OWF, it is highlighted that any potential consequences of displacement would likely be minimal for gannet due to their large foraging range, their diverse diet and the low energy costs associated with the additional flight distances incurred.

306. For the purpose of this assessment, the Applicant's approach is focussed on a displacement rate of 60% to 80% and mortality rate of 1% for each bio-season based on evaluation of the preceding evidence bases. Additional consideration is provided by reference to the SNCBs preferred method of assessing potential impacts from displacement using a range of between 60% to 80% displacement and range of between 1% and 10% mortality rates (SNCBs, 2022) as presented in **Table 13-44**.

307. A complete range of displacement matrices are presented in **Volume 2, Appendix 13.4 Offshore Displacement Analysis Report**, whilst **Table 13-44** has been populated with data for gannets during the breeding, post-breeding migration, winter and return migration bio-seasons within the Array Area as well as out to an asymmetrical 2km buffer. An annual displacement matrix for gannet within the Array Area plus 2km asymmetrical buffer is also presented in **Table 13-45**.

13.7.2.3.9.2. Receptor Sensitivity

308. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to disturbance and displacement of **medium**.

13.7.2.3.9.3. Impact Magnitude

309. The annual estimated mortality (when considering a displacement rate of 60% to 80% and a mortality rate of 1%) as a consequence of displacement during the operation and maintenance phase of the Project for gannet is seven to nine (6.68 – 8.90) individuals. This is further broken down into relevant bio-seasons in **Table 13-44**.

310. During the return migration bio-season, the mean peak abundance for gannet is 85 individuals within the Array Area plus 2km asymmetrical buffer. When considering a displacement rate of 60% to 80% and a mortality rate of 1%, this would result in less than a single (0.51 - 0.68) gannet being subject to mortality. The UK North Sea and Channel BDMPS for the return migration bio-season is defined as 248,385 individuals (**Table 13-24**) and, using the average baseline mortality rate of 0.1866 (**Table 13-25**), the natural predicted mortality of gannets in the return migration bio-season is 46,349 individuals per annum. The addition of less than a single predicted mortality would increase baseline mortality by 0.001%.

311. This magnitude of impact is therefore considered to be **negligible** during the return migration bio-season, as it represents no material change to baseline conditions due to the addition of less than one individual subject to potential mortality as a result of displacement.

Table 13-44 Gannet Bio-Season Displacement Estimates for the Project (Operation)

Bio-season (months)	Seasonal Abundance (Array Area plus 2km asymmetrical buffer)	Regional Baseline Populations and Baseline Mortality Rates		Estimated Number of Gannets Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
		Population (individuals)	Baseline Mortality (individuals per annum)	60% - 80% Disp; 1% Mort	60% - 80% Disp; 10% Mort	60% - 80% Disp; 1% Mort	60% - 80% Disp; 10% Mort
Breeding (June – August)	217	400,326	74,701	1.30 – 1.74	13.02 - 17.36	0.002 – 0.002	0.017 - 0.023
Post-breeding migration (October-November)	813	456,299	85,145	4.88 – 6.50	48.78 - 65.04	0.006 – 0.008	0.057 - 0.076
Return migration (December – February)	85	248,385	46,349	0.51 – 0.68	5.10 - 6.80	0.001 – 0.001	0.011 - 0.015
Annual (BDMPS)	1,113	456,299	85,145	6.68 – 8.90	66.78 - 89.04	0.008 – 0.010	0.078 - 0.105
Annual (Biogeographic)	1,113	1,180,000	220,188	6.68 – 8.90	66.78 - 89.04	0.003 – 0.004	0.030 - 0.040

Table 13-45 Gannet Annual Displacement Matrix for the Array Area Plus 2km Asymmetrical Buffer

Gannet annual displacement matrix (based on abundance of 1,113 for the Array Area plus 2km asymmetrical buffer)																
Displacement (%)	**Mortality (%)**															
	0	**1**	**2**	**3**	**4**	**5**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**89**	**90**	**100**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	1	1	2	3	4	6	7	8	9	10	11
10	0	1	2	3	4	6	11	22	33	45	56	67	78	89	100	111
20	0	2	4	7	9	11	22	45	67	89	111	134	156	178	200	223
30	0	3	7	10	13	17	33	67	100	134	167	200	234	267	301	334
40	0	4	9	13	18	22	45	89	134	178	223	267	312	356	401	445
50	0	6	11	17	22	28	56	111	167	223	278	334	390	445	501	557
60	0	7	13	20	27	33	67	134	200	267	334	401	467	534	601	668
70	0	8	16	23	31	39	78	156	234	312	390	467	545	623	701	779
80	0	9	18	27	36	45	89	178	267	356	445	534	623	712	801	890
90	0	10	20	30	40	50	100	200	301	401	501	601	701	801	902	1,002
100	0	11	22	33	45	56	111	223	334	445	557	668	779	890	1,002	1,113

312. During the breeding bio-season, the mean peak abundance for gannet is 217 individuals within the Array Area plus 2km asymmetrical buffer. When considering a displacement rate of 60% to 80% and a mortality rate of 1%, this would result in approximately one to two (1.30 – 1.74) gannets being subject to mortality. During the breeding bio-season the total gannet regional baseline population, is estimated to be 400,326 individuals (**Table 13-24**). Using the average baseline mortality rate of 0.1866 (**Table 13-25**), the natural predicted mortality of gannets in the breeding bio-season is 74,701 individuals per annum. The addition of one to two predicted mortalities would increase baseline mortality by 0.002%.

313. This magnitude of impact is therefore considered to be **negligible** during the breeding bio-season, as it represents no material change to baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

314. During the post-breeding migration bio-season, the mean peak abundance for gannet is 813 individuals within the Array Area plus 2km asymmetrical buffer. When considering a displacement rate of 60% to 80% and a mortality rate of 1%, this would result in approximately five to seven (4.88 – 6.05) gannets being subject to mortality. The UK North Sea and Channel BDMPS for the post-breeding migration bio-season is defined as 456,299 individuals (**Table 13-24**), using the average baseline mortality rate of 0.1866 (**Table 13-25**), the natural predicted mortality in the post-breeding migration bio-season is 85,145 individuals per annum. The addition of five to seven predicted mortalities would increase baseline mortality by 0.006% to 0.008%.

315. This magnitude of impact is therefore considered to be **negligible** during the post-breeding migration bio-season, as it represents only a slight difference to the baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

316. For all bio-seasons combined, the estimated number of gannets subject to mortality due to displacement from the Array Area plus 2km asymmetrical buffer is seven to nine (6.68 – 8.90) individuals per annum. Using the largest UK North Sea and Channel BDMPS population of 456,299 individuals (**Table 13-24**) as a proxy for the total BDMPS population across the year, the addition of seven to nine predicted mortalities would increase baseline mortality by 0.008% to 0.010%.

317. This magnitude of impact is therefore considered to be **negligible** at both the UK North Sea and Channel BDMPS and the biogeographic scale, as it represents only a slight difference to the baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

318. When considering the SNCB upper range approach to displacement (60 to 80% and a mortality rate of 10%), the number of gannets subject to mortality due to displacement from the Array Area plus 2km asymmetrical buffer is 67 to 89 (66.78 - 89.04) individuals per annum (**Table 13-44**). Using the largest UK North Sea and Channel BDMPS population of 456,299 individuals (**Table 13-24**) as a proxy for the total BDMPS population across the year, with an average baseline mortality rate of 0.1866 (**Table 13-25**), the addition of 67 to 89 predicted mortalities would increase baseline mortality by 0.078% to 0.105%.

319. To note, the likelihood of a 10% mortality rate is considered unreasonable given the available evidence when considering the information summarised in **Section 13.7.2.3.9**.

320. This magnitude of impact annually when considering the SNCB approach is concluded as **negligible**, even when considering the SNCB upper range, as it represents no material change to baseline conditions as a result of displacement.

13.7.2.3.9.4. Effect Significance

321. Overall, it is predicted that the sensitivity of the receptor is **medium** and the Applicant's and SNCB approach magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.2.4 Collision Risk due to Presence of Wind Turbines (ORN-O-06)

322. Following the outcome of the screening process (**Table 13-26**), the receptors undergoing assessment for collision risk due to the presence of wind turbines include:

- Kittiwake;
- Great black-backed gull;
- Herring gull;
- Lesser black-backed gull; and
- Gannet.

323. There is potential risk to birds from OWF through collision with wind turbines and associated infrastructure described in the worst-case scenario (**Section 13.4.4**) resulting in injury or fatality. This may occur when birds fly through the Array Area whilst foraging for food, commuting between breeding sites and foraging areas, or during migration.

324. CRM has been carried out for the Project, with detailed methods and results presented in **Volume 2, Appendix 13.3 Offshore Collision Risk Modelling Report**, to provide information for five seabird species of interest identified as potentially at risk and of interest for impact assessment. A selection process was undertaken based on the density of flying birds recorded within the Array Area and consideration of their perceived risk from collision (identified from the published literature). The results of this selection exercise are presented in **Table 13-26**. This screening process screened out the species for which the risk of collision is considered as very low. Species were also screened out if their densities in flight within the Array Area were low enough that the potential for a significant effect to occur could confidently be ruled out in the absence of modelling. Following this selection process (**Table 13 24**), five species were identified following the screening criteria for CRM assessment: gannet, kittiwake, great black-backed gull, lesser black-backed gull, and herring gull. These species were also agreed upon during the ETG2 meeting held on 23rd May 2024 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**).

325. CRM was undertaken using the stochastic collision risk model (sCRM) tool, initially developed on behalf of Marine Scotland (McGregor, 2018) and further developed by Caneco and Humphries (2022), whilst using the advocated parameters within the latest SNCB guidance (SNCBs, 2024a).

326. CRM accounts for several different species-specific behavioural aspects of the seabird being assessed, including the height at which birds fly, their ability to avoid moving or statis structures and how active they are diurnally and nocturnally. Details of these considerations are provided in **Volume 2, Appendix 13.3 Offshore Collision Risk Modelling Report**.

327. No requirement for an Applicant's and SNCB approach was required for CRM, due to the Applicant following the methods for both modelling and assessment presented within the latest SNCB guidance on collision risk (SNCBs, 2024a).

328. Further consideration has also been given to the risk of collision to migratory species. Migratory birds may not be reliably detected using DAS or any other existing generally applied survey method. This is because migratory birds may move through in short pulses, in poor weather, or at night (when no surveys take place), or at high altitudes, which makes recording their numbers extremely complex. Impact assessment for migratory species within the PEIR is based on a qualitative assessment however, following consultation with SNCBs after PEIR submission, quantitative assessment can be provided at ES.

13.7.2.4.1 Areas of uncertainty in relation to CRM

329. It is highly likely that the speed at which a bird flies is highly dependent on both wind speed and the type of flight behaviour exhibited, for example a seabird's flight speed when commuting or during migratory flights are likely to differ from when a species is actively foraging. Within the original Band (2012) CRM model and the sCRM (Donovan, 2018; Caneco and Humphries, 2022) an increase in flight speed leads to a greater flux of birds predicted to pass through the OWF, thus increasing collision risk. Within the guidance document for the Band (2012) CRM, one area of uncertainty identified related to species biometrics, including flight speed due to the parameters being a single fixed value. The author stated within the guidance (Band, 2012) that uncertainty relating to species biometrics and flight speed could affect the predicted impact by up to ±20%.

330. The flight speeds advocated by SNCBs are derived from Pennycuick (1997) for gannet and Alerstam *et al* (2007) for kittiwake. As highlighted in The Crown Estate Round 4 Plan Level HRA collision modelling annex the following points should be noted when using such datasets:

"The flight speed for gannet calculated in Pennycuick (1997) is based on a small sample size with these data having been collected from birds flying at a breeding colony (Foula, Shetland). It is therefore possible that the flight speeds recorded are not representative of the flight speeds of birds foraging offshore. This is therefore likely to over-estimate collision risk estimates and increase the uncertainty associated with these estimates.

331. "The birds observed by Alerstam et al (2007) were located either in southern Sweden or within the Arctic circle and no differentiation is provided between migratory or foraging birds from colonies. Indeed, the large range of species included in Alerstam et al (2007) suggests that non-breeding and / or migratory flights comprised a significant component of the data set. This is therefore likely to over-estimate collision risk estimates and increase the uncertainty associated with these estimates."

332. Flight speeds of seabirds within an operational OWF has been collected at Thanet OWF as part of the ORJIP avoidance study (Skov *et al.*, 2018). This study used laser rangefinder tracking data to estimate flight speed both inside and outside the Thanet OWF from 284 tracks over a period of approximately two years. Overall, flight speeds for both kittiwake and gannet were calculated to be considerably slower than as currently recommended. This difference could be due to a number of factors such as differing temporal and spatial scales of data collection, limited data collected within Pennycuick (1997) and Alerstam *et al* (2007), behavioural response to the OWF development or methodological differences.

333. Improvement in flight speed parameters for inclusion within assessment was recently assessed by Cook *et al* (2023) on behalf of the Scottish Government. Cook *et al* (2023) concluded:

"Typical flight speeds may be lower than those reported in these previous studies, which are often collected in areas which may not be representative of conditions experienced offshore (Alerstam et al., 2007; Pennycuick, 1997). Accounting for these differences can result in a substantial reduction in the predicted collision rate."

334. These studies suggest that currently advocated flight speeds are likely to be inflating the predicted impact of collision.

335. The recommended SNCB (2024a) Nocturnal Activity Factors (NAFs) for seabirds are derived from Cook *et al* (2023) for gannet, kittiwake and lesser black-backed gull. For herring gull and great black-backed gull, NAFs are derived from Garthe and Hüppop (2004). Prior to the recent CRM guidance updates (SNCBs, 2024a), all NAFs were derived from Garthe and Hüppop (2004), which used a scoring index of expected NAF based on literature review and personal observations. Cook *et al* (2023), provided updated parameters based on GPS tags deployed at colonies around the UK, the results of which recommended reduced NAFs comparative to the Garthe and Hüppop (2004) scoring indices. However, the author did note significant variability in NAF between colonies and years of deployment due to significant variation in day time activity, suggesting that wider environmental conditions should be considered to ensure appropriate transferability within assessment (Cook *et al.,* 2023). Additionally, as the results of Cook *et al* (2023) relate to the breeding season only, such rates therefore may not appropriately represent nocturnal activity during the non-breeding season. For herring gull and great black-backed gull, the results from Cook *et al* (2023) suggest that the use of Garthe and Hüppop (2004) may not be appropriate for at least the breeding season.

336. The Bird Collision Avoidance Study funded by ORJIP considered the potential avoidance rate of seabirds in response to Thanet OWF (Skov *et al*., 2018). Over the two-year study period (between 2014 and 2016) over 12,000 bird movements were recorded throughout the day and night (Skov *et al*., 2018). It was reported that only six birds (all gull species) in total collided with wind turbines suggesting there are still significant levels of precaution within the latest avoidance rates recommended for modelling. Although the avoidance rates determined from the Thanet OWF study (Skov *et al*., 2018) were considered within the determination of SNCBs latest recommended rates (SNCBs, 2024a), the recommended species specific rates from the study are higher than those currently recommended in SNCB guidance (SNCBs, 2024a).

337. The most recent empirical led study of collision risk to seabirds (AOWFL, 2023) was undertaken over two years off the coast of Aberdeen at an OWF site with 11 wind turbines collecting data during the breeding and post-breeding season (covering the months of April to October 2020 and 2021). The results from this study and its overall conclusions were that it is now evident that seabirds are exposed to very low risks of collision with wind turbines during daylight hours. This was also substantiated by the fact that no collisions or even narrow escapes were recorded in over 10,000 bird videos during the two years of monitoring. Despite this study not covering the period outside of the breeding / post-breeding season, when weather conditions may be more testing for birds and may influence flight behaviour more, it is evident that current annual CRM outputs are likely to overestimate the risk to seabirds.

338. Within the latest guidance (SNCBs, 2024a), the avoidance rates outlined in the Ozsanlav-Harris *et al* (2023) paper, are used. It must be noted that the current recommended values are mainly based on observations from onshore and coastal wind farms, which have significantly different designs to offshore developments (such as a far smaller air gap) and differences in bird flight behaviour between the onshore and offshore environment, resulting in differences in susceptibility to collision. The study concluded that for gannet and kittiwake a generic 'all gull rate' is recommended, and for lesser black-backed gull, herring gull and great black-backed gull, a generic 'large gull rate' is recommended for use as the avoidance rate. These recommendations are despite the provision of species-specific avoidance rates within the study. Not using species specific avoidance rates, but rather, generic rates, adds precaution to the assessment as it does not account for inter-specific variation in the avoidance behaviour between species.

339. Therefore, it is considered that the CRM input parameters used in the assessment of collision risk to seabirds for the Project and those from other developments, especially cumulatively, incorporate a high degree of precaution for all species assessed. Examples of the level of sensitivity of CRM to changes in even a single variable have been provided for recent OWF developments (GoBe, 2025; APEM, 2024; APEM 2022e), resulting in significant reductions in predicted impact.

13.7.2.4.2 Kittiwake

13.7.2.4.2.1. Receptor Sensitivity

340. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to collision risk of **medium**.

13.7.2.4.2.2. Impact Magnitude

341. The estimated mortalities by bio-season are presented in **Table 13-46**. On an annual basis, the estimated mortality rate for collision risk from the Project is approximately 136 (135.90) individuals when considering the worst-case design scenario, which is further broken down into relevant bio-seasons below (**Table 13-46**).

Table 13-46 Kittiwake Bio-Season Collision Estimates and Increase in Baseline Mortality

Bio-season (months)	Mean collisions (individuals per annum)	Regional baseline populations and baseline mortality rates		Increase in baseline mortality (%)
		Population (individuals)	Baseline mortality (individuals per annum)	
Breeding (March – August)	67.88	839,456	132,382	0.051
Post-breeding migration (September – December)	36.80	829,938	130,881	0.028
Return migration (January – February)	31.22	627,814	99,006	0.032
Annual (BDMPS)	135.90	839,456	132,382	0.103
Annual (Biogeographic)	135.90	5,100,000	804,270	0.017

342. During the return migration bio-season, 31 (31.22) kittiwake may be subject to mortality. The BDMPS population for the return migration bio-season is 627,814 kittiwakes (**Table 13-24**). When the average baseline mortality rate of 0.1577 (**Table 13-25**) is applied, the natural predicted mortality in the return migration bio-season is 99,006 individuals per annum. The addition of 31 predicted mortalities would increase baseline mortality by 0.032% (**Table 13-46**).

343. This magnitude of impact is therefore considered to be **negligible** during the return migration bio-season, as it represents no material change to baseline conditions as a result of collision.

344. During the breeding bio-season, 68 (67.88) kittiwake may be subject to mortality. The BDMPS population for the breeding bio-season is 839,456 kittiwakes (**Table 13-24**), which includes breeding adults and immature birds. When the average baseline mortality rate of 0.1577 (**Table 13-25**) is applied, the natural predicted mortality in the breeding bio-season is 132,382 individuals per annum. The addition of 68 predicted mortalities would increase baseline mortality by 0.051% (**Table 13-46**).

345. This magnitude of impact is therefore considered to be **negligible** during the breeding bio-season, as it represents no material change to baseline conditions as a result of predicted collision.

346. During the post-breeding migration bio-season, 37 (36.80) kittiwake may be subject to mortality. The BDMPS population for the post-breeding migration bio-season is 829,938 kittiwakes (**Table 13-24**). When the average baseline mortality rate of 0.1577 (**Table 13-25**) is applied, the natural predicted mortality in the post-breeding migration bio-season is 130,881 individuals per annum. The addition of 37 predicted mortalities would increase baseline mortality by 0.028% (**Table 13-46**).

347. This magnitude of impact is therefore considered to be **negligible** during the post-breeding migration bio-season, as it represents no material change to baseline conditions as a result of predicted collision.

348. For all bio-seasons combined, the estimated number of kittiwakes subject to mortality due to collision is approximately 136 (135.90) individuals per annum. Using the largest UK North Sea and Channel BDMPS population of 839,456 individuals (**Table 13-24**), the addition of 136 predicted mortalities would increase baseline mortality by 0.103% (**Table 13-46**).

349. This magnitude of impact is therefore considered to be **low** at both the UK North Sea and Channel BDMPS and the biogeographic scale, as it represents only a minor difference to baseline conditions as a result of predicted collision.

13.7.2.4.2.3. Effect Significance

350. Overall, it is considered that the species sensitivity is **medium** following the matrix approach (**Table 13-15**) and the magnitude of impact is **low**. Therefore, the potential significance of effect from collision risk on kittiwake has been determined to be **minor adverse** following the matrix approach (**Table 13-15**), which is **not significant** in EIA terms.

13.7.2.4.3 Great Black-Backed Gull

13.7.2.4.3.1. Receptor Sensitivity

351. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to collision risk of **medium**.

13.7.2.4.3.2. Impact Magnitude

352. The estimated mortalities by bio-season are presented in **Table 13-47**, which vary from a minimum of zero to a maximum of 0.4 individuals. On an annual basis, the estimated mortality rate for collision risk from the Project is less than a single (0.4) individual, which is further broken down into relevant bio-seasons (**Table 13-47**).

Table 13-47 Great Black-Backed Gull Bio-Season Collision Estimates and Increase in Baseline Mortality

Bio-season (months)	Mean collisions (individuals per annum)	Regional baseline populations and baseline mortality rates		Increase in baseline mortality (%)
		Population (individuals)	Baseline mortality (individuals per annum)	
Breeding (April – August)	0.00	25,917	2,511	0.000
Non-breeding (September – March)	0.40	91,398	8,856	0.005
Annual (BDMPS)	0.40	91,398	8,856	0.005
Annual (Biogeographic)	0.40	235,000	22,772	0.002

353. During the breeding bio-season, no great black-backed gulls were recorded in the Array Area during DAS. Therefore, no potential for effect concluded during the breeding bio-season.

354. During the non-breeding bio-season and annually, less than a single (0.40) great black-backed gull may be subject to mortality. The BDMPS population for the non-breeding bio-season is 91,398 great black-backed gulls (**Table 13-24**). When the average baseline mortality rate of 0.0969 (**Table 13-25**) is applied, the natural predicted mortality in the non-breeding bio-season is 8,856 individuals per annum. The addition of less than a single predicted mortality would increase baseline mortality by 0.005% (**Table 13-47**).

355. This magnitude of impact is therefore considered to be **negligible** during the non-breeding bio-season and annually, as it represents no material change to baseline conditions due to the addition of less than one individual subject to potential mortality as a result of collision.

13.7.2.4.3.3. Effect Significance

356. Overall, the species sensitivity is **medium** following the matrix approach (**Table 13-15**) and the magnitude of impact is **negligible**. Therefore, the potential significance of effect from collision risk on great black-backed gull has been determined to be **minor adverse** following the matrix approach (**Table 13-15**), which is **not significant** in EIA terms. Although following the matrix approach the effect significance is classified as minor, when taking into account expert judgement and the non-materiality of such a minimal predicted impact, a more appropriate significance conclusion of **negligible** is concluded overall.

13.7.2.4.4 Herring gull

13.7.2.4.4.1. Receptor Sensitivity

357. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to collision risk of **medium**.

13.7.2.4.4.2. Impact Magnitude

358. The estimated mortalities by bio-season are presented in **Table 13-48**. On an annual basis, the estimated mortality for collision risk from the Project is a single (1.15) individual, which is further broken down into relevant bio-seasons (**Table 13-48**).

Table 13-48 Herring Gull Bio-Season Collision Estimates and Increase in Baseline Mortality

Bio-season (months)	Mean collisions	Regional baseline populations and baseline mortality rates		Increase in baseline mortality (%)
		Population (individuals)	Baseline mortality (individuals per annum)	
Breeding (April – August)	0.00	324,887	56,011	0.000
Non-breeding (September – March)	1.15	466,510	80,426	0.001
Annual (BDMPS)	1.15	466,510	80,426	0.001
Annual (Biogeographic)	1.15	1,098,000	189,295	0.001

359. During the breeding bio-season, no herring gulls were recorded in the Array Area during DAS. Therefore, no potential for effect concluded during the breeding bio-season.

360. During the non-breeding bio-season and annually, a single (1.15) herring gull may be subject to mortality. The BDMPS population for the non-breeding bio-season is 466,510 herring gulls (**Table 13-24**). When the average baseline mortality rate of 0.1724 (**Table 13-25**) is applied, the natural predicted mortality in the return migration bio-season is 80,426 individuals per annum. The addition of a single predicted mortality would increase baseline mortality by 0.001% (**Table 13-48**).

361. This magnitude of impact is therefore considered to be **negligible** during the non-breeding bio-season and annually, as it represents no material change to baseline conditions due to the addition of less than one individual subject to potential mortality as a result of collision.

13.7.2.4.4.3. Effect Significance

362. Overall, the species sensitivity is **medium** following the matrix approach (**Table 13-15**) and the magnitude of impact is **negligible**. Therefore, the potential significance of effect from collision risk on herring gull has been determined to be **minor adverse** following the matrix approach (**Table 13-15**), which is **not significant** in EIA terms. Although following the matrix approach the effect significance is classified as minor, when taking into account expert judgement and the non-materiality of such a minimal predicted impact, a more appropriate significance conclusion of **negligible** is concluded overall.

13.7.2.4.5 Lesser Black-Backed Gull

13.7.2.4.5.1. Receptor Sensitivity

363. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to collision risk of **medium**.

13.7.2.4.5.2. Impact Magnitude

364. The monthly estimated mortality rates are presented in **Table 13-49**. On an annual basis, the estimated mortality for collision risk from the Project is less than a single (0.86) individual, which is further broken down into relevant bio-seasons **Table 13-49**.

Table 13-49 Lesser Black-Backed Gull Bio-Season Collision Estimates and Increase in Baseline Mortality

Bio-season (months)	Mean collisions	Regional baseline populations and baseline mortality rates		Increase in baseline mortality (%)
		Population (individuals)	Baseline mortality (individuals per annum)	
Breeding (April – August)	0.86	51,233	6,338	0.014
Post-breeding migration (September – October)	0.00	209,006	25,854	0.000
Migration-free winter (November – February)	0.00	39,313	4,863	0.000
Return migration (March)	0.00	197,482	24,429	0.000
Annual (BDMPS)	0.86	209,006	25,854	0.003
Annual (Biogeographic)	0.86	864,000	106,877	0.001

365. For all non-breeding bio-seasons (return migration, post-breeding migration and migration-free winter bio-season), no lesser black-backed gulls were recorded in the Array Area during DAS. Therefore, no potential for effect concluded for all non-breeding bio-seasons.

366. During the breeding bio-season and annually, less than a single (0.86) lesser black-backed gull may be subject to mortality. The BDMPS population for the breeding bio-season is 51,233 lesser black-backed gulls (**Table 13-24**). When the average baseline mortality rate of 0.1237 (**Table 13-25**) is applied, the natural predicted mortality in the breeding bio-season is 6,338 individuals per annum. The addition of a single predicted mortality would increase baseline mortality by 0.014% (**Table 13-49**).

367. This magnitude of impact is therefore considered to be **negligible** during the breeding bio-season and annually, as it represents no material change to baseline conditions due to the addition of less than one individual subject to potential mortality as a result of collision.

13.7.2.4.5.3. Effect Significance

368. Overall, the species sensitivity is **medium** following the matrix approach (**Table 13-15**) and the magnitude of impact is **negligible**. Therefore, the potential significance of effect from collision risk on lesser black-backed gull has been determined to be **minor adverse** following the matrix approach (**Table 13-15**), which is **not significant** in EIA terms. Although following the matrix approach the effect significance is classified as minor, when taking into account expert judgement and the non-materiality of such a minimal predicted impact, a more appropriate significance conclusion of **negligible** is concluded overall.

13.7.2.4.6 Gannet

13.7.2.4.6.1. Receptor Sensitivity

369. As detailed in **Section 13.6.4**, this receptor is classified as having an overall sensitivity to collision risk of **medium**.

13.7.2.4.6.2. Impact Magnitude

370. The estimated mortalities by bio-season are presented in **Table 13-50**. On an annual basis, the estimated mortality for collision risk from the Project is approximately six (5.95) individuals, which is further broken down into relevant bio-seasons (**Table 13-50**).

Table 13-50 Gannet Bio-Season Collision Estimates and Increase in Baseline Mortality

Bio-season (months)	Mean collisions	Regional baseline populations and baseline mortality rates		Increase in baseline mortality (%)
		Population (individuals)	Baseline mortality (individuals per annum)	
Breeding (March – September)	1.96	400,326	74,701	0.003
Post-breeding migration (October – November)	3.46	456,299	85,145	0.004
Return migration (December – February)	0.53	248,385	46,349	0.001
Annual (BDMPS)	5.95	456,299	85,145	0.007
Annual (Biogeographic)	5.95	1,180,000	220,188	0.003

Table note: Collision estimates are inclusive of macro-avoidance as outlined within **Volume 2, Appendix 13.3 Offshore Collision Risk Modelling Report**.

371. During the return migration bio-season, less than a single (0.5) gannet may be subject to mortality. The BDMPS population for the return migration bio-season is 248,385 gannets (**Table 13-24**). When the average baseline mortality rate of 0.1866 (**Table 13-25**) is applied, the natural predicted mortality in the return migration bio-season is 46,349 individuals per annum. The addition of a single predicted mortality would increase baseline mortality by 0.001% (**Table 13-50**).

372. This magnitude of impact is therefore considered to be **negligible** during the return migration bio-season, as it represents no material change to baseline conditions due to the addition of less than one individual subject to potential mortality as a result of collision.

373. During the breeding bio-season, approximately two (1.96) gannets may be subject to mortality. The BDMPS population for the breeding bio-season is 400,326 gannets (**Table 13-24**), which includes breeding adults and immature birds. When the average baseline mortality rate of 0.1866 (**Table 13-25**) is applied, the natural predicted mortality in the breeding bio-season is 74,701 individuals per annum. The addition of two predicted mortalities would increase baseline mortality by 0.003% (**Table 13-50**).

374. This magnitude of impact is therefore considered to be **negligible** during the breeding bio-season, as it represents no material change to baseline conditions due to the small number of individuals subject to potential mortality as a result of collision.

375. During the post-breeding migration bio-season, approximately three (3.46) gannets may be subject to mortality. The BDMPS population for the post-breeding migration bio-season is 456,299 gannets (**Table 13-24**). When the average baseline mortality rate of 0.1866 (**Table 13-25**) is applied, the natural predicted mortality in the post-breeding migration bio-season is 85,145 individuals per annum. The addition of three predicted mortalities would increase baseline mortality by 0.004% (**Table 13-50**).

376. This magnitude of impact is therefore considered to be **negligible** during the post-breeding migration bio-season, as it represents no material change to baseline conditions due to the small number of individuals subject to potential mortality as a result of collision.

377. For all bio-seasons combined, the estimated number of gannets subject to mortality due to collision is approximately six (5.95) individuals per annum. Using the largest UK North Sea and Channel BDMPS population of 456,299 individuals (**Table 13-24**) as a proxy for the total BDMPS population across the year, the addition of six predicted mortalities would increase baseline mortality by 0.007% (**Table 13-50**).

378. This magnitude of impact annually is therefore considered to be **negligible**, as it represents no material change to baseline conditions as a result of collision.

13.7.2.4.6.3. Effect Significance

379. Overall, the species sensitivity is **medium** following the matrix approach (**Table 13-15**) and the magnitude of impact is **negligible**. Therefore, the potential significance of effect from collision risk on gannets has been determined to be **minor adverse** following the matrix approach (**Table 13-15**), which is **not significant** in EIA terms.

13.7.2.4.7 Migratory Collision Risk

380. There is potential that seabirds, waders, passerines, raptors and wildfowl may intersect the Array Area whilst undertaking annual migratory movements from breeding and wintering grounds. A strategic assessment for 27 different seabird and 38 non-seabird migratory species was undertaken in relation to migratory collision risk by WWT and MacArthur Green Ltd (2014).

381. For seabird species such as terns and skua species, it was considered that based on expert opinion and known migratory behaviour, UK seabirds tend to migrate within coastal bands out to a maximum of 60km from the coast. The tendency for migratory UK seabirds to travel up to a maximum of 60km from the coast correlates with the Project site-specific survey results, as a very limited number of migratory seabirds were recorded within the Array Area during migratory months. The Array Areas shortest distance to shore is 213km offshore, this therefore suggests no intersection of potential migratory corridors utilised by UK migrants.

382. For wildfowl and wader species, WWT and MacArthur Green (2014) indicate that collision estimates are very small. Waterfowl and wader species migratory flights are at a high altitude and so collisions with turbines are highly unlikely. Only during unfavourable weather occurs will these species lower their flight altitude and follow coastal pointers to navigate (van de Kam *et al.*, 2004). This conclusion is corroborated by the modelling undertaken by Southern North Sea projects such as Outer Dowsing OWF (GoBe, 2024a). Outer Dowsing is located 54km off the Lincolnshire coast and is a proposed development of up to 100 turbines. The results of Outer Dowsing CRM predicted an annual collision mortality value for the majority of species assessed of well under a single individual, with the maximum annual predicted mortality seen for mallard at 20 (19.5) individuals. For all species the overall magnitude of effect was concluded as negligible and certainly would not lead to a significant adverse effect.

13.7.2.4.7.1. Impact Magnitude

383. In relation to the above evidence, the magnitude of impact is therefore considered to be **negligible**.

13.7.2.4.7.2. Effect significance

384. Given the magnitude of the impact has been determined to be **negligible**, the significance of the effect would be **minor** at most regardless of the sensitivity of the receptor. An effect of minor significance is **not significant** in EIA terms.

13.7.2.5 Combined Operational Displacement and Collision Risk

385. Following the outcome of the screening process (**Table 13-26**), the receptors undergoing assessment for both direct disturbance and displacement due to the presence of wind turbines and other offshore infrastructure in the Array Area and collision risk due to the presence of wind turbines include Gannet.

13.7.2.5.1 Gannet

386. Due to gannet being scoped in for both displacement and collision risk assessment during the O&M phase, there is a potential for these two potential impacts to adversely affect gannet populations cumulatively. Previous sections have concluded negligible predicted magnitudes of impact with respect to collision risk or displacement acting alone. However, the combined impact of both collision risk and displacement may be greater than either one acting alone. Further consideration of both impacts acting together is therefore required.

13.7.2.5.1.1. Receptor Sensitivity

387. As detailed in previous assessments for both displacement and collision risk combined for gannet, the overall sensitivity of the receptor is considered to be **medium**.

13.7.2.5.1.2. Impact Magnitude

388. As detailed in **Table 13-44** and **Table 13-50**, following the Applicant's approach to displacement impact assessment, the combined predicted mortality in the O&M phase (displacement and collision risk) equates to between 13 (12.64) and 15 (14.87) predicted additional mortalities per annum. Using the largest BDMPS population of 456,299 (**Table 13-24**), as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.1866 (**Table 13-25**), the natural predicted mortality is 85,145 individuals per annum. The addition of 13 to 15 predicted mortalities would increase baseline mortality by 0.015% to 0.017% of the annual BDMPS population.

389. This magnitude of impact annually is therefore considered to be **negligible**, as it represents no material change to baseline conditions as a result of displacement and collision impacts combined.

390. When considering the SNCB upper displacement range (60% to 80% displacement and 10% mortality rate), as detailed in **Table 13-44** and **Table 13-50**, the combined predicted mortality in the O&M phase (displacement and collision risk) equates to between 73 (72.9) and 95 (95.2) predicted additional mortalities per annum. Using the largest BDMPS population of 456,299 (**Table 13-24**), as a proxy for the annual BDMPS population, the addition of 73 to 95 predicted mortalities would increase baseline mortality by 0.086% to 0.112%.

391. This magnitude of the SNCB upper range impact annually is therefore considered to be **low**, as it represents only a minor change to baseline conditions due to displacement and collision impacts combined.

13.7.2.5.1.3. Effect Significance

392. Overall, the species sensitivity is **medium** following the matrix approach (**Table 13-12**) and the Applicant's approach to displacement the magnitude of impact is **negligible,** whilst the SNCB's approach varies from **negligible** to **low**. Therefore, the potential significance of effect from displacement combined with collision risk on gannets has been determined to be **minor adverse** following the matrix approach (**Table 13-15**), which **is not significant** in EIA terms.

13.7.2.6 Barrier Effects due to Presence of Wind Turbines and Other Offshore infrastructure (ORN-O-03)

393. In the operational phase, the presence of wind turbines could create a barrier to the movements of birds. This may result in permanent changes in flight routes for the birds concerned and an increase in energy demands associated with those movements. This might result in a lower rate of breeding success or in reduced survival chances for the individuals affected. This could affect both migrating birds and resident birds foraging in the region.

13.7.2.6.1 Receptor Sensitivity

13.7.2.6.1.1. Migratory Birds

394. Due to the difficulty in separating potential impacts that may arise from displacement and impacts from barrier effects, there is no specific sensitivity assessment for the latter, but rather for displacement and barrier effects as a whole (SNCBs, 2022). Therefore, displacement sensitivity scores have been used as a proxy for the barrier effect sensitivity scores. These scores, along with the interaction frequency and the conservation value provide the final sensitivity for each species. For migratory birds, the overall sensitivity of the receptors ranges from **low** to **high**.

13.7.2.6.1.2. Breeding Seabirds

395. As outlined in the aforementioned migratory birds sensitivity section, displacement sensitivity scores (used as a proxy for barrier effects), conservation status and interaction frequency have been used for attain an overall sensitivity score for breeding seabirds to barrier effects. For fulmar and kittiwake the overall sensitivity of these receptors is **low**. For gannet the overall sensitivity of these receptors is **medium**.

13.7.2.6.2 Impact Magnitude

13.7.2.6.2.1. Migratory Birds

396. The location, shape and size of the Project means the risk of a barrier effect to migrating birds is low. Most migratory UK seabirds tend to follow the coast (Forrester *et al*., 2007; WWT, 2014) limiting the potential for a barrier effect to occur since the Array Area is located 210km offshore from the north-east coast of England at it's closest point.

397. The worst-case scenario would be for a bird to reach the edge of the site and follow the perimeter around until resuming its original flight path, which would require a maximum deviation of approximately 49.51km to 36.00km going anticlockwise or clockwise, respectively. Such an increase when considering the overall distances covered from breeding colony to wintering grounds the addition of up to 50km extra distance on a biannual flight is likely to be minimal when account for migratory flight behaviour and insignificant compared to unsuitable wind conditions (Masden *et al*., 2010). Furthermore, migratory birds that do avoid the OWFS are able to alter their flight path to a lesser degree, for example adjusting their course earlier on and then correcting to reach the desired endpoint, rather than following the perimeter exactly. For migrating birds, this is considered to be a negligible distance as the increase in energy demand is minor and will be insignificant compared to unsuitable wind conditions (Masden *et al*., 2010).

398. Most migratory non-seabirds fly at heights well above the maximum turbine blade height (Alerstam, 1990) and therefore are likely to fly over the OWF, rather than be subject to a potential barrier effect.

399. The magnitude of impact from barrier effect is therefore considered to be **negligible** to all migrating birds.

13.7.2.6.2.2. Breeding Seabirds

400. Risk of a barrier effect can be more significant for resident seabirds on daily trips during the breeding bio-season, commuting between breeding colonies and feeding locations. The additional exertion required to avoid the Project on a daily basis can accumulate into a more significant overall impact than a one-off impact as per migratory birds (Masden *et al*., 2010).

401. Ecological theory suggests that central place foraging seabirds take the shortest (energetically most efficient) route to and from known areas that provide good foraging resources. These routes would, if the location of food resources is known, result in straight-out-and-back flights from the breeding cliffs to known foraging areas. For the Project to create a barrier to such flights then it would need to be sited across such flight lines and the bird species concerned would have to be known, or suspected, not to enter an operational OWF (i.e. exhibit a high degree of avoidance). Given the location of the Project and its distance offshore only those seabirds with the largest known foraging ranges would potentially encounter the Array Area once operational.

402. For the purpose of assessing a potential barrier effect fulmar, gannet and kittiwake were identified as having the potential to forage out to a distance as far as, or further than the Array Area based on the species generic foraging ranges (Woodward *et al.*, 2019). **Table 13-51** details the SPAs considered for the species of interest.

Table 13-51 Breeding Seabirds Considered for Potential Barrier Effect Assessment, the Qualifying Features and Distance to the Array Area (distances from Array Area are discussed further in the following species-specific sections)

SPA	Species	Distance from Array Area (nearest point)
Flamborough and Filey Coast SPA	Fulmar	210.6km
	Gannet	
	Kittiwake	
Forth Islands SPA	Gannet	353.5km
Coquet Island SPA	Kittiwake	271.0km
Farne Islands SPA	Kittiwake	278.9km

403. The potential for the Project's operational wind turbines to create a barrier to the movement of seabirds can be informed by knowledge of the existing routes that seabirds take between breeding sites and offshore foraging areas. Data of seabird foraging routes from SPA colonies in the form of tracking data (Seabird Tracking Database, 2023) were examined where available, against the location of the Array Area to identify potential connectivity between the sites.

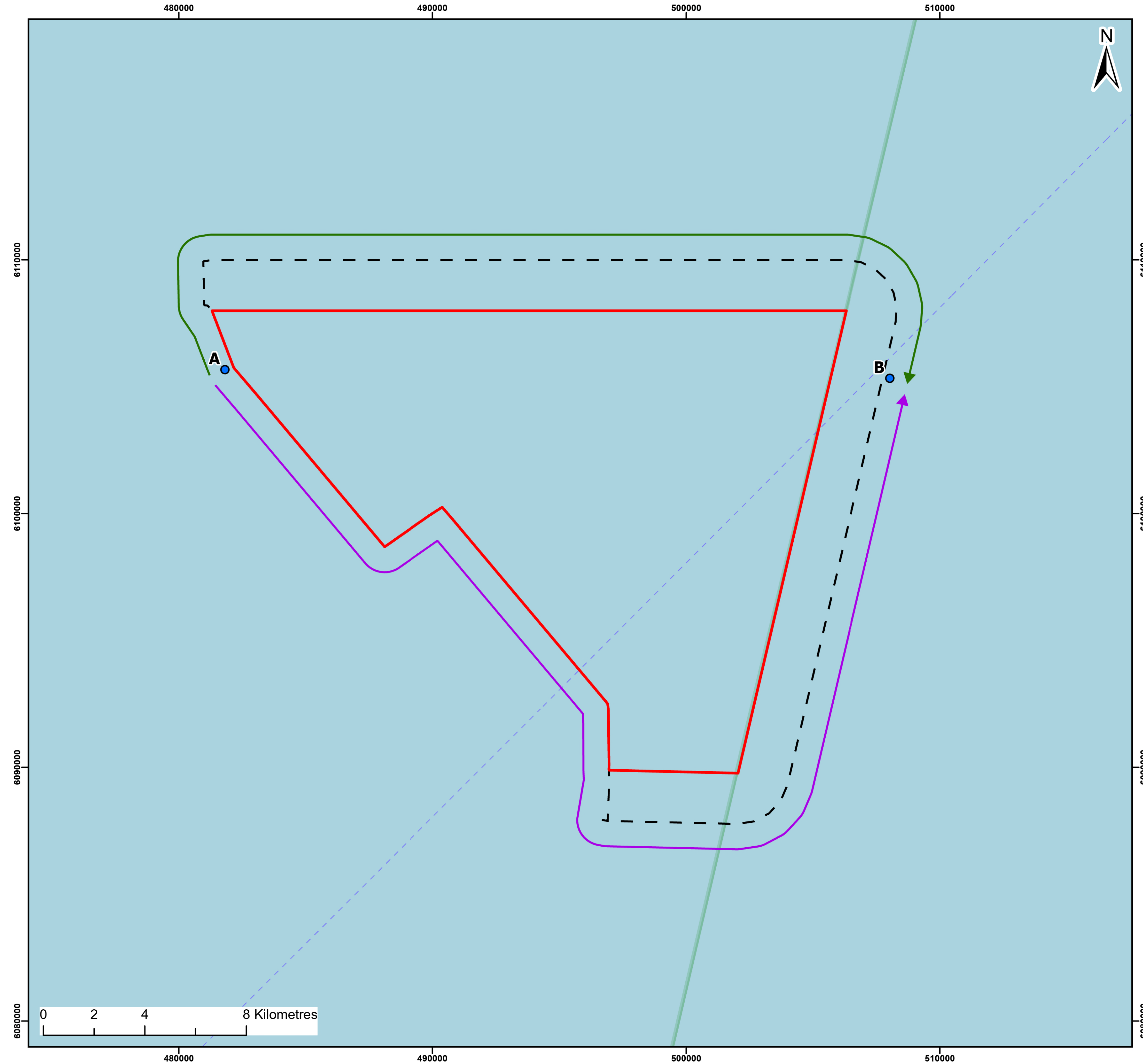
404. In addition, the energetic costs associated with a potential barrier effect are considered in order to inform the magnitude of impact. The width of the Array Area at the widest point (west to east) is 23.62km as depicted by the 'point A' to 'point B' on **Figure 13-3**. When a 2km buffer is attached to the Array Area the redirected route would equal 49.51km anticlockwise or 36.00km clockwise around the Array Area plus 2km buffer (**Figure 13-3**). These redirected routes would have a difference from the original direct distance through the Array Area (23.62km) of 25.89km and 12.38km, depending on the direction of travel. These differences in journey length can be compared against various foraging ranges for the species (Woodward *et al.*, 2019) to calculate percentage change and form a narrative on energetic costs associated with a longer journey.

405. Using existing foraging track data and the consideration of energetic costs from a potential barrier effect, a qualitative evaluation has been made of the likelihood that the Project would create a significant barrier to known movements for each species.

13.7.2.6.2.2.1. Fulmar

406. Fulmars are considered to have a very low sensitivity to displacement as well as exhibiting weak avoidance behaviour to OWF (Bradbury *et al.*, 2014; Dierschke *et al.*, 2016; Furness *et al.*, 2013), however, limited evidence of fulmar presence within OWF areas may suggest that fulmars do exhibit avoidance behaviour (Dierschke *et al.*, 2016). The reduced presence of fulmars within OWF sites could also relate to a lack of fishing activity within the area, as species is known to utilise fishery discards. This was considered within work conducted at the BARD OWF, located within German waters, where avoidance of the OWF by fulmars was observed (Neumann *et al.*, 2013; Braasch *et al.*, 2015). A review of post-construction monitoring of OWF in the North and Baltic Seas by Lamb *et al* (2024) found that the magnitude for displacement was large for fulmars relative to other species when such an impact was detected, however there was a low chance of detecting significant effects relative to other species as few studies reporting fulmar presence, and those which did often reported low densities of the species.

407. The Array Area is located 210.6km away from the Flamborough and Filey Coast SPA. Therefore, when considering the various foraging ranges provided by Woodward *et al* (2019), the amount of connectivity between the Flamborough and Filey Coast SPA and the Project notably changes. The largest foraging ranges Max Max (2,736km), Mean Max plus one SD (1,200km) and Mean Max Foraging Range (542km) indicate significant connectivity to the Flamborough and Filey Coast SPA. If the Mean plus one SD (224.7km) foraging range is considered, then there would only be partial connectivity to the Flamborough and Filey Coast SPA. Using the Mean (134.6km) foraging range would mean there is no connectivity to the Project and the Flamborough and Filey Coast SPA (**Table 13-52**).



Legend:

- Dogger Bank D Array Area
- Asymmetric Dogger Bank D Plus 2 km Buffer
- Barrier Effect Points
- Clockwise Flight Route
- Anti-clockwise Flight Route

Project: Dogger Bank D Offshore Wind Farm

DOGGER BANK WIND FARM

Title: Barrier effect around Array Area plus 2km buffer

Figure:	13-3	Drawing No:	PC6250-RHD-XX-ON-DR-GS-0569		
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
01	27/03/2025	AB	PT	A3	1:150,000

Co-ordinate system: WGS 1984 UTM Zone 31N

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Table 13-52 Increase in Journey Length when Compared Against Various Foraging Ranges for Fulmar

Foraging Range	Clockwise route		Anti-clockwise route	
	Woodward *et al* (2019) plus additional distance (12.38km)	Percentage increase in journey length (%)	Woodward *et al* (2019) plus additional distance (25.89km)	Percentage increase in journey length (%)
Max Max (2,736km)	2,748.4	0.5	2,761.9	0.9
Mean Max (542km)	554.4	2.3	567.9	4.8
Mean Max plus 1 SD (1,200km)	1,212.4	1.0	1,225.9	2.2

408. Depending on the journey taken around the Array Area, the change in journey length using the SNCBs recommended Mean Max Foraging Range plus one SD varies from 1.0% to 2.2% for the clockwise or the anticlockwise route, respectively. When considering the large foraging range of 1,200km (Mean Max Foraging Range plus one SD) the addition of 12.38km to 25.89km is minimal in terms of the change in journey length that would be required from a foraging fulmar. Such increases in journey length may not be routine as birds can alter their flight trajectories up to 1km to 2km prior to reaching an OWF and thus reducing the energy expenditure required if making a complete circumnavigation of a site (Vanermen *et al.*, 2013). Additionally, fulmar breeding foraging behaviour involves few and long foraging trips (as noted by their foraging range values; Woodward *et al.*, 2019). The species is adapted to using efficient gliding flights, so any additional flight distance requirement is likely to result in minimal energy expenditure (Masden *et al.*, 2010).

409. Although no tracking data for fulmar is available for the Flamborough and Filey Coast SPA there is potential connectivity between the Project and fulmar feature of the SPA due to the species foraging ranges (Woodward *et al.*, 2019). However, if a barrier effect would occur for fulmar the increase in travel distance around the Project is minor and given the species flight and foraging behaviour is unlikely to have a material increase in energy expenditure.

410. The magnitude of impact is therefore considered to be **negligible** from barrier effect.

13.7.2.6.2.2.2. Gannet

411. Gannets are known to avoid entering operational OWF (e.g. Krijgsveld *et al.*, 2011; Royal HaskoningDHV, 2013; APEM, 2014), indicating the potential for a barrier effect to the species.

412. If the various foraging ranges provided by Woodward *et al* (2019) are considered, the amount of connectivity between the listed SPAs and the Project changes significantly. The Max Max foraging range (709km) and the Mean Max Foraging Range plus one SD (509.4km) indicates connectivity to both SPAs screened in for gannet. The Mean Max Foraging Range (315.2km) allows for connectivity to only Flamborough and Filey Coast SPA. If the Mean plus one SD (170.4km) and the Mean (120km) foraging ranges are considered, there is no connectivity between the Project and both SPAs (**Table 13-53**).

Table 13-53 Increase in Journey Length when Compared Against Various Foraging Ranges for Gannet

Foraging Range	Clockwise route		Anti-clockwise route	
	Woodward *et al* (2019) plus additional distance (12.38km)	Percentage increase in journey length (%)	Woodward *et al* (2019) plus additional distance (25.89km)	Percentage increase in journey length (%)
Max Max (709.0km)	721.4	1.7	734.9	3.7
Mean Max (315.2km)	327.6	3.9	341.1	8.2
Mean Max plus 1 SD (509.4km)	521.8	2.4	535.3	5.1

413. Depending on the journey taken around the Array Area, the change in journey length using the SNCBs recommended Mean Max Foraging Range plus one SD varies from 2.4% to 5.1% for the clockwise or the anticlockwise route, respectively. When considering the large foraging range of 509.4km (Mean Max Foraging Range plus one SD) the addition of 12.38km to 25.89km is minimal in terms of the change in journey length that would be required from a foraging gannet. Such increases in journey length may not be routine as birds can alter their flight trajectories up to 1km to 2km prior to reaching an OWF and thus reducing the energy expenditure required if making a complete circumnavigation of a site (Vanermen *et al.*, 2013).

414. Tracking data for gannet has been collected at both SPAs. Of the eleven datasets of breeding adult gannets from Forth Islands SPA (Seabird Tracking Database, 2023) available, two show foraging tracks with potential overlap with the Project (pre-incubation foraging tracks 2017 – 2019 and in 2015). All other datasets highlight limited connectivity to the Project, with the majority of tracks remaining closer to the colony. One of the two datasets available from the Flamborough and Filey Coast SPA show potential connectivity, with several foraging tracks having potential overlap with the Project. The other tracking dataset from Flamborough and Filey Coast SPA suggests limited connectivity with gannet foraging trips remaining closer to the colony. Similarly foraging route tracks from Forth Islands and Flamborough and Filey Coast SPAs provided in Wakefield *et al* (2013) support the above and suggest connectivity with these colonies and the Project is limited.

415. On consideration of all of the information above, it is likely connectivity between the Project and gannet features of the Forth Islands and Flamborough and Filey Coast SPAs is limited given the Project's distant location offshore. In addition, for those datasets which show potential connectivity there are very few commuting flights which go beyond the eastern extent of the Array Area suggesting a barrier effect is unlikely. Although if a barrier effect would occur for gannet the increase in travel distance of a maximum 25.9km is likely minor given the species foraging range size and is therefore unlikely to have a material increase in energy expenditure.

416. It is important to note that as per SNCB guidance on displacement (SNCB, 2022) it is currently not possible to distinguish between displacement and barrier effects and therefore the approach to displacement assessments presented within **Section 13.7.2.1** account for both potential effects combined.

417. The magnitude of impact is therefore considered to be equal to or less than the magnitude concluded within **Section 13.7.2.1** of **negligible** due to potential barrier effect.

13.7.2.6.2.2.3. Kittiwake

418. The current UK SNCBs guidance on the requirements for displacement assessment (SNCBs, 2022), does not consider kittiwake to be a priority species as it falls below the SNCBs recommended threshold for assessment relating to both 'disturbance susceptibility' and 'habitat specialisation'. Dierschke *et al* (2016) completed a comprehensive review on avoidance and attraction to offshore wind farms based on behavioural responses of kittiwakes from 11 OWF. Mean scores were variable, with one account of strong attraction (increase of >80%), one account of weak attraction (increase of >50%), five accounts of no wind farm effect, one account of weak avoidance, one account of strong avoidance (decrease>80%) and two accounts of macro avoidance behaviour. The two accounts of macro avoidance at Horns Rev 1 and 2 were based on only 11 tracks (Skov *et al*., 2018), and in previous studies on distributional responses at the two sites no significant effects where reported and kittiwake were observed roosting on the jacket foundations (Skov *et al*., 2018; Peterson *et al*., 2012). The account of strong avoidance was from studies at Thornton Bank which suggested a displacement rate of 70%, however at the neighbouring Bligh Bank site displacement was not observed for kittiwake (Vanermen *et al*., 2019). Therefore, the high distributional response reported by one statistical model may not be genuine nor can it be attributed with high confidence to the presence of the wind farm. The concluding remark from the authors was, 'due to inconsistency between the significance levels of the MMI and full model OWF coefficients, the results for black-legged kittiwake should yet be regarded as inconclusive' (Vanermen *et al*., 2019). The Dierschke review concluded a mean score of 2.7 for kittiwake, classifying them as a species which are hardly affected by offshore wind farms or with attraction and avoidance approximately equal over all studies.

419. Further studies on displacement effects to kittiwake since the Dierschke *et al* (2016) review (APEM, 2017; Percival & Ford, 2017; Peschko *et al*., 2020; Trinder *et al*., 2024; and Lamb *et al*., 2024), overall concluded that there is a lack of strong empirical evidence to suggest kittiwake is significantly susceptible to displacement from OWF.

420. If the various foraging ranges provided by Woodward *et al* (2019) are considered, the amount of connectivity between the listed SPAs and the Project changes significantly. The Max Max foraging range (770km) indicates connectivity to all SPA sites screened in for kittiwake. The Mean Max Foraging Range plus one SD (300.6km) indicates connectivity to the Flamborough and Filey Coast SPA and only partial connectivity to Farne Islands and Coquet Island SPAs. If the Mean Max Foraging Range (156.1km), Mean plus one SD (105.1km) and the Mean (54.7km) foraging ranges are considered, there is no connectivity between the Project and all SPAs.

421. Depending on the journey taken around the Array Area, the change in journey length using the SNCBs recommended Mean Max Foraging Range plus one SD varies from 4.1% to 8.6% for the clockwise or the anticlockwise route, respectively (**Table 13-54**). Such increases in journey length may not be routine as birds can alter their flight trajectories up to 1km - 2km prior to reaching an OWF and thus reducing the overall energy expenditure required if making a complete circumnavigation of a site (Vanermen *et al.*, 2013).

Table 13-54 Increase in Journey Length when Compared Against Various Foraging Ranges for Kittiwake

Foraging Range	**Clockwise route**		**Anti-clockwise route**	
	Woodward *et al* (2019) plus additional distance (12.38km)	**Percentage increase in journey length (%)**	**Woodward *et al* (2019) plus additional distance (25.89km)**	**Percentage increase in journey length (%)**
Max Max (770km)	782.4	1.6	795.9	3.4
Mean Max plus 1 SD (300.6km)	313.0	4.1	326.5	8.6

422. Tracking data for kittiwake has been collected at two of the listed SPAs. The single dataset from Coquet Island SPA (Seabird Tracking Database, 2023) highlights no connectivity between the SPA and the Project. Of the five datasets available from the Flamborough and Filey Coast SPA, only one dataset suggests potential overlap with the Project, though overall overlap is limited. The other tracking datasets from Flamborough and Filey Coast SPA suggests no connectivity, with kittiwakes foraging trips remaining closer to the colony.

423. Considering all of the information above, it is likely connectivity between the Project and kittiwake features of the listed SPAs is limited given the Project's distant location offshore. In addition, the tracking datasets highlights a lack of regular commuting flights beyond the eastern extent of the Array Area which suggests the potential for a barrier effect is unlikely.

424. The magnitude of impact is therefore considered to be **negligible** from barrier effect.

13.7.2.6.3 Effect Significance

13.7.2.6.3.1. Migratory Birds

425. Overall, it is predicted that the sensitivity of the different migratory bird receptors ranges between **low** and **high** and the magnitude of impact is **negligible** The effect is therefore of **minor** to **negligible adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.2.6.3.2. Breeding Seabirds

426. Overall, for kittiwake and fulmar, it is predicted that the sensitivity of the receptors is **low** and the magnitude of impact is **negligible.** The effect is therefore of **negligible adverse** significance , which is **not significant** in EIA terms (**Table 13-15**).

427. For gannet, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.2.7 Indirect Impacts via Habitat or Prey Availability (ORN-O-05): Landfall

428. During the operation phase of the Project there is the potential for indirect effects on intertidal and offshore birds (red-throated diver, common scoter, common tern, Sandwich tern, little tern, little gull, herring gull, black-headed gull, great black-backed gull, common gull, sanderling, oystercatcher) via degradation of habitats used by birds or their prey; displacement of prey species due to increased disturbance; or reduction in prey accessibility due to increased suspended sediment and physical disturbance to the seabed. Underwater noise may cause fish and mobile invertebrates to avoid the construction area and also affect their physiology and behaviour. Suspended sediments may cause fish and mobile invertebrates to avoid the construction area, may smother and hide immobile benthic prey, or may change light transmission and water clarity for visual foraging. These mechanisms may result in less habitat and/or prey being available within the construction area to offshore and intertidal ornithology receptors.

13.7.2.7.1.1. Receptor sensitivity / value

429. Supporting habitats of the Greater Wash SPA in vicinity of the landfall (intertidal sand, subtidal sand, water column) have **medium sensitivity** to extraction, abrasion or penetration of the substrate, and to changes in light transmission and water clarity from suspension of solids, smothering and siltation associated with intrusive landfall maintenance works (Natural England, 2024a).

430. Common tern, little tern, Sandwich tern and little gull have **high sensitivity** to changes in light transmission and water clarity for foraging. Red-throated diver has **medium sensitivity** to changes in light transmission and water clarity, and sensitivity is unknown for common scoter due to a lack of evidence concerning the species (Natural England, 2024a). All six species are assigned **high sensitivity** to indirect effects via habitat and prey on a precautionary basis as they are SPA qualifying features (therefore high conservation value) and are largely visual foragers of mobile prey that can be displaced.

431. Common gull, black-headed gull, herring gull, great black-backed gull, sanderling and oystercatcher are assessed by expert judgement to have medium tolerance of impacts on resting habitat, foraging habitat or prey. There could be a moderate decline in a physiological attribute of individuals through decreased rest or food intake per unit time). The species are not able to completely avoid / adapt to / accommodate the pressure. These species are also assessed by expert judgement to have medium capacity to recover from this impact. Therefore, they have **medium sensitivity** to indirect effects via habitat and prey.

13.7.2.7.1.2. Impact magnitude

432. As assessed in **Chapter 10 Benthic and Intertidal Ecology** and **Chapter 11 Fish and Shellfish Ecology**, no significant effects are considered to occur on invertebrate or fish species (which form the food supply for birds in the intertidal area) due to operation and maintenance of the Project, therefore there is **negligible** magnitude of impact.

433. Common tern, little tern, Sandwich tern and little gull have rarely been recorded foraging or alighted on habitat at the landfall during baseline surveys or in desk data, instead typically undertaking active migration when recorded (**Volume 2, Appendix 13.5 Intertidal Ornithology Baseline Characterisation Report**). Therefore, the indirect impact through habitats and prey of these species from construction is assessed to be **negligible**.

434. Maintenance works in habitats of the Greater Wash SPA supporting red-throated diver and common scoter, and in supporting intertidal habitat for gulls, sanderling and oystercatcher, will be limited to routine and ad hoc maintenance work. These activities will be localised around the narrow cable corridor relative to the total intertidal habitat. Furthermore, the widespread occurrence along the Holderness Coast of red-throated diver, common scoter and sanderling in the desk study data indicate that effects on water clarity and light transmission for foraging at the landfall, or localised changes to habitat at the landfall, would represent an extremely low proportion of the total area of available habitat for resting and foraging, and a negligible proportion of the SPA area. In summary, impact on prey is not anticipated and any impact on bird habitat would be localised, short-term, intermittent and reversible. Therefore, there is **negligible** magnitude of impact via habitats or prey.

13.7.2.7.1.3. Effect significance

435. It is predicted that sensitivity of supporting habitats of the Greater Wash SPA is **medium** and magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

436. It is predicted that sensitivity of common tern, little tern, Sandwich tern and little gull is **high**, and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

437. It is predicted that sensitivity of red-throated diver and common scoter is **high**, and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

438. It is predicted that sensitivity of common gull, black-headed gull, herring gull, great black-backed gull, sanderling and oystercatcher is **medium**, and magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

13.7.2.8 Indirect Impacts via Habitat or Prey Availability (ORN-O-05): Offshore ECC

439. During the operation phase of the Project there is potential for indirect effects arising from the displacement of prey species due to increased noise and disturbance, or to disturbance of habitats from an increase in suspended sediment and physical disturbance to the seabed. Underwater noise may cause fish and mobile invertebrates to avoid the offshore ECC and also affect their physiology and behaviour. Suspended sediments may cause fish and mobile invertebrates to avoid the construction area and may smother and hide immobile benthic prey. These mechanisms may result in less prey being available within the construction area to foraging species.

13.7.2.8.1 Receptor Sensitivity

440. Red- throated diver have low habitat use flexibility, meaning they are highly sensitive to change in the foraging habitat through changes such as increased sediment or reduced prey availability (Fliessbach *et al.*, 2019; Cook and Burton, 2010). This receptor is classified as having an overall sensitivity to indirect impacts via habitat r prey availability of **high**.

13.7.2.8.2 Impact Magnitude

441. As no significant effects were identified to potential prey species (fish or benthic) or on the habitats that support them in the assessments on fish and benthic ecology (**Chapter 11 Fish and Shellfish Ecology** and **Chapter 10 Benthic and Intertidal Ecology**, respectively) then there is no potential for any indirect effects of an adverse significance to occur on ornithology receptors within the offshore ECC. Therefore, the magnitude of impact is considered to be **negligible**.

13.7.2.8.3 Effect Significance

442. Overall, it is predicted that sensitivity of the receptor is **high** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.2.9 Indirect Impacts via Habitat or Prey Availability (ORN-O-05): Array Area

443. During the operation phase of the Project there is the potential for indirect effects arising from the displacement of prey species due to increased noise and disturbance, or to disturbance of habitats from an increase in suspended sediment and physical disturbance to the seabed. Underwater noise may cause fish and mobile invertebrates to avoid the Array Area and also affect their physiology and behaviour. Suspended sediments may cause fish and mobile invertebrates to avoid the construction area and may smother and hide immobile benthic prey. These mechanisms may result in less prey being available within the construction area to foraging seabirds.

444. It should be noted that maintenance activities during the operation and maintenance phase are likely to be ad hoc and short term. An example of this is if cable repair was to be conducted. In this instance the cable would be brought to the surface, repaired and then re-buried. This could cause short term displacement and a potential increase in suspended sediment or that brief timeframe.

445. Similarly, in the operation and maintenance phase fish are less disturbed by underwater noise than in the construction phase as the level of noise, although constant, is at a much lower decibel level.

13.7.2.9.1 Receptor Sensitivity

446. Of the receptors scoped in for indirect impacts via habitat or prey availability in the Array Area (**Table 13-26**), there is variability in sensitivity to this impact. The seabird species being assessed have medium to large foraging ranges (Woodward *et al*., 2019) meaning that they are able to utilise areas not impacted by any disturbance to prey or habitat. Similarly, when assessed against habitat use flexibility (Fliessbach *et al*., 2019), the receptors have a good degree of flexibility in habitat they are able to utilise. Great northern diver has not been considered for such sensitivity, but using red-throated diver as a proxy here, the species has low flexibility in habitat use. The receptors are therefore classified as having an overall sensitivity to indirect impacts via habitat or prey availability of **low** to **medium**, with great northern diver having a **high** sensitivity.

13.7.2.9.2 Impact Magnitude

447. As no significant effects were identified to potential prey species (fish or benthic) or on the habitats that support them in the assessments on fish and benthic ecology (**Chapter 11 Fish and Shellfish Ecology** and **Chapter 10 Benthic and Intertidal Ecology**, respectively) then there is no potential for any indirect effects of an adverse significance to occur on offshore and intertidal ornithology receptors. Therefore, the magnitude of impact is considered to be **negligible**.

13.7.2.9.3 Effect Significance

448. Overall, it is predicted that the sensitivity of receptor is **low** to **high** and the magnitude of impact is **negligible**. The effect is therefore of **negligible** to **minor adverse** significance, which is **not significant** in EIA terms (**Table 13-15**).

13.7.3 Potential Effects during Decommissioning

449. No decision has been made regarding the final decommissioning strategy for the offshore infrastructure, as it is recognised that regulatory requirements and industry best practice change over time.

450. Commitment ID CO21 (see **Table 13-5**) requires an Offshore Decommissioning Plan to be prepared and agreed with the relevant authorities prior to the commencement of offshore decommissioning works. This will ensure that decommissioning offshore and intertidal ornithology impacts will be assessed in accordance with the applicable regulations and guidance at that time of decommissioning where relevant, with appropriate mitigation implemented as necessary to avoid significant effects.

451. The detailed activities and methodology for decommissioning will be determined later within the Project's lifetime, but would be expected to include:

- Removal of all the wind turbine components and part of the foundations (those above seabed level);
- Removal of some or all of the array and export cables; and
- The inter-array and offshore export cables will likely be cut at the cable ends and left in-situ below the seabed, and scour and cable protection would likely be left in-situ other than where there is a specific condition for its removal.

452. Whilst a detailed assessment of decommissioning impacts cannot be undertaken at this stage, for this assessment, it is assumed that decommissioning is likely to operate within the parameters identified for construction (i.e. any activities are likely to occur within the temporary construction working areas and require no greater amount or duration of activity than assessed for construction). The decommissioning sequence will generally be the reverse of the construction sequence. It is therefore assumed that decommissioning impacts would likely be of similar nature to, and no worse than, those identified during the construction phase.

453. The magnitude of decommissioning effects will be comparable to, or less than, those as assessed during the construction and operation phase. Accordingly, offshore and intertidal ornithology receptors during the construction and operation phases, it is anticipated that the same would be valid for the decommissioning phase regardless of the final decommissioning methodologies. Therefore, all would be considered as **not significant** in EIA terms.

13.7.4 Additional Mitigation Measures

454. All assessments presented within **Section 13.7** for the Project alone concluded a **minor adverse** residual effect at most, which is concluded as **not significant** in EIA terms for all effect pathways considered. No additional mitigation measures have therefore been proposed for offshore and intertidal ornithology.

13.8 Cumulative Effects

455. Cumulative effects are the result of the impacts of the Project acting in combination with the impacts of other proposed and reasonably foreseeable developments on receptors. This includes plans and projects that are not inherently considered as part of the current baseline.

456. The overarching framework used to identify and assess cumulative effects is set out in **Chapter 6 Environmental Impact Assessment Methodology**. The four-stage approach is based upon the Planning Inspectorate's Nationally Significant Infrastructure Projects: Advice on Cumulative Effects Assessment (Planning Inspectorate, 2024) and the Offshore Wind Marine Environmental Assessments: Best Practice Advance for Evidence and Data Standards (Parker *et al.*, 2022a). The fourth stage of the process is the assessment stage, which is detailed within the sections below for potential cumulative effects on offshore and intertidal ornithology receptors.

13.8.1 Screening for Potential Cumulative Effects

457. The first step of the CEA identifies which impacts associated with the Project alone, as assessed under **Section 13.6.4**, have the potential to interact with other plans and projects to give rise to cumulative effects. All potential cumulative effects to be taken forward in the CEA are detailed in **Table 13-55** with a rationale for screening in or out. Only impacts determined to have a residual effect greater than negligible are included in the CEA. Those assessed as 'no impact' are excluded, as there is no potential for them to contribute to a cumulative effect.

Table 13-55 Offshore and Intertidal Ornithology – Potential Cumulative Effects

Impact ID	Impact and Project Activity	Potential for Cumulative Effects	Rationale
Construction			
ORN-C-01	Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall - intertidal and offshore from installation of offshore and landfall infrastructure	No	No projects and plans have been identified that may have an effect pathway that is likely to coincide spatially or temporally with the Project.
ORN-C-02	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure - offshore (red-throated diver, gannet, auks) from installation of offshore and landfall infrastructure	No	No projects and plans have been identified that may have an effect pathway that is likely to coincide spatially or temporally with the Project.
ORN-C-05	Indirect impacts via habitats or prey availability - intertidal and offshore from construction activities e.g. installation of cables and foundations	No	No projects and plans have been identified that may have an effect pathway that is likely to coincide spatially or temporally with the Project.

Impact ID	Impact and Project Activity	Potential for Cumulative Effects	Rationale
Operation and Maintenance			
ORN-O-01	Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall - intertidal and offshore from maintenance of wind turbines and other infrastructure	No	No projects and plans have been identified that may have an effect pathway that is likely to coincide spatially or temporally with the Project.
ORN-O-02	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure - offshore (red-throated diver, gannet, auks) from presence of wind turbines and other infrastructure	Yes	Multiple OWF developments within a species foraging range may cause increased disturbance effects. The maximum interactive effects from operational and maintenance activities from the Project and other developments are provided in **Table 13-57**. These developments were selected as deemed to be within the ZOI and therefore the birds present within the Project area are expected to interact with the protected sites and receptors scoped with this environmental assessment.
ORN-O-03	Barrier effect due to presence of wind turbines and other offshore infrastructure - offshore (including migratory non-seabirds) from presence of operational wind turbines	No	Magnitude of impact concluded as negligible for the Project alone. In addition, as detailed within the Natural England's best practice guidance note (Parker *et al*., 2022c) any impact from barrier effects is currently already considered to be assessed within disturbance and displacement assessments (ORN-O-02).
ORN-O-05	Indirect impacts via habitats or prey availability - intertidal and offshore from presence of foundations in the seabed, cable / scour protection, pillars in the water column	No	Magnitude of impact concluded as negligible for the Project alone. Any potential impact on prey and supporting habitat within the Operational phase relates to any required ad hoc maintenance or repairs. Such works would be highly localised and short term in nature, therefore no potential for a material cumulative effect to occur.
ORN-O-06	Collision risk - offshore (kittiwake, gannet, migratory non-seabirds) from presence of wind turbines	Yes	Multiple OWF developments within a species foraging range may cause increased levels of collision. The maximum interactive effects from operational and maintenance activities from the Project and other developments are presented in **Table 13-57**. These developments were selected as deemed to be within the ZOI and therefore the birds present within the Project area are expected to interact with the protected sites and features scoped with this environmental assessment.
Decommissioning			
ORN-D-01	Direct disturbance and displacement due to work activity in the Array Area, Offshore ECC or landfall - intertidal and offshore. Decommissioning activities not yet defined	No	There is insufficient information available on other plans and projects which could have a spatial and temporal overlap with the Project's offshore decommissioning works. The details and scope of offshore decommissioning works will be determined by the relevant regulations and guidance at the time of decommissioning and provided in the Offshore Decommissioning Plan (see **Table 13-5**, Commitment ID CO21). This will include a detailed assessment of decommissioning impacts and appropriate mitigation measures to avoid significant effects, including cumulative effects. For this assessment, it is assumed that cumulative decommissioning effects would be of similar nature to, and no worse than, those identified during the construction phase.
ORN-D-02	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure - offshore (red-throated diver, gannet, auks) . Decommissioning activities not yet defined	No	
ORN-D-05	Indirect impacts via habitats or prey availability - intertidal and offshore. Decommissioning activities not yet defined	No	

458. It must be noted that impacts associated with 'Direct Disturbance to Displacement Due to Work Activity' and 'Direct Disturbance Due to Presence of Wind Turbines and Other Offshore Infrastructure' are considered together when understanding disturbance and displacement impacts. This is because the two impacts cannot be readily distinguished from one another.

13.8.2 Screening for Other Plans / Projects

459. The second step of the CEA identifies a short-list of other plans and projects that have the potential to interact with the Project to give rise to significant cumulative effects during the construction and operation phases. The exhaustive list of all offshore plans and projects considered in the development of the Project's CEA framework is provided in **Volume 2, Appendix 6.4 Cumulative Effects Screening Report – Offshore** and **Volume 2, Appendix 6.5 Cumulative Effects Screening Report - Onshore**.

460. The screening exercise has been undertaken based on available information on each plan or project as of the 31st December 2024. Information has been obtained from the planning Inspectorate website (Planning Inspectorate, 2025), the Marine Government website (MMO, 2025) and individual project reports, with references provided in **Section 13.8.3**. It is noted that further information regarding the identified plans and projects may become available between PEIR publication and DCO application submission or may not be available in detail prior to construction. The assessment presented here is therefore considered to be conservative, with the significance of cumulative effects expected to be reduced compared to those presented here. The short list of plans and projects will be updated at ES stage to incorporate anymore recent information at the time of drafting.

461. As described further in **Chapter 6 Environmental Impact Assessment Methodology** a seven-tier system based on the guidance issued by Natural England has been adopted (Parker *et al*., 2022c) (**Table 13-56**). Plans and projects identified in **Table 13-57** have been assigned a tier based on their development status, the level of information available to inform the CEA and the degree of confidence.

Table 13-56 Description of Tiers of Other Developments Considered for CEA (Adapted from Parker et al (2022c))

Tier level	Consenting or construction stage	Data availability
Tier 1	Built and operational projects	Pre-construction (and possibly post construction) survey data from built projects and environmental characterisation data (from the ES)
Tier 2	Under construction	As tier 1 but excluding the post-construction data
Tier 3	Consented (but construction has not commenced)	Environmental characterisation data (from the ES) and possibly pre-construction data
Tier 4	Application submitted to appropriate regulatory body but not yet determined	Environmental characterisation data (from the ES)
Tier 5	Projects have produced PEIR and have characterisation data in public domain	Environmental characterisation data (from PEIR)
Tier 6	Projects listed under the Planning Inspectorate programme of projects	Possible environmental characterisation data
Tier 7	Projects identified in relevant strategic plans or programme	Historic survey data collected for other purposes / projects.

Table 13-57 Short List of Plans / Projects for the Offshore and Intertidal Ornithology Cumulative Effect Assessment

Project / Plan	Development Type	Status	Tier	Construction / Operation Period	Closest Distance to Array Area (km)	Closest Distance to Offshore ECC (km)	Potential for Significant Cumulative Effects	Rationale
Dudgeon Extension (EN10109)	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: 2025 to 2029 Operation: 2029 to 2064*	101.25	202.20	Yes	Potential for spatial and temporal overlap during the operational and maintenance phase at the Array Area and associated buffers.
East Anglia ONE North (EN010077)	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: estimated completion in 2027 Operation: 2027 to 2052	229.21	280.15	Yes	
East Anglia Three (EN010056)	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: 2025 to 2026 Operation: 2026 to 2051	240.91	220.34	Yes	
East Anglia TWO (EN010078)	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: estimated completion in 2029 Operation: 2029 to 2054	232.76	295.68	Yes	
ForthWind Offshore Wind Demonstration Project - phase 1	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: dates to be determined Operation: 25 years	286.42	375.61	Yes	
Green Volt (00010230)	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: estimated completion in 2029 Operation: 2029 to 2064*	297.36	362.01	Yes	
Hornsea Four (EN010098)	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: 2025 to 2029 Operation: 2029 to 2064	31	134	Yes	
Hornsea Three (EN010080)	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: 2023 to 2027 Operation: 2027 to 2052*	107	106	Yes	
Inch Cape (00010140)	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: 2024 to 2027 Operation: 2027 to 2052*	247.28	330.78	Yes	
Norfolk Boreas (EN010087)	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: 2025 to 2027 Operation: 2027 to 2062*	192.37	188.68	Yes	
Norfolk Vanguard (EN010079)	Offshore Wind Farm	Consented (awaiting commencement)	3	Estimated completion before 2030	204.39 (east) 185.29 (west)	209.74 (east) 212.23 (west)	Yes	

Project / Plan	Development Type	Status	Tier	Construction / Operation Period	Closest Distance to Array Area (km)	Closest Distance to Offshore ECC (km)	Potential for Significant Cumulative Effects	Rationale
Pentland Floating (00010577)	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: 2025 to 2026 Operation: 2026 to 2061*	485.88	557.44	Yes	Potential for spatial and temporal overlap during the operational and maintenance phase at the Array Area and associated buffers.
Sheringham Shoal Extension (EN10109)	Offshore Wind Farm	Consented (awaiting commencement)	3	Construction: 2025 to 2029 Operation: 2029 to 2064*	107.65	223.87	Yes	
Berwick Bank (00010190)	Offshore Wind Farm	Application submitted	4	Construction: estimated completion by 2030 Operation: 2030 to 2065	188.96	272.36	Yes	
Dogger Bank South (EN010125)	Offshore Wind Farm	Application submitted	4	Construction: 2025 to 2029 Operation: 2030 to 2065*	110	30	Yes	
Five Estuaries (EN010115)	Offshore Wind Farm	Application submitted	4	Construction: 2027 to 2030 Operation: 2030 to 2065*	262.86	329.28	Yes	
North Falls (EN010119)	Offshore Wind Farm	Application submitted	4	Construction: estimated completion by 2030 Operation: 2030 to 2065*	254	333	Yes	
Ossian (EN0210006)	Offshore Wind Farm	Application submitted	4	Construction: early 2030s	159.47	230.87	Yes	
Outer Dowsing (EN010130)	Offshore Wind Farm	Application submitted	4	Construction: 2027 to 2030 Operation: 2030 to 2065*	76.76	170.14	Yes	
Rampion 2 (EN010117)	Offshore Wind Farm	Application submitted	4	Construction: 2027 to 2030 Operation: 2030 to 2065*	363	523	Yes	
Salamander (00010807)	Offshore Wind Farm	Application submitted	4	Construction: 2026 to 2028 Operation: 2028 to 2063	293.52	363.01	Yes	
West of Orkney (00010561)	Offshore Wind Farm	Application submitted	4	Construction: estimated completion in 2030 Operation: 2030 to 2065*	508	578	Yes	

*Table note: These dates are estimates based on the assumption that each wind farm will be operational for 35 years.

**Table note: Phase One of the Blyth Demonstration Site was commissioned in 2017. Phase Two will be commissioned in spring 2025.

462. Using this tier approach accounts for uncertainty around the projects considered within the cumulative assessment, due to the different data being used and its age (Parker *et al.*, 2022c). Projects within tiers four to six could go through design changes or not even get consent and so within the individual cumulative assessments these have been split off, to provide separate cumulative totals for consented and then the consented plus planned projects (**Section 13.8.3**). When considering this tiering approach, tiers taken through within this cumulative assessment include tiers one to six.

463. It must be noted that there is potential for significant precaution around the impact values taken forward in cumulative assessments. Most projects are assessed against their consented design rather than the actual as-built turbines and layout. In previous headroom works (MacArthur Green, 2020) this has been deemed to lead to a significant overestimate of impacts for collision risk. Additionally, it is assumed that all projects awaiting consent decision are to be developed to the full worst-case extent of their proposed project designs. This is precautionary as some projects may ultimately not received consent, may reduce the proposed design prior to consent or reduce the project boundary.

464. The ZOI used to identify relevant plans and projects for the offshore and intertidal ornithology CEA is based on the BDMPS regions as outlined in Furness (2015). The latest guidance provided by Natural England and Natural Resource Wales (2024) recommends the use of BDMPS populations when conducting impact assessments at the EIA scale. This is recommended for both alone and cumulative assessments. Therefore, the ZOI for cumulative assessment is any project within the same BDMPS as outlined for each species (**Table 13-24**). For example, when considering gannet cumulative assessments, the Array Area is within the UK North Sea (and Channel) BDMPS and so any projects within the UK North Sea (and Channel) BDMPS are to be considered when conducting cumulative assessment.

465. Each plan or project in **Table 13-57** has been considered on a case-by-case basis. Only plans and projects with potential for significant cumulative effects with the Project are taken forward to a detailed assessment, which are screened based on the following criteria:

- There is potential that a pathway exists whereby an impact could have a cumulative effect on a receptor;
- The impact on a receptor from the Project and the plan or project in consideration has a spatial overlap (i.e. occurring over the same area);
- The impact on a receptor from the Project and the plan or project in consideration has a temporal overlap (e.g. occurring at the same time);
- There is sufficient information available on the plan or project in consideration and moderate to high data confidence to undertake a meaningful assessment; and
- There is some likelihood that the residual effect (i.e. after accounting for mitigation measures) of the Project could result in significant cumulative effects with the plan or project in consideration.

466. The short-list provided in **Table 13-57** has been produced specifically to assess cumulative effects on offshore and intertidal ornithology receptors. The CEA for offshore and intertidal ornithology has identified a total of 57 plans and projects where significant cumulative effects could arise in combination with the Project. A detailed assessment of cumulative effects is provided in **Section 13.8.3**.

13.8.3 Assessment of Cumulative Effects

467. Cumulative effects assessments have been considered for those species and impacts whereby a significance of low or higher has been determined. Significance of effects of negligible has not been taken forward for cumulative effects assessment. However, assessment for herring gull, lesser black backed gull and great black-backed gull have been provided based on the requested of Natural England (ETG2 held on 21st October 2024 - see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**), in order to provide an audit trail of impacts.

13.8.3.1 Cumulative Impact 1: Operational Disturbance and Displacement (ORN-O-02)

468. The estimated mortality resulting from disturbance and displacement arising from the developments included in this section are presented for each species assessed. The source of seasonal mean peak abundance estimates for each project included, is provided for each individual assessment presented below. The inclusion of seasonal mean peak abundance estimates for each species from each project, where available, ensures that a consistent approach to estimating potential displacement consequent mortality rates can be provided. It also reduces any uncertainties from projects that may not have undertaken or presented quantitative assessments for displacement.

13.8.3.1.1 Great Northern Diver

469. A review of relevant projects was undertaken in order to understand the potential cumulative effect of disturbance and displacement on great northern diver.

470. As described in the **Volume 2, Appendix 13.2 Offshore Ornithology Baseline Characterisation Report**, great northern divers have only been recorded within the wider dogger bank area infrequently, with less than ten individuals recorded in surveys overall. Single records of great northern diver were observed within the entire Dogger Bank Zone in April, May and June during 2010 boat-based surveys for DBA, DBB, DBC and Sofia. Boat-based surveys for the zone the following year only recorded two birds. Similarly, DAS surveys conducted for DBS between 2021 and 2023 recorded a single great northern diver. Therefore, for the wider Dogger Bank area, available evidence would suggest that usage of the overall area is infrequent both on a monthly, seasonal and annual basis, alongside very low abundance.

471. Extending this to the wider area of the southern North Sea, records of great northern diver were scant for other OWF, with low records for Norfolk Vanguard (only in three out of 32 surveys) (MacArthur Green, 2018), Norfolk Boreas (a single individual) (MacArthur Green, 2019) and Outer Dowsing (a single individual) (GoBe, 2024a).

472. It is therefore concluded that there is no potential for a significant effect to arise cumulatively given the lack of consistent spatial and temporal overlap between projects within the Southern North Sea combined with the limited number of great northern diver recorded in previous Array Areas. Therefore, cumulative effects on great northern-diver have therefore been screened out from further assessment.

13.8.3.1.2 Guillemot

13.8.3.1.2.1. Receptor Sensitivity

473. Guillemot has an overall sensitivity of **medium** as detailed in the main assessment of effect section (**Section 13.7**).

13.8.3.1.2.2. Cumulative Impact Magnitude

474. For this cumulative displacement and disturbance assessment, the application of a displacement rate of 50% and a mortality rate of 1% based on best available evidence, as detailed in **Section 13.7.2.1**, has been used to inform the Applicant's approach to assessment. This approach to assessment is considered suitably precautionary as the estimates are based on peak mean abundance data for each bio-season. Subsequently, the estimated mean peak abundances within each project area (and associated buffers) are likely to be artificially higher than possible when combining all data sets together. This is due to no correction factor being considered or applied to account for the double counting of individual birds being present within multiple project areas across a single bio-season.

475. During the breeding bio-season, the cumulative abundance for guillemot is 345,167 individuals (**Table 13-58**), which results in a conservative estimate of 1,726 (1,725.8) mortalities as a consequence of displacement (**Table 13-59**). The regional population of guillemots within the breeding bio-season is estimated to be 2,045,078 individuals (**Table 13-24**). Assuming an average baseline mortality rate of 0.1405 (**Table 13-25**), the natural predicted mortality in the breeding bio-season is 287,333 individuals per annum. Therefore, the addition of 1,726 individual mortalities due to cumulative displacement would increase baseline mortality by 0.601%.

Table 13-58 Guillemot Cumulative Bio-Season and Total Abundance Estimates (Operational)

Development	Predicted Abundance			Tier	Source
	Breeding	Non-breeding	Annual		
Beatrice	13,610	2,755	16,365	1	Royal HaskoningDHV (2023a)
Blyth Demonstration Site	1,220	1,321	2,541	1	Royal HaskoningDHV (2023a)
Dudgeon	334	542	876	1	Royal HaskoningDHV (2023a)
East Anglia One	274	640	914	1	Royal HaskoningDHV (2023a)
EOWDC	547	225	772	1	Royal HaskoningDHV (2023a)
Galloper	305	593	898	1	Royal HaskoningDHV (2023a)
Greater Gabbard	345	548	893	1	Royal HaskoningDHV (2023a)
Gunfleet Sands	0	363	363	1	Royal HaskoningDHV (2023a)
Hornsea Project One	9,836	8,097	17,933	1	Royal HaskoningDHV (2023a)
Humber Gateway	99	138	237	1	Royal HaskoningDHV (2023a)
Hywind Scotland Pilot Park	249	2,136	2,385	1	Royal HaskoningDHV (2023a)
Kentish Flats	0	3	3	1	Royal HaskoningDHV (2023a)
Kentish Flats Extension	0	4	4	1	Royal HaskoningDHV (2023a)
Kincardine	632	0	632	1	Royal HaskoningDHV (2023a)
Lincs & LID	582	814	1,396	1	Royal HaskoningDHV (2023a)

Development	Predicted Abundance			Tier	Source
	Breeding	Non-breeding	Annual		
London Array	192	377	569	1	Royal HaskoningDHV (2023a)
Methil	25	0	25	1	Royal HaskoningDHV (2023a)
Race Bank	361	708	1069	1	Royal HaskoningDHV (2023a)
Rampion	10,887	15,536	26,423	1	Royal HaskoningDHV (2023a)
Scroby Sands	-	-	-	1	Royal HaskoningDHV (2023a)
Sheringham Shoal	390	715	1,105	1	Royal HaskoningDHV (2023a)
Teesside	267	901	1,168	1	Royal HaskoningDHV (2023a)
Thanet	18	124	142	1	Royal HaskoningDHV (2023a)
Westermost Rough	347	486	833	1	Royal HaskoningDHV (2023a)
Hornsea Project Two	7,735	13,164	20,899	1	Royal HaskoningDHV (2023a)
Moray East	9,820	547	10,367	1	Royal HaskoningDHV (2023a)
Triton Knoll	425	746	1,171	1	Royal HaskoningDHV (2023a)
Neart na Gaoithe	1,755	3,761	5,516	2	Royal HaskoningDHV (2023a)
Dogger Bank C	3,283	2,268	5,551	2	Royal HaskoningDHV (2023a)
Sofia	5,211	3,701	8,912	2	Royal HaskoningDHV (2023a)
Seagreen (Phase 1 and 1A)	24,724	8,800	33,524	2	Royal HaskoningDHV (2023a)
Moray West	24,426	38,174	62,600	2	Royal HaskoningDHV (2023a)
Dogger Bank A	5,407	6,142	11,549	3	Royal HaskoningDHV (2023a)
Dogger Bank B	9,479	10,621	20,100	3	Royal HaskoningDHV (2023a)
East Anglia Three	1,744	2,859	4,603	3	Royal HaskoningDHV (2023a)
Hornsea Three	13,374	17,772	31,146	3	Royal HaskoningDHV (2023a)
Inch Cape	4,371	3,177	7,548	3	Royal HaskoningDHV (2023a)

Development	Predicted Abundance			Tier	Source
	Breeding	Non-breeding	Annual		
Norfolk Vanguard	4,320	4,776	9,096	3	Royal HaskoningDHV (2023a)
Norfolk Boreas	7,767	13,777	21,544	3	Royal HaskoningDHV (2023a)
East Anglia ONE North	4,183	1,888	6,071	3	Royal HaskoningDHV (2023a)
East Anglia TWO	2,077	1,675	3,752	3	Royal HaskoningDHV (2023a)
Hornsea Four	9,382	36,965	46,347	3	Royal HaskoningDHV (2023a)
ForthWind Offshore Wind Demonstration Project - phase 1	417	401	818	3	HiDef (2022a)
Green Volt	4,429	16,105	20,534	3	Royal HaskoningDHV (2023a)
Sheringham Shoal Extension	1,085	1,095	2,180	3	Royal HaskoningDHV (2023a)
Dudgeon Extension	3,839	14,887	18,726	3	Royal HaskoningDHV (2023a)
Pentland Floating Offshore Wind Farm	1,146	650	1,796	3	HiDef (2022b)
Totals consented	**190,919**	**240,977**	**431,896**	**-**	**-**
Berwick Bank	74,154	44,171	118,325	4	HiDef (2022c)
West of Orkney	7,973	4,393	12,365	4	MacArthur Green (2024c)
Salamander	3,616	11,779	15,395	4	ERM (2024a)
Ossian	27,247	48,340	75,587	4	RPS (2024)
Outer Dowsing	14,371	9,215	23,586	4	GoBe (2024c)
Rampion 2	134	5,723	5,857	4	RWE (2024a)
North Falls	866	5,365	6,231	4	Royal HaskoningDHV (2024e)
Dogger Bank South	17,814	42,923	60,737	4	RWE (2024a)
Five Estuaries	1,201	3,698	4,899	4	RWE (2024a)

Development	Predicted Abundance			Tier	Source
	Breeding	Non-breeding	Annual		
Dogger Bank D (asymmetrical buffer)	6,872	7,406	14,278	4	-
Total All Projects	**345,167**	**423,990**	**769,156**	**-**	**-**

476. This magnitude of impact is therefore considered to be **low** during the breeding bio-season, as it represents only a slight difference to the baseline conditions.

477. During the non-breeding bio-season, the cumulative abundance for guillemot is 423,990 individuals (**Table 13-58**), which results in a conservative estimate of 2,120 (2,119.9) mortalities as a consequence of displacement. The regional population of guillemots within the non-breeding bio-season is estimated to be 1,617,305 individuals (**Table 13-24**). Assuming an average baseline mortality rate of 0.1405 (**Table 13-25**), the natural predicted mortality in the non-breeding bio-season is 227,231 individuals per annum. Therefore, the addition of 2,120 individual mortalities due to cumulative displacement would increase baseline mortality by 0.933% (**Table 13-59**).

478. This magnitude of impact is therefore considered to be **low** during the non-breeding bio-season, as it represents only a slight difference to the baseline conditions.

479. Annually, the estimated cumulative number of guillemot subject to mortality is estimated to be 3,846 (3,845.8) individuals cumulatively across all projects. Using the UK North Sea and Channel BDMPS population of 2,045,078 individuals (**Table 13-24**) as a proxy for total BDMPS population across the year, the addition of 3,846 mortalities from cumulative displacement would increase baseline mortality by 1.338% (**Table 13-59**).

480. It is important to note that most projects which have recently been consented or are currently awaiting consent determination have proposed potential compensation in relation to predicted impacts against UK designated sites, which is currently not accounted for within the cumulative assessment presented, though will likely provide positive effects at an EIA level, not just in relation to designated sites. For example, the recently consented Hornsea Project Four OWF is required to compensate for an impact of 452 breeding adult guillemots per annum (Department for Energy Security & Net Zero, 2023), which once achieved, will provide a considerable positive effect to the EIA population. A more reflective annual impact taking into account both adverse and positive effects (proposed and agreed compensation) is therefore the increase in baseline mortality of 0.776%, when considering all consented projects only plus the Project.

481. When taking into account the levels of additive precaution within cumulative assessments, the current evidence base regarding guillemot behavioural response (**Section 13.7.2.3.4** and **Section 13.7.2.3.5**) and positive effect of current proposed compensation for the species, the magnitude of impact is therefore considered to be **low** against the UK North Sea and Channel BDMPS, as the predicted magnitude of effect represents only a slight difference to the baseline conditions as a result of cumulative displacement.

482. When considering the SNCB approach, a displacement rate of 30% to 70% and a mortality rate of 1% to 10% is applied. Using the UK North Sea and Channel BDMPS population of 2,045,078 individuals (**Table 13-24**) as a proxy for total BDMPS population across the year, the natural baseline mortality is 287,333 individuals. Annually, the estimated cumulative number of guillemot subject to mortality is estimated to be 2,308 to 53,841 (2,307.5 - 53,840.9) individuals across all projects. The additional mortalities, from cumulative displacement, would increase total mortality by 0.803% to 18.738% (**Table 13-59**).

483. Using the SNCB approach the annual magnitude of impact is therefore considered to be between **low** to **high** against the UK North Sea and Channel BDMPS, when considering the range of potential change in baseline conditions as a result of displacement.

13.8.3.1.2.3. Cumulative Effect Significance

484. Overall, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of impact has been determined as **low** cumulatively when considering the Applicant's and SNCB lower range approach. Therefore, the significance of such effect would be **minor adverse**, which can be concluded as **not significant** in EIA terms (**Table 13-15**).

485. When considering the SNCB upper range **high** magnitude of impact cumulatively, the significance of the effect would be **major** adverse, which can be concluded as **significant** in EIA terms (**Table 13-15**).

13.8.3.1.2.4. Additional Mitigation and Residual Cumulative Effect

486. Further investigation of the SNCB approach population consequences will be undertaken to inform the final conclusions within the ES utilising PVA analysis as per Natural England's best practice guidance (Parker *et al.*, 2022c). The Project will also seek engagement post-PEIR through the ETG2 to further refine the appropriateness and most likely level of effect in relation to the SNCB range approach and to discuss whether there is further feasible mitigation required.

Table 13-59 Guillemot Bio-Season Displacement Estimates Cumulatively with Other Projects

Bio-season (months)	Projects included	Seasonal Abundance (Array Area plus 2km buffer; individuals)	Regional Baseline Populations and Baseline Mortality Rates (individuals)		Estimated Number of Guillemots Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
			Population	Baseline Mortality	50% Disp; 1% Mort	30-70% Disp; 1-10% Mort	50% Disp; 1% Mort	30-70% Disp; 1-10% Mort
Breeding (March – July)	DBD plus all consented	197,791	2,045,078	287,333	989.0	593.4 - 13,845.4	0.344	0.207 - 4.819
	All projects	345,167			1,725.8	1,035.5 – 24,161.7	0.601	0.360 - 8.409
Non-breeding (August – February)	DBD plus all consented	248,383	1,617,305	227,231	1,241.9	745.1 - 17,386.8	0.547	0.328 - 7.652
	All projects	423,990			2,119.9	1,272.0 – 29,679.3	0.933	0.560 - 13.061
Annual (BDMPS)	DBD plus all consented	446,174	2,045,078	287,333	2,230.9	1,338.5 - 31,232.2	0.776	0.466 - 10.870
	All projects	769,156			3,845.8	2,307.5 – 53,840.9	1.338	0.803 - 18.738
Annual (Biogeographic)	DBD plus all consented	446,174	4,125,000	579,563	2,230.9	1,338.5 - 31,232.2	0.385	0.231 - 5.389
	All projects	769,156			3,845.8	2,307.5 – 53,840.9	0.664	0.398 - 9.290

13.8.3.1.3 Razorbill

13.8.3.1.3.1. Receptor Sensitivity

487. Razorbill has an overall sensitivity of **medium** as detailed in the main assessment of effect section (**Section 13.6.4**).

13.8.3.1.3.2. Cumulative Impact Magnitude

488. For this cumulative displacement and disturbance assessment, the Application of a displacement rate of 50% and a mortality rate of 1% based on best available evidence, as detailed in **Section 13.7.2.1**, has been used to inform the Applicant's approach to assessment. This approach to assessment is considered suitably precautionary as the estimates are based on peak mean abundance data for each bio-season. Subsequently, the estimated mean peak abundances within each project area (and associated buffers) are likely to be artificially higher than possible when combining all data sets together. This is due to no correction factor being considered or applied to account for the double counting of individual birds being present within multiple project areas across a single bio-season.

489. During the return migration bio-season, the cumulative abundance for razorbill is 64,804 individuals (**Table 13-60**), which results in a conservative estimate of 324 (324.0) mortalities as a consequence of displacement (**Table 13-61**). The regional population of razorbills within the return migration bio-season is estimated to be 591,875 individuals (**Table 13-24**). Assuming an average baseline mortality rate of 0.1302 (**Table 13-25**), the natural predicted mortality in the return migration bio-season is 77,062 individuals per annum. Therefore, the addition of 324 individual mortalities due to cumulative displacement would increase baseline mortality by 0.420% (**Table 13-61**).

490. This magnitude of impact is therefore considered to be **low** during the return migration bio-season, as it represents only a slight difference to the baseline conditions.

491. During the breeding bio-season, the cumulative abundance for razorbill is 48,490 individuals (**Table 13-60**), which results in a conservative estimate of 243 (242.5) mortalities as a consequence of displacement. The regional population of razorbills within the breeding bio-season is estimated to be 158,031 individuals (**Table 13-24**). Assuming an average baseline mortality rate of 0.1302 (**Table 13-25**), the natural predicted mortality in the breeding bio-season is 20,576 individuals per annum. Therefore, the addition of 243 individual mortalities due to cumulative displacement would increase baseline mortality by 1.178% (**Table 13-61**).

492. This magnitude of impact is therefore considered to be **low** during the breeding bio-season, as it represents only a slight difference to the baseline conditions.

493. During the post-breeding migration bio-season, the cumulative abundance for razorbill is 67,602 individuals (**Table 13-60**), which results in a conservative estimate of 338 (338.0) mortalities as a consequence of displacement. The regional population of razorbills within the post-breeding migration bio-season is estimated to be 591,875 individuals (**Table 13-24**). Assuming an average baseline mortality rate of 0.1302 (**Table 13-25**), the natural predicted mortality in the post-breeding migration bio-season is 77,062 individuals per annum. Therefore, the addition of 338 individual mortalities due to cumulative displacement would increase baseline mortality by 0.439% (**Table 13-61**).

494. This magnitude of impact is therefore considered to be **low** during the post-breeding migration bio-season, as it represents only a slight difference to the baseline conditions.

495. During the winter bio-season, the cumulative abundance for razorbill is 42,542 individuals (**Table 13-60**), which results in a conservative estimate of 213 (212.7) mortalities as a consequence of displacement. The regional population of razorbills within the winter bio-season is estimated to be 218,621 individuals (**Table 13-24**). Assuming an average baseline mortality rate of 0.1302 (**Table 13-25**), the natural predicted mortality in the winter bio-season is 28,464 individuals per annum. Therefore, the addition of 213 individual mortalities, due to cumulative displacement, would increase baseline mortality by 0.747% (**Table 13-61**).

496. This magnitude of impact is therefore considered to be **low** during the winter bio-season, as it represents only a slight difference to the baseline conditions.

497. Annually, the estimated cumulative number of razorbill subject to mortality is estimated to be 1,117 (1,117.2) individuals cumulatively across all projects. Using the UK North Sea and Channel BDMPS population of 591,875 (**Table 13-24**) as a proxy for total BDMPS population across the year, the addition of 1,116 mortalities from cumulative displacement would increase baseline mortality by 1.450% (**Table 13-61**).

498. When taking into account the levels of additive precaution within cumulative assessments and the current evidence base regarding razorbill behavioural response (**Section 13.7.2.3.4** and **Section 13.7.2.3.5**), this magnitude of impact is therefore considered to be **low** against the UK North Sea and Channel BDMPS, as it represents only a slight increase over a 1% increase in baseline mortality for all projects as a result of displacement.

499. When considering the SNCB approach, a displacement rate of 30% to 70% and a mortality rate of 1% to 10% is applied. Annually, the estimated cumulative number of razorbill subject to mortality is estimated to be 670 to 15,641 (670.3 – 15,640.7) individuals cumulatively across all projects. Using the UK North Sea and Channel BDMPS population of 591,875 (**Table 13-24**) as a proxy for total BDMPS population across the year, the natural baseline mortality is 77,062 individuals. The addition of 670 to 15,641 mortalities from cumulative displacement would increase baseline mortality by 0.870% to 20.296% (**Table 13-61**).

Table 13-60 Razorbill Cumulative Bio-Season and Total Abundance Estimates (Operational)

Development	Predicted Abundance					Tier	Source
	Breeding	Post-breeding migration	Winter	Return Migration	Annual		
Beatrice	873	833	555	833	3,094	1	Royal HaskoningDHV (2023a)
Blyth Demonstration Site	121	91	61	91	364	1	Royal HaskoningDHV (2023a)
Dudgeon	256	346	745	346	1,693	1	Royal HaskoningDHV (2023a)
East Anglia One	16	26	155	336	533	1	Royal HaskoningDHV (2023a)
EOWDC	161	64	7	26	258	1	Royal HaskoningDHV (2023a)
Galloper	44	43	106	394	587	1	Royal HaskoningDHV (2023a)
Greater Gabbard	0	0	387	84	471	1	Royal HaskoningDHV (2023a)
Gunfleet Sands	0	0	30	0	30	1	Royal HaskoningDHV (2023a)
Hornsea Project One	1,109	4,812	1,518	1,803	9,242	1	Royal HaskoningDHV (2023a)
Humber Gateway	27	20	13	20	80	1	Royal HaskoningDHV (2023a)
Hywind Scotland Pilot Park	30	719	10	-	759	1	Royal HaskoningDHV (2023a)
Kentish Flats and Extension	-	-	-	-	0	1	Royal HaskoningDHV (2023a)
Kincardine	22	-	-	-	22	1	Royal HaskoningDHV (2023a)
Lincs & LID	45	34	22	34	135	1	Royal HaskoningDHV (2023a)
London Array	14	20	14	20	68	1	Royal HaskoningDHV (2023a)
Methil	4	0	0	0	4	1	Royal HaskoningDHV (2023a)
Race Bank	28	42	28	42	140	1	Royal HaskoningDHV (2023a)
Rampion	630	66	1,244	3,327	5,267	1	Royal HaskoningDHV (2023a)
Scroby Sands	-	-	-	-	0	1	Royal HaskoningDHV (2023a)
Sheringham Shoal	106	1,343	211	30	1,690	1	Royal HaskoningDHV (2023a)
Teesside	16	61	2	20	99	1	Royal HaskoningDHV (2023a)
Thanet	3	0	14	21	38	1	Royal HaskoningDHV (2023a)

Development	Predicted Abundance					Tier	Source
	Breeding	**Post-breeding migration**	**Winter**	**Return Migration**	**Annual**		
Westermost Rough	91	121	152	91	455	1	Royal HaskoningDHV (2023a)
Hornsea Project Two	2,511	4,221	720	1,668	9,120	1	Royal HaskoningDHV (2023a)
Moray East	2,423	1,103	30	168	3,724	1	Royal HaskoningDHV (2023a)
Triton Knoll	40	254	855	117	1,266	1	Royal HaskoningDHV (2023a)
Dogger Bank C	1,153	592	1,426	2,953	6,124	2	Royal HaskoningDHV (2023a)
Moray West	2,808	3,544	184	3,585	10,121	2	Royal HaskoningDHV (2023a)
Neart na Gaoithe	331	5,492	508	-	6,331	2	Royal HaskoningDHV (2023a)
Seagreen (Phase 1 and 1A)	9,574	-	2,375	-	11,949	2	Royal HaskoningDHV (2023a)
Sofia	834	310	959	1,919	4,022	2	Royal HaskoningDHV (2023a)
Dogger Bank A	1,250	1,576	1,728	4,149	8,703	3	Royal HaskoningDHV (2023a)
Dogger Bank B	1,538	2,097	2,143	5,119	10,897	3	Royal HaskoningDHV (2023a)
Dudgeon Extension	923	3,741	845	320	5,829	3	Royal HaskoningDHV (2023a)
East Anglia ONE North	403	85	54	207	749	3	Royal HaskoningDHV (2023a)
East Anglia Three	1,807	1,122	1,499	1,524	5,952	3	Royal HaskoningDHV (2023a)
East Anglia TWO	281	44	136	230	691	3	Royal HaskoningDHV (2023a)
ForthWind Offshore Wind Demonstration Project - phase 1	386	4,311	455	449	5,601	3	HiDef (2022a)
Green Volt	457	58	-	-	515	3	APEM (2022c)
Hornsea Four	57	81	58	81	277	3	Royal HaskoningDHV (2023a)
Hornsea Three	630	2,020	3,649	2,105	8,404	3	Royal HaskoningDHV (2023a)
Inch Cape	1,436	2,870	651		4,957	3	Royal HaskoningDHV (2023a)
Norfolk Boreas	630	263	1,065	345	2,303	3	Royal HaskoningDHV (2023a)
Norfolk Vanguard	879	866	839	924	3,508	3	Royal HaskoningDHV (2023a)

Development	Predicted Abundance					Tier	Source
	Breeding	Post-breeding migration	Winter	Return Migration	Annual		
Pentland Floating Offshore Wind Farm	134	16	17	14	181	3	HiDef (2022b)
Sheringham Shoal Extension	316	759	686	144	1,905	3	Royal HaskoningDHV (2023a)
Totals consented	**34,397**	**44,066**	**26,156**	**33,539**	**138,158**	**-**	**-**
Berwick Bank	4,040	8,849	1,399	7,480	21,768	4	HiDef (2022c)
Dogger Bank South	2,836	9,573	8,443	8,034	28,886	4	RWE (2024a)
Five Estuaries	90	284	1,046	756	2,176	4	RWE (2024a)
North Falls	104	248	1,781	1,741	3,874	4	RWE (2024a)
Ossian	2,608	1,493	138	224	4,463	4	RPS (2024)
Outer Dowsing	3,159	2,185	1,779	5,134	12,257	4	GoBe (2024c)
Rampion 2	32	26	1,193	6,303	7,554	4	RWE (2024a)
Salamander	334	484	-	-	818	4	ERM (2024a)
West of Orkney	141	112	19	132	405	4	MacArthur Green (2024c)
Dogger Bank D (asymmetrical buffer)	749	282	588	1,461	3,080	4	-
Total All Projects	**48,490**	**67,602**	**42,542**	**64,804**	**223,439**	**-**	**-**

Table 13-61 Razorbill Bio-Season Displacement Estimates Cumulatively with Other Projects

Bio-season (months)	Projects included	Seasonal Abundance (Array Area plus 2km buffer; individuals)	Regional Baseline Populations and Baseline Mortality Rates (individuals)		Estimated Number of Razorbills Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
			Population	Baseline Mortality	50% Disp; 1% Mort	30-70% Disp; 1-10% Mort	50% Disp; 1% Mort	30-70% Disp; 1-10% Mort
Breeding (April – July)	DBD plus all consented	35,146	158,031	20,576	175.7	105.4 – 2,460.2	0.854	0.512 - 11.957
	All projects	48,490			242.5	145.5 – 3,394.3	1.178	0.707 - 16.497
Post-breeding migration (August – October)	DBD plus all consented	44,348	591,875	77,062	221.7	133.0 – 3,104.4	0.288	0.173 - 4.028
	All projects	67,602			338.0	202.8 – 4,732.2	0.439	0.263 - 6.141
Winter (November – December)	DBD plus all consented	26,744	218,621	28,464	133.7	80.2 – 1,872.1	0.470	0.282 - 6.577
	All projects	42,542			212.7	127.6 – 2,978.0	0.747	0.448 - 10.462
Return migration (January – March)	DBD plus all consented	35,000	591,875	77,062	175.0	105.0 – 2,450.0	0.227	0.136 - 3.179
	All projects	64,804			324.0	194.4 – 4,536.3	0.420	0.252 - 5.887
Annual (BDMPS)	DBD plus all consented	141,238	591,875	77,062	706.2	423.7 – 9,886.7	0.916	0.550 - 12.829
	All projects	223,439			1,117.2	670.3 – 15,640.7	1.450	0.870 - 20.296
Annual (Biogeographic)	DBD plus all consented	141,238	1,707,000	222,251	706.2	423.7 – 9,886.7	0.318	0.191 - 4.448
	All projects	223,439			1,117.2	670.3 – 15,640.7	0.503	0.302 - 7.037

500. Using the SNCB approach the annual magnitude of impact is therefore considered to be between **low** to **medium** against the UK North Sea and Channel BDMPS, when considering the range of potential change in baseline conditions as a result of displacement.

13.8.3.1.3.3. Cumulative Effect Significance

501. Overall, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of impact has been determined as **low** cumulatively when considering the Applicant's and SNCB lower range approach. Therefore, the significance of the effect would be **minor adverse**, which can be concluded as **not significant** in EIA terms (**Table 13-15**).

502. When considering the SNCB upper range **medium** magnitude of impact cumulatively, the significance of the effect would be **moderate** adverse, which can be concluded as **significant** in EIA terms (**Table 13-15**).

13.8.3.1.3.4. Additional Mitigation and Residual Cumulative Effect

503. Further investigation of the SNCB approach population consequences will be undertaken to inform the final conclusions within the ES utilising PVA analysis as per Natural England's best practice guidance (Parker *et al.*, 2022c). The Project will also seek engagement post-PEIR through the ETG2 to further refine the appropriateness and most likely level of effect in relation to the SNCB range approach and to discuss whether there is further feasible mitigation required.

13.8.3.1.4 Puffin

13.8.3.1.4.1. Receptor Sensitivity

504. Puffin has an overall sensitivity of **medium** as detailed in the main assessment of effect section (**Section 13.6.4**).

13.8.3.1.4.2. Cumulative Impact Magnitude

505. For this cumulative displacement and disturbance assessment, the Application of a displacement rate of 50% and a mortality rate of 1% based on best available evidence, as detailed in **Section 13.7.2.1**, has been used to inform the Applicant's approach to assessment. This approach to assessment is considered suitably precautionary as the estimates are based on peak mean abundance data for each bio-season. Subsequently, the estimated mean peak abundances within each project area (and associated buffers) are likely to be artificially higher than possible when combining all data sets together. This is due to no correction factor being considered or applied to account for the double counting of individual birds being present within multiple project areas across a single bio-season.

506. During the breeding bio-season, the cumulative abundance for puffin is 39,588 individuals (**Table 13-62**), which results in a conservative estimate of 198 (197.9) mortalities as a consequence of displacement (**Table 13-63**). The regional population of puffins within the breeding bio-season is estimated to be 868,689 individuals (**Table 13-24**). Assuming an average baseline mortality rate of 0.119 (**Table 13-25**), the natural predicted mortality in the breeding bio-season is 103,374 individuals per annum. Therefore, the addition of 198 individual mortalities due to cumulative displacement would increase baseline mortality by 0.191% (**Table 13-63**).

507. This magnitude of impact is therefore considered to be **low** during the breeding bio-season, as it represents only a slight difference to the baseline conditions.

Table 13-62 Puffin Cumulative Bio-Season and Total Abundance Estimates (Operational)

Development	Predicted Abundance			Tier	Source
	Breeding	Non-breeding	Annual		
Beatrice	2,858	2,435	5,293	1	APEM (2022d)
Blyth Demonstration Site	235	123	358	1	APEM (2022d)
Dudgeon	1	3	4	1	APEM (2022d)
East Anglia One	16	32	48	1	APEM (2022d)
EOWDC	42	82	124	1	APEM (2022d)
Galloper	0	1	1	1	APEM (2022d)
Greater Gabbard	0	1	1	1	APEM (2022d)
Gunfleet Sands	-	-	-	1	APEM (2022d)
Hornsea Project One	1,070	1,257	2,327	1	APEM (2022d)
Hornsea Project Two	468	2,039	2,507	1	APEM (2022d)
Humber Gateway	15	10	25	1	APEM (2022d)
Hywind Scotland Pilot Park	119	85	204	1	APEM (2022d)
Kentish Flats	-	-	0	1	APEM (2022d)
Kentish Flats Extension	3	6	9	1	APEM (2022d)
Kincardine	19	0	19	1	APEM (2022d)

Development	Predicted Abundance			Tier	Source
	Breeding	Non-breeding	Annual		
Lincs & LID	3	6	9	1	APEM (2022d)
London Array	0	1	1	1	APEM (2022d)
Methil	8	0	8	1	APEM (2022d)
Moray East	-	-	-	1	APEM (2022d)
Race Bank	1	10	11	1	APEM (2022d)
Rampion	7	0	7	1	APEM (2022d)
Scroby Sands	-	-	-	1	APEM (2022d)
Sheringham Shoal	4	26	30	1	APEM (2022d)
Teesside	35	18	53	1	APEM (2022d)
Thanet	0	0	0	1	APEM (2022d)
Triton Knoll	23	71	94	1	APEM (2022d)
Westermost Rough	61	35	96	1	APEM (2022d)
Dogger Bank C	34	273	307	2	APEM (2022d)
Moray West	1,115	3,966	5,081	2	APEM (2022d)
Neart na Gaoithe	6,173	3,656	9,829	2	GoBe (2018)
Seagreen (Phase 1 and 1A)	6,154	5,389	11,543	2	APEM (2022d)
Sofia	35	329	364	2	APEM (2022d)
DEP and SEP	0	28	28	3	APEM (2022d)
Dogger Bank A	37	295	332	3	APEM (2022d)
Dogger Bank B	102	743	845	3	APEM (2022d)
East Anglia ONE North	-	-	0	3	APEM (2022d)
East Anglia Three	181	307	488	3	APEM (2022d)

Development	Predicted Abundance			Tier	Source
	Breeding	Non-breeding	Annual		
East Anglia TWO	15	0	15	3	APEM (2022d)
Green Volt	250	41	291	3	APEM (2022d)
Hornsea Four	203	442	645	3	APEM (2022d)
Hornsea Three	253	67	320	3	APEM (2022d)
Inch Cape	2,956	2,688	5,644	3	APEM (2022d)
Norfolk Boreas	0	23	23	3	APEM (2022d)
Norfolk Vanguard	67	112	179	3	APEM (2022d)
Pentland Floating Offshore Wind Farm	1,211	2	1,213	3	HiDef (2022b)
Totals consented	**26,569**	**25,258**	**51,827**	**-**	**-**
Berwick Bank	4,513	-	4,513	4	HiDef (2022c)
Dogger Bank South	172	377	549	4	RWE (2024a)
Five Estuaries	0	0	0	4	RWE (2024a)
North Falls	0	3	3	4	RWE (2024a)
Ossian	1,928	-	1,928	4	RPS (2024)
Outer Dowsing	666	414	1,080	4	GoBe (2024c)
Rampion 2	0	0	0	4	RWE (2024a)
Salamander	357	-	357	4	ERM (2024a)
West of Orkney	5,272	2,136	7,408	4	MacArthur Green (2024c)
Dogger Bank D (asymmetrical buffer)	111	24	135	4	-
Total All Projects	**39,588**	**28,212**	**67,800**	**-**	**-**

Table 13-63 Puffin Bio-Season Displacement Estimates Cumulatively with Other Projects

Bio-season (months)	Projects included	Seasonal Abundance (Array Area plus 2km buffer; individuals)	Regional Baseline Populations and Baseline Mortality Rates (individuals)		Estimated Number of Puffins Subject to Mortality (individuals per annum)		Increase in Baseline Mortality (%)	
			Population	Baseline Mortality	50% Disp; 1% Mort	30-70% Disp; 1-10% Mort	50% Disp; 1% Mort	30-70% Disp; 1-10% Mort
Breeding (April – July)	DBD plus all consented	26,680	868,689	103,374	133.4	80.0 – 1,867.6	0.129	0.077 - 1.807
	All projects	39,588			197.9	118.8 – 2,771.2	0.191	0.115 - 2.681
Non-breeding (August – March)	DBD plus all consented	25,282	231,958	27,603	126.4	75.8 – 1,769.7	0.458	0.275 - 6.411
	All projects	28,212			141.1	84.6 – 1,974.8	0.511	0.307 - 7.154
Annual (BDMPS)	DBD plus all consented	51,962	868,689	103,374	259.8	155.9 – 3,637.3	0.251	0.151 - 3.519
	All projects	67,800			339.0	203.4 – 4,746.0	0.328	0.197 - 4.591
Annual (Biogeographic)	DBD plus all consented	51,962	2,370,000	282,030	259.8	155.9 – 3,637.3	0.092	0.055 - 1.290
	All projects	67,800			339.0	203.4 – 4,746.0	0.120	0.072 - 1.683

508. During the non-breeding bio-season, the cumulative abundance for puffin is 28,212 individuals (**Table 13-62**), which results in a conservative estimate of 141 (141.1) mortalities as a consequence of displacement. The regional population of puffins within the non-breeding bio-season is estimated to be 231,958 individuals (**Table 13-24**). Assuming an average baseline mortality rate of 0.119 (**Table 13-25**), the natural predicted mortality in the non-breeding bio-season is 27,603 individuals per annum. Therefore, the addition of 141 individual mortalities due to cumulative displacement would increase baseline mortality by 0.511% (**Table 13-63**).

509. This magnitude of impact is therefore considered to be **low** during the non-breeding bio-season, as it represents only a slight difference to the baseline conditions.

510. Annually, the estimated cumulative number of puffin subject to mortality is estimated to be 339 (339.0) individuals cumulatively across all projects. Using the UK North Sea and Channel BDMPS population of 868,689 (**Table 13-24**) as a proxy for total BDMPS population across the year, the addition of 339 mortalities from cumulative displacement would increase baseline mortality by 0.328% (**Table 13-63**).

511. This magnitude of impact is therefore considered to be **low** against the UK North Sea and Channel BDMPS, as it represents only a slight difference to the baseline conditions.

512. When considering the SNCB approach, incorporating a displacement rate of 30% to 70% and a mortality rate of 1% to 10% is applied. Annually, the estimated cumulative number of puffin subject to mortality is estimated to be 203 to 4,746 (203.4 – 4,746.0) individuals cumulatively across all projects. Using the UK North Sea and Channel BDMPS population of 868,689 (**Table 13-24**) as a proxy for total BDMPS population across the year, the addition of 203 to 4,746 mortalities from cumulative displacement would increase baseline mortality by 0.197% to 4.591% (**Table 13-63**).

513. Using the SNCB approach the annual magnitude of impact is therefore considered to be between **low** to **medium** against the UK North Sea and Channel BDMPS, when considering the range of potential change in baseline conditions as a result of displacement.

13.8.3.1.4.3. Cumulative Effect Significance

514. Overall, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of impact has been determined as **low** cumulatively when considering the Applicant's and SNCB lower range approach. Therefore, the significance of the effect would be **minor adverse**, which can be concluded as **not significant** in EIA terms (**Table 13-15**).

515. When considering the SNCB upper range **medium** magnitude of impact cumulatively, the significance of the effect would be **moderate** adverse, which can be concluded as **significant** in EIA terms (**Table 13-15**).

13.8.3.1.4.4. Additional Mitigation and Residual Cumulative Effect

516. Further investigation of the SNCB approach population consequences will be undertaken to inform the final conclusions within the ES utilising PVA analysis as per Natural England's best practice guidance (Parker *et al*., 2022c). The Project will also seek engagement post-PEIR through the ETG2 to further refine the appropriateness and most likely level of effect in relation to the SNCB range approach and to discuss whether there is further feasible mitigation required.

13.8.3.1.5 Gannet

13.8.3.1.5.1. Receptor Sensitivity

517. Gannet has an overall sensitivity of **medium** as detailed in the main assessment of effect section (**Section 13.7**).

13.8.3.1.5.2. Cumulative Impact Magnitude

518. For this cumulative displacement and disturbance assessment, the Applicant applied a displacement rate of 60% to 80% and a mortality rate of 1% based on best available evidence, as detailed in **Section 13.7.2.1**. This approach is also consistent with the SNCB lower range of preferred displacement and mortality rate. This approach to assessment is considered suitably precautionary as the estimates are based on peak mean abundance data for each bio-season. Subsequently, the estimated mean peak abundances within each project area (and associated buffers) are likely to be artificially higher than possible when combining all data sets together. This is due to no correction factor being considered or applied to account for the double counting of individual birds being present within multiple project areas across a single bio-season.

519. During the return migration bio-season, the cumulative abundance for gannet is 6,759 individuals (**Table 13-64**), which results in a conservative estimate of 41 to 54 (40.6 – 54.1) mortalities as a consequence of displacement (**Table 13-65**). The regional population of gannets within the return migration bio-season is estimated to be 248,385 individuals (**Table 13-24**). Assuming an average baseline mortality rate of 0.1866 (**Table 13-25**), the natural predicted mortality in the return migration bio-season is 46,349 individuals per annum. Therefore, the addition of 41 to 54 individual mortalities due to cumulative displacement would increase baseline mortality by 0.087% to 0.117% (**Table 13-65**).

520. This magnitude of impact is therefore considered to be **low** during the return migration bio-season, as it represents only a slight difference to the baseline conditions.

Table 13-64 Gannet Cumulative Bio-Season and Total Abundance Estimates (Operational)

Development	Predicted Abundance				Tier	Source
	Breeding	Post-breeding migration	Return Migration	Annual		
Beatrice	151		0	0	1	Royal HaskoningDHV (2023a)
Blyth Demonstration Site	-	-	-	-	1	Royal HaskoningDHV (2023a)
Dudgeon	53	25	11	89	1	Royal HaskoningDHV (2023a)
East Anglia One	161	3,638	76	3,875	1	Royal HaskoningDHV (2023a)
EOWDC	35	5	0	40	1	Royal HaskoningDHV (2023a)
Galloper	360	907	276	1,543	1	Royal HaskoningDHV (2023a)
Greater Gabbard	252	69	105	426	1	Royal HaskoningDHV (2023a)
Gunfleet Sands	0	12	9	21	1	Royal HaskoningDHV (2023a)
Hornsea Project One	671	694	250	1,615	1	Royal HaskoningDHV (2023a)
Hornsea Project Two	457	1,140	124	1,721	1	Royal HaskoningDHV (2023a)
Humber Gateway	-	-	-	-	1	Royal HaskoningDHV (2023a)
Hywind Scotland Pilot Park	10	0	4	14	1	Royal HaskoningDHV (2023a)
Kentish Flats	-	-	-	0	1	Royal HaskoningDHV (2023a)
Kentish Flats Extension	0	13	0	13	1	Royal HaskoningDHV (2023a)
Kincardine	120	0	0	120	1	Royal HaskoningDHV (2023a)
Lincs & LID	-	-	-	0	1	Royal HaskoningDHV (2023a)
London Array	-	-	-	0	1	Royal HaskoningDHV (2023a)
Methil	23	0	0	23	1	Royal HaskoningDHV (2023a)
Moray East	564	292	27	883	1	Royal HaskoningDHV (2023a)
Race Bank	92	32	29	153	1	Royal HaskoningDHV (2023a)
Rampion	0	590	0	590	1	Royal HaskoningDHV (2023a)
Scroby Sands	-	-	-	-	1	Royal HaskoningDHV (2023a)

Development	Predicted Abundance				Tier	Source
	Breeding	Post-breeding migration	Return Migration	Annual		
Sheringham Shoal	47	31	2	80	1	Royal HaskoningDHV (2023a)
Teesside	1	0	0	1	1	Royal HaskoningDHV (2023a)
Thanet	-	-	-	0	1	Royal HaskoningDHV (2023a)
Triton Knoll	211	15	24	250	1	Royal HaskoningDHV (2023a)
Westermost Rough	-	-	-	0	1	Royal HaskoningDHV (2023a)
Dogger Bank C and Sofia	2,250	887	464	3,601	2	Royal HaskoningDHV (2023a)
Moray West	2,827	439	144	3,410	2	Royal HaskoningDHV (2023a)
Neart na Gaoithe	1,987	552	281	2,820	2	Royal HaskoningDHV (2023a)
Seagreen Phase 1 and 1A	2,956	664	332	3,952	2	Royal HaskoningDHV (2023a)
Dogger Bank A and B	1,155	2,048	394	3,597	3	Royal HaskoningDHV (2023a)
Dudgeon Extension	23	295	11	329	3	Royal HaskoningDHV (2023a)
East Anglia ONE North	149	468	44	661	3	Royal HaskoningDHV (2023a)
East Anglia Three	412	1,269	524	2,205	3	Royal HaskoningDHV (2023a)
East Anglia TWO	192	891	192	1,275	3	Royal HaskoningDHV (2023a)
ForthWind Offshore Wind Demonstration Project - phase 1	64	26	44	134	3	HiDef (2022a)
Green Volt	166	24	8	198	3	APEM (2022c)
Hornsea Four	976	790	401	2,167	3	Royal HaskoningDHV (2023a)
Hornsea Three	1,333	984	524	2,841	3	Royal HaskoningDHV (2023a)
Inch Cape	2,398	703	212	3,313	3	Royal HaskoningDHV (2023a)
Norfolk Boreas	1,229	1,723	526	3,478	3	Royal HaskoningDHV (2023a)
Norfolk Vanguard	271	2,453	437	3,161	3	Royal HaskoningDHV (2023a)
Sheringham Shoal Extension	120	16	49	185	3	Royal HaskoningDHV (2023a)

Development	Predicted Abundance				Tier	Source
	Breeding	Post-breeding migration	Return Migration	Annual		
Totals consented	**21,542**	**21,400**	**5,513**	**48,455**	-	-
Berwick Bank	4,735	1,500	269	6,504	4	HiDef (2022c)
Dogger Bank South	1,560	1,574	161	3,295	4	RWE (2024a)
Five Estuaries	233	640	67	940	4	APEM (2022d)
North Falls	69	287	290	646	4	RWE (2024a)
Ossian	1,393	775	42	2,210	4	RPS (2024)
Outer Dowsing	554	496	69	1,119	4	GoBe (2024c)
Rampion 2	111	102	123	336	4	RWE (2024a)
Salamander	442	369	-	811	4	ERM (2024a)
West of Orkney	852	1,368	140	2,359	4	MacArthur Green (2024c)
Dogger Bank D (asymmetrical buffer)	217	813	85	1,115	4	-
Total All Projects	**31,708**	**29,324**	**6,759**	**67,790**	-	-

Table 13-65 Gannet Bio-Season Displacement Estimates Cumulatively with Other Projects

Bio-season (months)	Projects included	Seasonal Abundance (Array Area plus 2km buffer)	Regional Baseline Populations and Baseline Mortality Rates (individuals per annum)		Estimated Number of Gannets Subject to Mortality		Increase in Baseline Mortality (%)	
			Population	Baseline Mortality	60 - 80% Disp; 1% Mort	60 - 80% Disp; 10% Mort	60 - 80% Disp; 1% Mort	60 - 80% Disp; 10% Mort
Breeding (June – August)	DBD plus all consented	21,759	400,326	74,701	130.6 - 174.1	1,305.5 – 1,740.7	0.175 - 0.233	0.233 - 2.330
	All projects	31,708			190.2 - 253.7	1,902.5 – 2,536.6	0.255 - 0.340	0.340 - 3.396
Post-breeding migration (October-November)	DBD plus all consented	22,213	456,299	85,145	133.3 - 177.7	1,332.8 – 1,777.0	0.157 - 0.209	0.209 - 2.087
	All projects	29,324			175.9 - 234.6	1,759.4 – 2,345.9	0.207 - 0.276	0.276 - 2.755
Return migration (December – February)	DBD plus all consented	5,598	248,385	46,349	33.6 - 44.8	335.9 - 447.8	0.072 - 0.097	0.097 - 0.966
	All projects	6,759			40.6 - 54.1	405.5 - 540.7	0.087 - 0.117	0.117 - 1.167
Annual (BDMPS)	DBD plus all consented	49,570	456,299	85,145	297.4 - 396.6	2,974.2 – 3,965.6	0.349 - 0.466	0.466 - 4.657
	All projects	67,790			406.7 - 542.3	4,067.4 – 5,423.2	0.478 - 0.637	0.637 - 6.369
Annual (Biogeographic)	DBD plus all consented	49,570	1,180,000	220,188	297.4 - 396.6	2,974.2 – 3,965.6	0.135 - 0.180	0.180 - 1.801
	All projects	67,790			406.7 - 542.3	4,067.4 – 5,423.2	0.185 - 0.246	0.246 - 2.463

521. During the breeding bio-season, the cumulative abundance for gannet is 31,708 individuals (**Table 13-64**), which results in a conservative estimate of 190 to 254 (190.2 – 253.7) mortalities as a consequence of displacement. The regional population of gannets within the breeding bio-season is estimated to be 400,326 individuals (**Table 13-24**). Assuming an average baseline mortality rate of 0.1866 (**Table 13-25**), the natural predicted mortality in the breeding bio-season is 74,701 individuals per annum. Therefore, the addition of 190 to 254 individual mortalities due to cumulative displacement would increase baseline mortality by 0.255% to 0.340% (**Table 13-65**).

522. This magnitude of impact is therefore considered to be **low** during the breeding bio-season, as it represents only a slight difference to the baseline conditions.

523. During the post-breeding migration bio-season, the cumulative abundance for gannet is 29,324 individuals (**Table 13-64**), which results in a conservative estimate of 176 to 235 (175.9 – 234.6) mortalities as a consequence of displacement. The regional population of gannets within the post-breeding migration bio-season is estimated to be 456,299 individuals (**Table 13-24**). Assuming an average baseline mortality rate of 0.1866 (**Table 13-25**), the natural predicted mortality in the post-breeding migration bio-season is 85,145 individuals per annum. Therefore, the addition of 176 to 235 individual mortalities due to cumulative displacement would increase the mortality relative to the baseline mortality by 0.207% to 0.276% (**Table 13-65**).

524. This magnitude of impact is therefore considered to be **low** during the post-breeding migration bio-season, as it represents only a slight difference to the baseline conditions.

525. Annually, the estimated cumulative number of gannet subject to mortality is estimated to be 407 to 542 (406.7 – 542.3) individuals cumulatively across all projects. Using the UK North Sea and Channel BDMPS population of 456,299 (**Table 13-24**) as a proxy for total BDMPS population across the year, the addition of 407 to 542 mortalities from cumulative displacement would increase baseline mortality by 0.478% to 0.637% (**Table 13-65**).

526. This magnitude of impact is therefore considered to be **low** against the UK North Sea and Channel BDMPS, as it represents only a slight difference to the baseline conditions as a result of displacement.

527. When considering the SNCB upper range approach, a displacement rate of 60% to 80% and a mortality rate of 10% is applied. Annually, the estimated cumulative number of gannet subject to mortality is estimated to be 4,067 to 5,423 (4,067.4 – 5,423.2) individuals cumulatively across all projects. Using the UK North Sea and Channel BDMPS population of 456,299 (**Table 13-24**) as a proxy for total BDMPS population across the year, the addition of 4,067 to 5,423 mortalities from cumulative displacement would increase baseline mortality by 4.777% to 6.369% (**Table 13-65**).

528. Using the SNCB upper range approach the magnitude of impact is considered to be **medium** against the UK North Sea and Channel BDMPS, when considering the range of potential change in baseline conditions as a result of displacement.

13.8.3.1.5.3. Cumulative Effect Significance

529. Overall, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of impact has been determined as **low** cumulatively when considering the Applicant's and SNCB lower range approach. Therefore, the significance of the effect would be **minor adverse**, which can be concluded as **not significant** in EIA terms (**Table 13-15**).

530. When considering the SNCB upper range **medium** magnitude of impact cumulatively, the significance of the effect would be **moderate** adverse, which can be concluded as **significant** in EIA terms (**Table 13-15**).

13.8.3.1.5.4. Additional Mitigation and Residual Cumulative Effect

531. Further investigation of the SNCB approach population consequences will be undertaken to inform the final conclusions within the ES utilising PVA analysis as per Natural England's best practice guidance (Parker *et al*., 2022c). The Project will also seek engagement post-PEIR through the ETG2 to further refine the appropriateness and most likely level of effect in relation to the SNCB range and to discuss whether there is further feasible mitigation required.

13.8.3.2 Cumulative Impact 2: Collision Risk (ORN-O-06)

532. The estimated cumulative collision risk mortality from the developments included in this section are presented for each species assessed. The source of predicted collision risk for each project included, is provided for each individual assessment presented below. The cumulative collision risk estimates are presented for each species as bio-season and annual totals.

533. To ensure cumulative assessments are in adherence to the recent update to recommended avoidance rates for assessment (SNCBs, 2024b), the correction factor for the Sheringham Shoal and Dudgeon OWF Extensions (Royal HaskoningDHV ,2023b) has been applied where applicable. Any changes to project collision estimates are noted within each assessment below for transparency. Similarly, macro avoidance has been applied to the cumulative values included for gannet where applicable.

13.8.3.2.1 Kittiwake

13.8.3.2.1.1. Receptor Sensitivity

534. Kittiwake has an overall sensitivity of **medium** as detailed in the main assessment of effect section (**Section 13.6.4**).

13.8.3.2.1.2. Potential Magnitude of Impact

535. During the return migration bio-season, a total of 897 (896.9) kittiwakes may be subject to mortality (**Table 13-66**). The BDMPS population for the return migration bio-season (**Table 13-24**) is 627,814 individuals and using the average baseline mortality rate of 0.1577 (**Table 13-25**), the natural predicted mortality in the return migration bio-season is 99,006 individuals. Therefore, the addition of 897 individual mortalities would represent an increase in baseline mortality by 0.906% (**Table 13-67**).

536. This level of potential cumulative impact is considered to be of **medium** magnitude during the return migration bio-season, as it represents an increase to baseline mortality of over 1%.

537. During the breeding bio-season, a total of 1,769 (1,769.4) kittiwakes may be subject to mortality (**Table 13-66**). The BDMPS population for the breeding bio-season (**Table 13-24**) is 839,456 individuals and using the average baseline mortality rate of 0.1577 (**Table 13-25**), the natural predicted mortality in the breeding bio-season is 132,382 individuals. Therefore, the addition of 1,769 individual mortalities would represent an increase in baseline mortality of 1.337% (**Table 13-67**).

538. This level of potential cumulative impact is considered to be of **medium** magnitude during the breeding bio-season, as it represents an increase to baseline mortality of over 1%.

539. During the post-breeding migration bio-season, a total of 1,114 (1,114.1) kittiwakes may be subject to mortality (**Table 13-66**). The BDMPS population for the post-breeding migration bio-season (**Table 13-24**) is 829,938 individuals and using the average baseline mortality rate of 0.1577 (**Table 13-25**), the natural predicted mortality in the post-breeding migration bio-season is 130,881 individuals. Therefore, the addition of 1,114 individual mortalities would represent an increase in baseline mortality of 0.851% (**Table 13-67**).

540. This level of potential cumulative impact is considered to be of **low** magnitude during the post-breeding migration bio-season, as it represents only a slight difference to the baseline conditions.

541. The annual cumulative total of kittiwakes subject to mortality due to collision is estimated to be 3,695 (3,695.1) individuals, with 136 from the Offshore Project **(Table 13-66**). Using the largest BDMPS population of 839,456 (**Table 13-24**), as a proxy for the annual BDMPS population, the addition of 3,695 predicted mortalities would increase baseline mortality by 2.791% (**Table 13-67**).

542. This level of cumulative impact annually is considered to be of **medium** magnitude, as it represents an increase to baseline mortality of over 1%.

543. It is important to note that most projects that have recently been consented or are currently awaiting consent determination have proposed potential compensation in relation to predicted impacts against UK designated sites. This compensation is not currently accounted for within the cumulative assessment presented, though will likely provide positive effects at an EIA level, not just in relation to designated sites. For example, the recently consented Hornsea Project Four OWF is required to compensate for an impact of 71 breeding adult kittiwakes per annum (Department for Energy Security & Net Zero, 2023), which once achieved, will provide a considerable positive effect to the EIA population. A more reflective annual impact taking into account both adverse and positive effects (proposed and agreed compensation) is therefore the increase in baseline mortality of 1.883%, when considering all consented projects only plus the Project (**Table 13-67**).

13.8.3.2.1.3. Significance of Effect

544. Overall, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of the annual impact has been determined to be **medium** cumulatively. Therefore, the significance of the effect would be **moderate adverse**, which can be concluded as **significant** in EIA terms.

13.8.3.2.1.4. Additional Mitigation and Residual Cumulative Effect

545. Further investigation of the population consequences posed cumulatively will be undertaken to inform the final conclusions within the ES utilising PVA analysis as per Natural England's best practice guidance (Parker *et al.*, 2022c), with the aim of eventually concluding a **not significant** cumulative impact. In addition engagement with SNCBs through ETG2 meetings will take place to discuss whether there is further feasible mitigation required.

Table 13-66 Kittiwake Cumulative Bio-Season and Total Collision Mortality Estimates

Development	Predicted Collision Mortalities				Tier	Source	Modelling Approach	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Post-breeding migration	Return migration	Annual					
Beatrice	66.3	7.5	27.9	101.6	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Beatrice Demonstrator	0.0	1.5	1.2	2.7	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Blyth Demonstration Site	1.2	1.6	1.0	3.8	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Dudgeon	-	-	-	-	1	Royal HaskoningDHV (2023b)	-	-	-
East Anglia One	1.3	112.3	32.8	146.3	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
EOWDC	8.3	4.1	0.8	13.1	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Galloper	4.4	19.5	22.3	46.1	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Greater Gabbard	0.8	10.5	8.0	19.3	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Gunfleet Sands	-	-	-	-	1	Royal HaskoningDHV (2023b)	-	-	-
Hornsea Project One	30.8	39.1	14.6	84.6	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Hornsea Project Two	11.2	6.3	2.1	19.6	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Humber Gateway	1.3	2.2	1.3	4.9	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Hywind Scotland Pilot Park	11.6	0.6	0.6	12.9	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Kentish Flats	0.0	0.6	0.5	1.1	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Kentish Flats Extension	0.0	0.0	1.9	1.9	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Kincardine	15.4	6.3	0.7	22.4	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Lincs & LID	0.5	0.8	0.5	1.8	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
London Array	1.0	1.6	1.3	3.9	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Methil	0.3	0.0	0.0	0.3	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Moray East	30.5	1.4	13.5	45.4	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Race Bank	1.3	16.7	3.9	22.0	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923

Development	Predicted Collision Mortalities				Tier	Source	Modelling Approach	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Post-breeding migration	Return migration	Annual					
Rampion	38.1	26.2	20.8	-	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Scroby Sands	-	-	-	-	1	Royal HaskoningDHV (2023b)	-	-	-
Sheringham Shoal	-	-	-	-	1	Royal HaskoningDHV (2023b)	-	-	-
Teesside	26.9	16.8	1.8	45.4	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Thanet	0.1	0.4	0.3	0.8	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Triton Knoll	17.2	97.3	31.8	146.3	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Westermost Rough	0.1	0.1	0.1	-	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Dogger Bank C and Sofia	95.8	63.5	151.8	311.2	2	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Moray West	55.3	16.8	4.9	77.0	2	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Neart na Gaoithe	5.6	11.9	1.4	18.9	2	Royal HaskoningDHV (2024d)	Deterministic	0.989	Updated to 0.9923
Seagreen Phase 1 and 1A	119.8	99.6	23.5	242.9	2	Royal HaskoningDHV (2024d)	Deterministic	0.989	Updated to 0.9923
Dogger Bank A and B	202.0	94.5	206.8	503.3	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Dudgeon Extension and Sheringham Shoal Extension	7.2	4.3	0.9	12.4	3	Royal HaskoningDHV (2023b)	Stochastic	0.992	Not required
East Anglia ONE North	28.3	5.7	2.5	36.4	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
East Anglia Three	4.3	48.3	26.3	78.9	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
East Anglia TWO	20.7	3.8	5.2	29.6	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
ForthWind Offshore Wind Demonstration Project - phase 1	0.0	0.0	0.0	0.0	3	HiDef (2022e)	Deterministic	0.989	Updated to 0.9923
Green Volt	5.2	5.4	3.3	13.9	3	APEM (2023a)	Stochastic	0.993	Not required
Hornsea Four	48.1	9.0	3.0	60.0	3	APEM (2022d)	Deterministic	0.989	Updated to 0.9923
Hornsea Three	53.9	26.6	5.6	86.1	3	Royal HaskoningDHV (2023b) Natural England approach	Deterministic	0.989	Updated to 0.9923

Development	Predicted Collision Mortalities				Tier	Source	Modelling Approach	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Post-breeding migration	Return migration	Annual					
Inch Cape	28.0	18.2	4.2	50.4	3	Royal HaskoningDHV (2024d)	Deterministic	0.989	Updated to 0.9923
Norfolk Boreas	9.3	22.5	8.3	40.2	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Norfolk Vanguard	15.3	11.5	13.5	40.3	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	Updated to 0.9923
Pentland Floating Offshore Wind Farm	4.9	4.9	0.0	9.8	3	HiDef (2022d)	Deterministic	0.989	Updated to 0.9923
Totals consented	**972.1**	**819.9**	**650.6**	**2,357.3**	-	-	-	-	-
Berwick Bank	431.9	133.0	125.3	690.2	4	Pelagica and Cork Ecology (2022) Scoping approach	Deterministic	0.989	Updated to 0.9923
Dogger Bank South	191.1	79.3	29.5	299.9	4	RWE (2024b)	Stochastic	0.993	Not required
Five Estuaries	8.5	5.6	3.9	18.0	4	MacArthur Green (2024a)	Stochastic	0.993	Not required
North Falls	8.8	3.6	7.9	20.3	4	Royal HaskoningDHV (2024d)	Stochastic	0.993	Not required
Ossian	28.1	5.4	6.2	39.7	4	RPS (2024)	Stochastic	0.993	Not required
Outer Dowsing	27.2	3.0	2.9	33.2	4	GoBe (2024b)	Stochastic	0.993	Not required
Rampion 2	1.2	9.8	17.3	28.2	4	APEM (2023c)	Stochastic	0.993	Not required
Salamander	14.7	1.4	0.3	16.4	4	ERM (2024b)	Stochastic	0.993	Not required
West of Orkney	17.9	16.3	21.9	56.0	4	MacArthur Green (2024b)	Stochastic	0.9928	Not required
Dogger Bank D	67.9	36.8	31.2	135.9	4	-	Stochastic	0.9929	Not required
Total All Projects	**1,769.4**	**1,114.1**	**896.9**	**3,695.1**	-	-	-	-	-

Table 13-67 Kittiwake Bio-Season Cumulative Collision Estimates and Increase in Baseline Mortality

Bio-season (months)	Projects Included	Mean collisions (individuals per annum)	Regional baseline populations and baseline mortality rates		Increase in baseline mortality (%)
			Population (individuals)	**Baseline mortality (individuals per annum)**	
Breeding (March – August)	DBD plus all consented	1,040.0	839,456	132,382	0.786
	All projects	1,769.4			1.337
Post-breeding migration (September – December)	DBD plus all consented	856.7	829,938	130,881	0.655
	All projects	1,114.1			0.851
Return migration (January – February)	DBD plus all consented	681.8	627,814	99,006	0.689
	All projects	897.0.			0.906
Annual (BDMPS)	DBD plus all consented	2,493.2	839,456	132,382	1.883
	All projects	3,695.1			2.791
Annual (Biogeographic)	DBD plus all consented	2,493.2	5,100,000	804,270	0.310
	All projects	3,695.1			0.459

13.8.3.2.2 Great Black-Backed Gull

13.8.3.2.2.1. Receptor Sensitivity

546. Great black-backed gull has an overall sensitivity of **medium** as detailed in the main assessment of effect section (**Section 13.6.4**).

13.8.3.2.2.2. Potential Magnitude of Impact

547. During the breeding bio-season, a total of 223 (222.8) great black-backed gulls may be subject to mortality (**Table 13-68**). The BDMPS population for the breeding bio-season (**Table 13-24**) is 25,917 individuals and using the average baseline mortality rate of 0.0969 (**Table 13-25**), the natural predicted mortality in the breeding bio-season is 2,511 individuals. Therefore, the addition of 223 individual mortalities would represent an increase in mortality relative to the baseline mortality of 8.870% (**Table 13-69**).

548. Despite the predicted impact exceeding a 1% baseline mortality rate increase during the breeding bio-season, the Project does not contribute to the level of cumulative impact. Therefore, there is no potential for a cumulative effect during the breeding bio-season.

549. During the non-breeding bio-season, a total of 971 (971.4) great black-backed gulls may be subject to mortality (**Table 13-68**). The BDMPS population for the non-breeding bio-season (**Table 13-24**) is 91,398 individuals and using the average baseline mortality rate of 0.0969 (**Table 13-25**), the natural predicted mortality in the non-breeding bio-season is 8,856 individuals. Therefore, the addition of 971 individual mortalities would represent an increase in mortality relative to the baseline mortality of 10.968% (**Table 13-69**).

550. Despite the predicted impact exceeding a 1% baseline mortality rate increase during the non-breeding bio-season, as discussed and agreed during the ETG2 meeting held on the 21st of October 2024 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**), the Project predicted level of impact of less than a single (0.4) great black-backed gull is not expected to materially contribute to the cumulative level of impact. Therefore, a conclusion of **negligible** magnitude during the non-breeding bio-season is concluded.

551. The annual cumulative total of great black-backed gulls subject to mortality due to collision is estimated to be 1,194 (1,194.2) individuals. Using the largest BDMPS population of 91,938 (**Table 13-24**), as a proxy for the annual BDMPS population, the addition of 1,194 predicted mortalities would increase baseline mortality by 13.484% (**Table 13-69**).

552. The annual contribution of the Project is less than a single bird per annum which is not expected to materially contribute to the cumulative total of great black-backed gull mortality due to collision impacts. Upon discussion with Natural England at the ETG2 meeting held on the 21st of October 2024 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**), it was decided that an audit trail be provided for great black-backed gull to aid future assessments, hence why the assessment has been provided here. Therefore, for the Project, the level of cumulative impact annually is considered to be of **negligible** magnitude.

13.8.3.2.2.3. Significance of Effect

553. Overall, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of the annual impact has been determined to be **negligible** cumulatively. Therefore, the significance of the effect would be **minor adverse** at most regardless of the sensitivity of great black-backed gulls, which can be concluded as **not significant** in EIA terms.

Table 13-68 Great Black-Backed Gull Cumulative Bio-Season and Total Collision Mortality Estimates

Development	Predicted Collision Mortalities			Tier	Source	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Non-breeding	Annual				
Beatrice	36.2	145.0	181.2	1	Royal HaskoningDHV (2023b)	0.995	0.994
Beatrice Demonstrator	0.0	0.0	0.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
Blyth Demonstration Site	1.6	6.1	7.6	1	Royal HaskoningDHV (2023b)	0.995	0.994
Dudgeon	0.0	0.0	0.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
East Anglia One	0.0	55.2	55.2	1	Royal HaskoningDHV (2023b)	0.995	0.994
EOWDC	0.7	2.9	3.6	1	Royal HaskoningDHV (2023b)	0.995	0.994
Galloper	5.4	21.6	27.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
Greater Gabbard	18.0	72.0	90.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
Gunfleet Sands	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Hornsea Project One	20.6	82.3	103.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
Hornsea Project Two	3.6	24.0	27.6	1	Royal HaskoningDHV (2023b)	0.995	0.994
Humber Gateway	1.6	6.1	7.6	1	Royal HaskoningDHV (2023b)	0.995	0.994
Hywind Scotland Pilot Park	0.4	5.4	5.8	1	Royal HaskoningDHV (2023b)	0.995	0.994
Kentish Flats	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Kentish Flats Extension	0.1	0.2	0.3	1	Royal HaskoningDHV (2023b)	0.995	0.994
Kincardine	0.0	0.0	0.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
Lincs & LID	0.0	0.0	0.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
London Array	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Methil	1.0	1.0	1.9	1	Royal HaskoningDHV (2023b)	0.995	0.994
Moray East	11.4	30.6	42.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
Race Bank	0.0	0.0	0.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
Scroby Sands	-	-	-	1	Royal HaskoningDHV (2023b)	-	-

Development	Predicted Collision Mortalities			Tier	Source	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Non-breeding	Annual				
Sheringham Shoal	0.0	0.0	0.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
Teesside	10.4	41.8	52.3	1	Royal HaskoningDHV (2023b)	0.995	0.994
Thanet	0.1	0.5	0.6	1	Royal HaskoningDHV (2023b)	0.995	0.994
Triton Knoll	29.3	117.1	146.4	1	Royal HaskoningDHV (2023b)	0.995	0.994
Westermost Rough	0.0	0.0	0.1	1	Royal HaskoningDHV (2023b)	0.995	0.994
Dogger Bank C and Sofia	7.7	30.6	38.3	2	Royal HaskoningDHV (2023b)	0.995	0.994
Moray West	4.8	6.0	10.8	2	Royal HaskoningDHV (2023b)	0.995	0.994
Neart na Gaoithe	0.0	3.6	3.6	2	GoBe (2018)	0.995	0.994
Seagreen Phase 1 and 1A	16.1	64.1	80.2	2	Royal HaskoningDHV (2023b)	0.995	0.994
Dogger Bank A and B	7.0	28.0	34.9	3	Royal HaskoningDHV (2023b)	0.995	0.994
Dudgeon Extension and Sheringham Shoal Extension	5.7	0.3	6.0	3	Royal HaskoningDHV (2023b)	0.994	Not required
East Anglia ONE North	4.4	1.4	6.0	3	Royal HaskoningDHV (2023b)	0.995	0.994
East Anglia Three	5.5	41.3	46.8	3	Royal HaskoningDHV (2023b)	0.995	0.994
East Anglia TWO	4.2	4.1	8.3	3	Royal HaskoningDHV (2023b)	0.995	0.994
ForthWind Offshore Wind Demonstration Project - phase 1	-	-	-	3	HiDef (2022e)	-	-
Green Volt	0.1	6.9	7.0	3	APEM (2023a)	0.994	Not required
Hornsea Four	1.0	10.6	11.5	3	APEM (2022d)	0.995	0.994
Hornsea Three	9.6	33.6	43.2	3	Royal HaskoningDHV (2023b)	0.995	0.994
Inch Cape	0.0	44.2	44.2	3	Royal HaskoningDHV (2023b)	0.995	0.994
Norfolk Boreas	8.3	34.4	42.7	3	Royal HaskoningDHV (2023b)	0.995	0.994
Norfolk Vanguard	5.4	25.8	31.2	3	Royal HaskoningDHV (2023b)	0.995	0.994
Pentland Floating Offshore Wind Farm	-	-	-	3	HiDef (2022d)	-	-
Totals consented	**220.1**	**946.5**	**1,166.7**	**-**	**-**	**-**	**-**

Development	Predicted Collision Mortalities			Tier	Source	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Non-breeding	Annual				
Berwick Bank	-	-	-	4	Pelagica and Cork Ecology (2022)	-	-
Dogger Bank South	0.6	2.7	3.4	4	RWE (2024b)	0.994	Not required
Five Estuaries	0.7	1.2	1.8	4	MacArthur Green (2024a)	0.994	Not required
North Falls	0.0	3.0	3.0	4	Royal HaskoningDHV (2024d)	0.9939	Not required
Ossian	-	-	-	4	RPS (2024)	-	-
Outer Dowsing	0.5	3.4	4.0	4	GoBe (2024b)	0.994	Not required
Salamander	0.0	3.0	3.0	4	ERM (2024b)	0.994	Not required
West of Orkney	0.8	11.1	11.9	4	MacArthur Green (2024b)	0.9939	Not required
Dogger Bank D	0.0	0.4	0.4	4	-	0.994	Not required
Total All Projects	**222.8**	**971.4**	**1,194.2**	**-**	**-**		

Table 13-69 Great Black-Backed Gull Bio-Season Cumulative Collision Estimates and Increase in Baseline Mortality

Bio-season (months)	Projects Included	Mean collisions	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
			Population	Baseline mortality	
Breeding (April – August)	DBD plus all consented	220.1	25,917	2,511	8.764
	All projects	222.8			8.870
Non-breeding (September – March)	DBD plus all consented	946.9	91,398	8,856	10.692
	All projects	971.4			10.968
Annual (BDMPS)	DBD plus all consented	1,167.1	91,398	8,856	13.178
	All projects	1,194.2			13.484
Annual (Biogeographic)	DBD plus all consented	1,167.1	235,000	22,772	5.125
	All projects	1,194.24			5.244

13.8.3.2.3 Herring Gull

13.8.3.2.3.1. Receptor Sensitivity

554. Herring gull has an overall sensitivity of **medium** as detailed in the main assessment of effect section (**Section 13.6.4**).

13.8.3.2.3.2. Potential Magnitude of Impact

555. During the breeding bio-season, a total of 526 (525.5) herring gulls may be subject to mortality (**Table 13-70**). The BDMPS population for the breeding bio-season (**Table 13-24**) is 324,887 individuals and using the average baseline mortality rate of 0.1724 (**Table 13-25**), the natural predicted mortality in the breeding bio-season is 56,011 individuals. Therefore, the addition of 526 individual mortalities would represent an increase in mortality relative to the baseline mortality of 0.938% (**Table 13-71**).

556. During the breeding bio-season the Project does not contribute to the level of impact predicted. Therefore, there is no potential for a cumulative effect during the breeding bio-season.

557. During the non-breeding bio-season, a total of 491 (491.0) herring gulls may be subject to mortality (**Table 13-70**). The BDMPS population for the non-breeding bio-season (**Table 13-24**) is 466,510 individuals and using the average baseline mortality rate of 0.1724 (**Table 13-25**), the natural predicted mortality in the non-breeding bio-season is 80,426. Therefore, the addition of 491 individual mortalities would represent an increase in mortality relative to the baseline mortality of 0.611% (**Table 13-71**).

558. During the breeding bio-season, as discussed and agreed during the ETG2 meeting held on the 21st of October 2024 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**), the Project predicted level of impact of a single (1.2) individual is not expected to materially contribute to the cumulative level of impact. Therefore, a conclusion of **negligible** magnitude during the non-breeding bio-season is concluded.

559. The annual cumulative total of herring gulls subject to mortality due to collision is estimated to be 1,017 (1,016.5) individuals. Using the largest BDMPS population of 466,510 (**Table 13-24**), as a proxy for the annual BDMPS population, the addition of 1,017 predicted mortalities would increase baseline mortality by 1.264% (**Table 13-71**).

560. The annual contribution of the Project is a single bird per annum which is not expected to materially contribute to the cumulative total of herring gull mortality due to collision impacts. Upon discussion with Natural England at the ETG2 meeting held on the 21st of October 2024 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**), it was decided that an audit trail be provided for herring gull to aid future assessments, hence why the assessment has been provided here. Therefore, for the Project, the level of cumulative impact annually is considered to be **negligible** magnitude.

13.8.3.2.3.1. Significance of Effect

561. Overall, it is predicted that the sensitivity of the receptor is **medium** and magnitude of the annual impact has been determined to be **negligible** cumulatively. Therefore, the significance of the effect would be **minor adverse** at most regardless of the sensitivity of herring gulls, which can be concluded as **not significant** in EIA terms.

Table 13-70 Herring Gull Cumulative Bio-Season and Total Collision Mortality Estimates

Development	Predicted Collision Mortalities			Tier	Source	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Non-breeding	Annual				
Beatrice	59.3	236.9	296.2	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Beatrice Demonstrator	0.0	0.0	0.0	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Blyth Demonstration Site	0.6	2.6	3.2	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Dudgeon	-	-	-	1	MacArthur Green & Royal HaskoningDHV (2021b)	-	-
East Anglia One	0.0	22.8	22.8	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
EOWDC	5.8	0.0	5.8	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Galloper	32.6	0.0	32.6	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Greater Gabbard	0.0	0.0	0.0	1	MacArthur Green & Royal HaskoningDHV (2021b)	-	-
Gunfleet Sands	-	-	-	1	MacArthur Green & Royal HaskoningDHV (2021b)	-	-
Hornsea Project One	3.5	13.9	17.4	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Hornsea Project Two	28.6	0.0	28.6	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Humber Gateway	0.5	1.3	1.8	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Hywind Scotland Pilot Park	0.7	9.4	10.1	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Kentish Flats	0.0	0.0	0.0	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Kentish Flats Extension	0.6	2.0	2.6	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Kincardine	1.2	0.0	1.2	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Lincs & LID	0.0	0.0	0.0	1	MacArthur Green & Royal HaskoningDHV (2021b)	-	-
London Array	-	-	-	1	MacArthur Green & Royal HaskoningDHV (2021b)	-	-
Methil	7.0	4.4	11.4	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Moray East	62.4	0.0	62.4	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Race Bank	0.0	0.0	0.0	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Rampion	186.0	0.0	186.0	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994

Development	Predicted Collision Mortalities			Tier	Source	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Non-breeding	Annual				
Scroby Sands	-	-	-	1	MacArthur Green & Royal HaskoningDHV (2021b)	-	-
Sheringham Shoal	0.0	0.0	0.0	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Teesside	10.4	41.4	51.8	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Thanet	5.9	23.5	29.4	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Triton Knoll	0.0	0.0	0.0	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Westermost Rough	0.1	0.0	0.1	1	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Dogger Bank C and Sofia	0.0	0.0	0.0	2	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Moray West	14.4	1.2	15.6	2	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Neart na Gaoithe	2.4	4.8	7.2	2	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Seagreen Phase 1 and 1A	6.5	19.9	26.4	2	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Dogger Bank A and B	0.0	0.0	0.0	3	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Dudgeon Extension and Sheringham Shoal Extension	0.3	0.0	0.3	3	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
East Anglia ONE North	0.0	0.0	0.0	3	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
East Anglia Three	0.0	27.6	27.6	3	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
East Anglia TWO	0.0	0.6	0.6	3	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
ForthWind Offshore Wind Demonstration Project - phase 1	0.0	0.0	0.0	3	HiDef (2022e)	0.990 (BO3)	-
Green Volt	0.1	5.8	5.8	3	APEM (2023a)	0.994	-
Hornsea Four	1.4	0.8	2.2	3	APEM (2021)	0.995	0.994
Hornsea Three	1.2	4.8	6.0	3	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Inch Cape	1.2	3.6	4.8	3	Royal HaskoningDHV (2024d)	0.995	0.994
Norfolk Boreas	1.8	6.5	8.3	3	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994
Norfolk Vanguard	0.5	8.5	9.0	3	MacArthur Green & Royal HaskoningDHV (2021b)	0.995	0.994

Development	Predicted Collision Mortalities			Tier	Source	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Non-breeding	Annual				
Pentland Floating Offshore Wind Farm	0.0	0.0	0.0	3	HiDef (2022d)	0.990 (BO3)	-
Totals consented	**434.8**	**442.4**	**877.3**	**-**	**-**		
Berwick Bank	52.0	8.5	60.5	4	Pelagica and Cork Ecology (2022)	0.995	0.994
Dogger Bank South	0.8	1.4	2.2	4	RWE (2024b)	0.994	-
Five Estuaries	0.4	1.0	1.4	4	MacArthur Green (2024a)	0.994	-
North Falls	0.7	0.0	0.7	4	Royal HaskoningDHV (2024d)	0.9939	-
Ossian	0.0	2.7	2.7	4	RPS (2024)	0.9939	-
Outer Dowsing	2.3	0.7	2.9	4	GoBe (2024b)	0.994	-
Rampion 2	34.5	28.1	62.6	4	APEM (2023c)	0.994	-
Salamander	0.0	5.0	5.0	4	ERM (2024b)	0.994	-
West of Orkney	-	-	-	4	MacArthur Green (2024b)	-	-
Dogger Bank D	0.0	1.2	1.2	4	-	0.994	-
Total All Projects	**525.5**	**491.0**	**1,016.5**	**-**	**-**		

Table 13-71 Herring Gull Bio-Season Cumulative Collision Estimates and Increase in Baseline Mortality

Bio-season (months)	Projects Included	Mean collisions (individuals per annum)	Regional baseline populations and baseline mortality rates		Increase in baseline mortality (%)
			Population (individuals)	Baseline mortality (individuals per annum)	
Breeding (April – August)	DBD plus all consented	343.8	324,887	56,011	0.614
	All projects	525.5			0.938
Non-breeding (September – March)	DBD plus all consented	443.6	466,510	80,426	0.552
	All projects	491.0			0.611
Annual (BDMPS)	DBD plus all consented	878.5	466,510	80,426	1.092
	All projects	1,016.5			1.264
Annual (Biogeographic)	DBD plus all consented	878.5	1,098,000	189,295	0.464
	All projects	1,016.5			0.537

13.8.3.2.4 Lesser Black-Backed Gull

13.8.3.2.4.1. Receptor Sensitivity

562. Lesser black-backed gull has an overall sensitivity of **medium** as detailed in the main assessment of effect section (**Section 13.6.4**).

13.8.3.2.4.2. Potential Magnitude of Impact

563. During the breeding bio-season, a total of 229 (229.1) lesser black-backed gulls may be subject to mortality (**Table 13-72**). The BDMPS population for the breeding bio-season (**Table 13-24**) is 51,233 individuals and using the average baseline mortality rate of 0.1237 (**Table 13-25**), the natural predicted mortality in the breeding bio-season is 6,338 individuals. Therefore, the addition of 229 individual mortalities would represent an increase in mortality relative to the baseline mortality of 3.616% **(Table 13-73**).

564. Despite the predicted impact exceeding a 1% baseline mortality rate increase during the breeding bio-season, as discussed and agreed during the ETG2 meeting held on the 21st of October 2024 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**), the Project predicted level of impact of less than a single (0.9) individual is not expected to materially contribute to the cumulative level of impact. Therefore, a conclusion of **negligible** magnitude during the breeding bio-season is concluded.

565. Due to limitations in available collision risk data for seasonal splits of the non-breeding bio-season, all impacts during the non-breeding bio-seasons are assessed as one. During the non-breeding bio-season, a total of 424 (424.3) lesser black-backed gulls may be subject to mortality (**Table 13-72**). Using the largest BDMPS population for the migration and winter bio-seasons of 209,006 (**Table 13-24)** as a proxy for the non-breeding BDMPS population, (**Table 13-24**), with an average baseline mortality rate of 0.1237 (**Table 13-25**), the natural predicted mortality in the non-breeding bio-season is 25,854. Therefore, the addition of 424 individual mortalities would represent an increase in mortality relative to the baseline mortality of 1.641% **(Table 13-73**).

566. Despite the predicted impact exceeding a 1% baseline mortality rate increase during the non-breeding bio-season, the Project does not contribute to the level of impact predicted. Therefore, there is no potential for a cumulative effect during the non-breeding bio-season.

567. The annual cumulative total of lesser black-backed gulls subject to mortality due to collision is estimated to be 654 (653.5) individuals. However, the total annual contribution from the Project is less than a single (0.9) individual (**Table 13-72**). Using the largest BDMPS population of 209,006 (**Table 13-24**), as a proxy for the annual BDMPS population, the addition of 654 predicted mortalities would increase baseline mortality by 2.528% **(Table 13-73**).

568. The annual contribution of the Project is less than a single bird per annum which is not expected to materially contribute to the cumulative total of lesser black-backed gull mortality due to collision impacts. Upon discussion with Natural England at the ETG2 meeting held on the 21st of October 2024 (see **Volume 2, Appendix 13.1 Consultation for Offshore and Intertidal Ornithology**), it was decided that an audit trail be provided for lesser black-backed gull to aid future assessments, hence why the assessment has been provided here. Therefore, for the Project, the level of cumulative impact annually is considered to be **negligible** magnitude.

13.8.3.2.4.1. Significance of Effect

569. Overall, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of the annual impact has been determined to be **negligible** cumulatively. Therefore, the significance of the effect would be **minor adverse** at most regardless of the sensitivity of lesser black-backed gulls, which can be concluded as **not significant** in EIA terms.

Table 13-72 Lesser Black-Backed Gull Cumulative Bio-Season and Total Collision Mortality Estimates

Development	Predicted Collision Mortalities			Tier	Source	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Non-breeding	Annual				
Beatrice	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Beatrice Demonstrator	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Blyth Demonstration Site	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Dudgeon	9.2	36.7	46.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
East Anglia One	7.1	40.6	47.6	1	Royal HaskoningDHV (2023b)	0.995	0.994
EOWDC	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Galloper	33.4	133.2	166.6	1	Royal HaskoningDHV (2023b)	0.995	0.994
Greater Gabbard	7.4	29.8	37.2	1	Royal HaskoningDHV (2023b)	0.99	0.994
Gunfleet Sands	0.6	0.0	0.6	1	Royal HaskoningDHV (2023b)	0.99	0.994
Hornsea Project One	5.3	20.9	26.2	1	Royal HaskoningDHV (2023b)	0.995	0.994
Hornsea Project Two	2.4	2.4	4.8	1	Royal HaskoningDHV (2023b)	0.995	0.994
Humber Gateway	0.4	1.3	1.7	1	Royal HaskoningDHV (2023b)	0.995	0.994
Hywind Scotland Pilot Park	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Kentish Flats	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Kentish Flats Extension	0.4	1.6	1.9	1	Royal HaskoningDHV (2023b)	0.995	0.994
Kincardine	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Lincs & LID	2.0	8.2	10.2	1	Royal HaskoningDHV (2023b)	0.995	0.994
London Array	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Methil	0.5	0.0	0.5	1	Royal HaskoningDHV (2023b)	-	-
Moray East	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Race Bank	51.8	13.0	64.8	1	Royal HaskoningDHV (2023b)	0.995	0.994
Rampion	1.9	7.6	9.5	1	Royal HaskoningDHV (2023b)	0.995	0.994

Development	Predicted Collision Mortalities			Tier	Source	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Non-breeding	Annual				
Scroby Sands	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Sheringham Shoal	2.0	7.9	10.0	1	Royal HaskoningDHV (2023b)	0.995	0.994
Teesside	-	-	-	1	Royal HaskoningDHV (2023b)	-	-
Thanet	3.8	15.4	19.2	1	Royal HaskoningDHV (2023b)	0.995	0.994
Triton Knoll	8.9	35.5	44.4	1	Royal HaskoningDHV (2023b)	0.995	0.994
Westermost Rough	0.1	0.4	0.5	1	Royal HaskoningDHV (2023b)	0.995	0.994
Dogger Bank C and Sofia	2.9	11.5	14.4	2	Royal HaskoningDHV (2023b)	0.995	0.994
Moray West	1.2	0.0	1.2	2	Royal HaskoningDHV (2023b)	-	-
Neart na Gaoithe	2.5	10.1	12.6	2	GoBe (2018)	0.995	0.994
Seagreen Phase 1 and 1A	-	-	-	2	Royal HaskoningDHV (2023b)	0.995	0.994
Dogger Bank A and B	3.1	12.5	15.6	3	Royal HaskoningDHV (2023b)	0.995	0.994
Dudgeon Extension and Sheringham Shoal Extension	1.9	0.3	2.2	3	Royal HaskoningDHV (2023b)	0.994	-
East Anglia ONE North	1.1	0.7	1.8	3	Royal HaskoningDHV (2023b)	0.995	0.994
East Anglia Three	2.2	9.8	12.0	3	Royal HaskoningDHV (2023b)	0.995	0.994
East Anglia TWO	5.0	0.6	5.6	3	Royal HaskoningDHV (2023b)	0.995	0.994
ForthWind Offshore Wind Demonstration Project - phase 1	0.0	0.0	0.0	3	Royal HaskoningDHV (2023b)	0.989 (BO3)	0.994
Green Volt	-	-	-	3	APEM (2023a)	-	-
Hornsea Four	0.9	0.2	1.1	3	APEM (2022d)	0.995	0.994
Hornsea Three	9.6	1.2	10.8	3	Royal HaskoningDHV (2023b)	0.995	0.994
Inch Cape	-	-	-	3	Royal HaskoningDHV (2023b)	-	-
Norfolk Boreas	7.4	9.7	17.2	3	Royal HaskoningDHV (2023b)	0.995	0.994
Norfolk Vanguard	10.1	4.3	14.4	3	Royal HaskoningDHV (2023b)	0.995	0.994

Development	Predicted Collision Mortalities			Tier	Source	Original Avoidance Rate	Updated Avoidance Rate
	Breeding	Non-breeding	Annual				
Pentland Floating Offshore Wind Farm	-	-	-	3	HiDef (2022d)	-	-
Totals consented	**185.2**	**415.2**	**600.4**	**-**	**-**		
Berwick Bank	7.6	0.0	7.6	4	Pelagica and Cork Ecology (2022)	0.995	0.994
Dogger Bank South	1.2	0.0	1.2	4	RWE (2024b)	0.994	-
Five Estuaries	24.0	3.7	27.8	4	MacArthur Green (2024a)	0.994	-
North Falls	6.4	2.1	8.5	4	Royal HaskoningDHV (2024d)	0.9939	-
Ossian	0.3	0.0	0.3	4	RPS (2024)	0.9939	-
Outer Dowsing	2.0	0.4	2.4	4	GoBe (2024b)	0.994	-
Rampion 2	1.5	2.9	4.4	4	APEM (2023c)	0.994	-
Salamander	-	-	-	4	ERM (2024b)	-	-
West of Orkney	-	-	-	4	MacArthur Green (2024b)	-	-
Dogger Bank D	0.9	0.0	0.9	4	-	0.994	-
Total All Projects	**229.1**	**424.3**	**653.5**	**-**	**-**		

Table 13-73 Lesser Black-Backed Gull Bio-Season Cumulative Collision Estimates and Increase in Baseline Mortality

Bio-season (months)	Projects Included	Mean collisions (individuals per annum)	Regional baseline populations and baseline mortality rates		Increase in baseline mortality (%)
			Population (individuals)	Baseline mortality (individuals per annum)	
Breeding (April – August)	DBD plus all consented	186.1	51,233	6,338	2.936
	All projects	229.2			3.616
Non-breeding (September – March)	DBD plus all consented	415.2	209,006	25,854	1.606
	All projects	424.3			1.641
Annual (BDMPS)	DBD plus all consented	601.3	209,006	25,854	2.326
	All projects	653.5			2.528
Annual (Biogeographic)	DBD plus all consented	601.3	864,000	106,877	0.563
	All projects	653.5			0.611

13.8.3.2.5 Gannet

13.8.3.2.5.1. Receptor Sensitivity

570. Gannet has an overall sensitivity of **medium** as detailed in the main assessment of effect section (**Section 13.6.4**).

13.8.3.2.5.2. Potential Magnitude of Impact

571. During the return migration bio-season, a total of 57 (57.0) gannets may be subject to mortality (**Table 13-74**). The BDMPS population for the return migration bio-season (**Table 13-24**) is 248,385 individuals and using the average baseline mortality rate of 0.1866 (**Table 13-25**), the natural predicted mortality in the return migration bio-season is 46,349 individuals. Therefore, the addition of 57 individual mortalities would represent an increase in mortality relative to the baseline mortality of 0.123% (**Table 13-75**).

572. This level of potential cumulative impact is considered to be of **low** magnitude during the return migration bio-season, as it represents only a slight difference to the baseline conditions.

573. During the breeding bio-season, a total of 763 (762.7) gannets may be subject to mortality (**Table 13-74**). The BDMPS population for the breeding bio-season (**Table 13-24**) is 400,326 individuals and using the average baseline mortality rate of 0.1866 (**Table 13-25**), the natural predicted mortality in the breeding bio-season is 74,701 individuals. Therefore, the addition of 763 individual mortalities would represent an increase in mortality relative to the baseline mortality of 1.021% (**Table 13-75**).

574. This level of potential cumulative impact is considered to be of **medium** magnitude during the breeding bio-season, as it represents an increase to baseline mortality of over 1%.

575. During the post-breeding migration bio-season, a total of 173 (172.7) gannets may be subject to mortality (**Table 13-74**). The BDMPS population for the post-breeding migration bio-season (**Table 13-24**) is 456,299 individuals and using the average baseline mortality rate of 0.1866 (**Table 13-25**), the natural predicted mortality in the post-breeding migration bio-season is 85,145. Therefore, the addition of 173 individual mortalities would represent an increase in mortality relative to the baseline mortality of 0.203% (**Table 13-75**).

576. This level of potential cumulative impact is considered to be of **low** magnitude during the post-breeding migration bio-season, as it represents only a slight difference to the baseline conditions.

577. The annual cumulative total of gannets subject to mortality due to collision is estimated to be 993 (992.5) individuals. However, the total annual contribution from the Project is only six (6.0) individuals (**Table 13-74**). Using the largest BDMPS population of 456,299 (**Table 13-24**), as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.1866, the natural predicted mortality is 85,145 individuals per annum. The addition of 993 predicted mortalities would increase baseline mortality by 1.166% (**Table 13-75**).

578. This level of cumulative impact annually is considered to be of **medium** magnitude, as it represents an increase to baseline mortality of over 1%.

13.8.3.2.5.3. Significance of Effect

579. Overall, it is predicted that the sensitivity of the receptor is **medium** and the magnitude of the annual impact has been determined to be **medium** cumulatively. Therefore, the significance of the effect would be **moderate adverse**, which can be concluded as **significant** in EIA terms.

13.8.3.2.5.4. Further Mitigation

580. Further investigation of the population consequences posed cumulatively will be undertaken to inform the final conclusions within the ES utilising PVA analysis as per Natural England's best practice guidance (Parker *et al.*, 2022c), with the aim of eventually concluding a **not significant** cumulative impact. In addition engagement with SNCBs through ETG2 meetings will take place to discuss whether there is further feasible mitigation required.

Table 13-74 Gannet Cumulative Bio-Season and Total Collision Mortality Estimates

Development	Predicted Collision Mortalities				Tier	Source	Modelling Approach	Original Avoidance Rate	Updated Avoidance Rate	Macro-avoidance Included
	Breeding	Post-breeding migration	Return migration	Annual						
Beatrice	26.2	10.2	2.0	38.4	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Beatrice Demonstrator	0.4	0.2	0.1	0.8	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Blyth Demonstration Site	0.7	0.4	0.6	1.8	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Dudgeon	4.7	8.2	4.0	16.9	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
East Anglia One	0.7	27.5	1.3	29.5	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
EOWDC	2.9	1.1	0.0	4.0	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Galloper	3.8	6.5	2.6	12.9	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Greater Gabbard	2.9	1.8	1.0	5.8	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Gunfleet Sands	-	-	-	-	1	Royal HaskoningDHV (2023b)	Deterministic	-	-	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Hornsea Project One	2.4	6.7	4.7	13.9	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance

Development	Predicted Collision Mortalities				Tier	Source	Modelling Approach	Original Avoidance Rate	Updated Avoidance Rate	Macro-avoidance Included
	Breeding	Post-breeding migration	Return migration	Annual						
Hornsea Project Two	1.5	2.9	1.3	5.7	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Humber Gateway	0.4	0.2	0.3	0.9	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Hywind Scotland Pilot Park	3.9	0.2	0.2	4.3	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Kentish Flats	0.3	0.2	0.2	0.7	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Kentish Flats Extension	-	-	-	-	1	Royal HaskoningDHV (2023b)	Deterministic	-	-	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Kincardine	2.1	0.0	0.0	2.1	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Lincs & LID	0.5	0.3	0.4	1.2	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
London Array	0.5	0.3	0.4	1.2	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Methil	1.3	0.0	0.0	1.3	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Moray East	56.4	7.4	1.9	65.7	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Race Bank	23.6	2.5	0.9	26.9	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance

Development	Predicted Collision Mortalities				Tier	Source	Modelling Approach	Original Avoidance Rate	Updated Avoidance Rate	Macro-avoidance Included
	Breeding	Post-breeding migration	Return migration	Annual						
Rampion	7.6	13.3	0.4	21.4	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Scroby Sands	-	-	-	-	1	Royal HaskoningDHV (2023b)	Deterministic	-	-	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Sheringham Shoal	3.0	0.7	0.0	3.7	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Teesside	1.0	0.4	0.0	1.4	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Thanet	0.2	0.0	0.0	0.2	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Triton Knoll	5.6	13.5	6.3	25.4	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Westermost Rough	0.0	0.0	0.0	0.1	1	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Dogger Bank C and Sofia	3.1	2.1	2.3	7.5	2	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Moray West	7.0	0.4	0.2	7.6	2	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Neart na Gaoithe	62.3	1.5	1.5	65.2	2	Royal HaskoningDHV (2024d)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Seagreen Phase 1 and 1A	207.1	3.0	1.5	211.5	2	Royal HaskoningDHV (2024d)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance

Development	Predicted Collision Mortalities				Tier	Source	Modelling Approach	Original Avoidance Rate	Updated Avoidance Rate	Macro-avoidance Included
	Breeding	Post-breeding migration	Return migration	Annual						
Dogger Bank A and B	17.0	17.5	11.4	46.0	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Dudgeon Extension and Sheringham Shoal Extension	0.4	0.6	0.0	1.1	3	Royal HaskoningDHV (2023b)	Deterministic	0.992	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
East Anglia ONE North	2.6	2.3	0.2	5.1	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
East Anglia Three	1.3	7.0	2.0	10.3	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
East Anglia TWO	2.6	4.9	0.8	8.3	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
ForthWind Offshore Wind Demonstration Project - phase 1	1.0	0.0	0.0	1.0	3	HiDef (2022e)	Deterministic	0.98	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Green Volt	14.9	0.1	0.7	15.7	3	APEM (2023a)	Stochastic	0.993	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Hornsea Four	3.0	1.0	0.3	4.3	3	APEM (2021)	Stochastic	0.989	0.9929	No - 70% macro avoidance rate already included for all bio-seasons
Hornsea Three	2.1	1.1	0.8	4.0	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Inch Cape	75.6	1.1	0.8	77.5	3	Royal HaskoningDHV (2024d)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Norfolk Boreas	3.0	2.7	0.8	6.4	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance

Development	Predicted Collision Mortalities				Tier	Source	Modelling Approach	Original Avoidance Rate	Updated Avoidance Rate	Macro-avoidance Included
	Breeding	Post-breeding migration	Return migration	Annual						
Norfolk Vanguard	1.7	3.9	1.1	6.7	3	Royal HaskoningDHV (2023b)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to all bio-seasons to conform with English guidance
Pentland Floating Offshore Wind Farm	1.4	0.0	0.0	1.4	3	HiDef (2022d)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Totals consented	**558.9**	**153.7**	**53.3**	**765.9**	**-**	**-**				
Berwick Bank	119.0	3.8	0.6	123.4	4	Pelagica and Cork Ecology (2022)	Deterministic	0.989	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Dogger Bank South	8.3	3.7	0.3	12.2	4	RWE (2024b)	Stochastic	0.998	0.9929	No - 70% macro avoidance rate already included for all bio-seasons
Five Estuaries	1.3	1.5	0.2	3.0	4	MacArthur Green (2024a)	Stochastic	0.9979	0.9929	No - 70% macro avoidance rate already included for all bio-seasons, incorporated within avoidance rate
North Falls	0.6	0.9	0.6	2.1	4	Royal HaskoningDHV (2024d)	Stochastic	0.993	0.9929	No - 70% macro avoidance rate already included for all bio-seasons
Ossian	28.2	1.1	0.1	29.4	4	RPS (2024)	Stochastic	0.993	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Outer Dowsing	1.1	0.4	0.1	1.5	4	GoBe (2024b)	Stochastic	0.993	0.9929	No - 70% macro avoidance rate already included for all bio-seasons
Rampion 2	2.9	1.4	0.6	4.9	4	APEM (2023c)	Stochastic	0.993	0.9929	No - 70% macro avoidance rate already included for all bio-seasons
Salamander	5.2	0.5	0.2	5.8	4	ERM (2024b)	Stochastic	0.993	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
West of Orkney	35.3	2.3	0.6	38.2	4	MacArthur Green (2024b)	Stochastic	0.9928	0.9929	Yes 70% macro-avoidance rate applied to non-breeding bio-seasons to conform with Scottish guidance
Dogger Bank D	2.0	3.5	0.5	6.0	4	-	Stochastic	0.9929	-	No - 70% macro avoidance rate already included for all bio-seasons

Development	Predicted Collision Mortalities				Tier	Source	Modelling Approach	Original Avoidance Rate	Updated Avoidance Rate	Macro-avoidance Included
	Breeding	Post-breeding migration	Return migration	Annual						
Total All Projects	**762.7**	**172.7**	**57.0**	**992.5**	-	-				

Table 13-75 Gannet Bio-Season Cumulative Collision Estimates and Increase in Baseline Mortality

Bio-season (months)	Projects Included	Mean collisions (individuals per annum)	Regional baseline populations and baseline mortality rates		Increase in baseline mortality (%)
			Population (individuals)	Baseline mortality (individuals per annum)	
Breeding (March – September)	DBD plus all consented	560.9	400,326	74,701	0.751
	All projects	762.7			1.021
Post-breeding migration (October – November)	DBD plus all consented	157.2	456,299	85,145	0.185
	All projects	172.7			0.203
Return migration (December – February)	DBD plus all consented	53.8	248,385	46,349	0.116
	All projects	57.0			0.123
Annual (BDMPS)	DBD plus all consented	771.9	456,299	85,145	0.907
	All projects	992.5			1.166
Annual (Biogeographic)	DBD plus all consented	771.9	1,180,000	220,188	0.351
	All projects	992.5			0.451

13.8.3.3 Cumulative Impact 3: Combined Operational Disturbance and Displacement Collision Risk

13.8.3.3.1 Gannet

581. Due to gannet being scoped in for both displacement and collision risk assessments during the operation and maintenance phase, there is potential for these two impacts to cumulatively adversely affect gannet populations when combined. Previous sections have concluded **low** to **medium** predicted magnitudes of impact with respect to collision risk (**Section 13.7.2.4.6**) or displacement (**Section 13.7.2.3.9**) cumulatively.

582. It is recognised that assessing these two potential impacts together amounts to double counting, as birds that are subject to displacement would not be subject to potential collision risk as they are already assumed to have not entered the Array Area. Equally, birds estimated to be subject to collision risk mortality would not be able to be subjected to consequent displacement mortality. As a more refined method to consider displacement and collision together whilst reducing any double counting of impacts is not agreed with SNCBs the precautionary and highly unlikely approach of simply adding both impacts together is presented in this assessment.

13.8.3.3.1.1. Receptor Sensitivity

583. Gannet has an overall sensitivity of **medium** as detailed in the main assessment of effect section (**Section 13.6.4**).

13.8.3.3.1.2. Cumulative Impact Magnitude

584. As detailed in **Table 13-65** and **Table 13-74**, following the Applicant’s approach to displacement impact assessment, the combined predicted cumulative mortality in the O&M phase (displacement and collision risk) equates to between 1,399 (1,399.2) and 1,535 (1,534.8) predicted additional mortalities per annum (**Table 13-76**). Using the largest BDMPS population of 456,299 (**Table 13-24**), as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.1866 (**Table 13-25**), the natural predicted mortality is 85,145 individuals per annum. The addition of 1,399 to 1,535 predicted mortalities would increase baseline mortality by 1.643% – 1.803% of the annual BDMPS population (**Table 13-76**).

585. This level of cumulative impact annually is considered to be of **medium** magnitude, as it represents an increase to baseline mortality of over 1%.

13.8.3.3.1.1. Effect Significance

586. Overall, the species sensitivity is **medium** following the matrix approach (**Table 13-12**) and the magnitude of impact is **medium** cumulatively. Therefore, the potential significance of effect from displacement combined with collision risk on gannets has been determined to be **moderate adverse** following the matrix approach (**Table 13-15**) which is **significant** in EIA terms.

13.8.3.3.1.2. Additional Mitigation and Residual Cumulative Effect

587. Further investigation of the SNCB approach population consequences will be undertaken to inform the final conclusions within the ES utilising PVA analysis as per Natural England’s best practice guidance (Parker *et al*., 2022c). The Project will also seek engagement post-PEIR through the ETG2 to further refine the appropriateness and most likely level of effect in relation to the SNCB range approach.

Table 13-76 Gannet Bio-Season Combined Displacement and Collision Mortality Estimates Cumulatively with Other Projects

Bio-season (months)	Projects included	Regional Baseline Populations and Baseline Mortality Rates (individuals per annum)		Estimated Number of Gannets Subject to Mortality		Increase in Baseline Mortality (%)	
		Population	Baseline Mortality	60 - 80% Disp; 1% Mort + CRM	60 - 80% Disp; 10% Mort + CRM	60 - 80% Disp; 1% Mort + CRM	60 - 80% Disp; 10% Mort + CRM
Breeding (June – August)	DBD plus all consented	400,326	74,701	691.5 – 735.0	1,866 – 2,301.6	0.926 – 0.984	2.499 – 3.081
	All projects			952.9 – 1,016.4	2,665.2 – 3,299.3	1.276 – 1.361	3.658 – 4.417
Post-breeding migration (October-November)	DBD plus all consented	456,299	85,145	290.5 – 334.9	1,490.0 – 1,934.2	0.341 – 0.393	1.750 – 2.272
	All projects			348.7 – 407.3	1,932.2 – 2,518.6	0.410 – 0.478	2.269 – 2.958
Return migration (December – February)	DBD plus all consented	248,385	46,349	87.4 – 98.6	389.7 – 501.6	0.189 – 0.213	0.841 – 1.082
	All projects			97.6 – 111.1	462.6 – 597.7	0.211 – 0.240	0.998 – 1.290
Annual (BDMPS)	DBD plus all consented	456,299	85,145	1,069.3 – 1,168.5	3,746.1 – 4,737.5	1.256 – 1.372	4.400 – 5.564
	All projects			1,399.2 – 1,534.8	5,059.8 – 6,415.6	1.643 – 1.803	5.943 – 7.535
Annual (Biogeographic)	DBD plus all consented	1,180,000	220,188	1,069.3 – 1,168.5	3,746.1 – 4,737.5	0.486 – 0.531	1.701 – 2.152
	All projects			1,399.2 – 1,534.8	5,059.8 – 6,415.6	0.635 – 0.697	2.298 – 2.914

13.9 Transboundary Effects

588. Transboundary effects arise when impacts from a development within one EEA state affects the environment of other EEA states.

589. Transboundary impacts upon avian receptors, seaward of the MHWS are possible due to the wide foraging and migratory ranges of typical bird species in the North Sea. In addition, a number of bird species that have been recorded during previous surveys include those that are listed as qualifying features of European Sites in other EEA States. The key bird species present in the Array Area based on the results of the desk study and aerial digital survey data presented in **Volume 2, Appendix 13.2 Offshore Ornithology Baseline Characterisation Report** include great northern diver, gannet, kittiwake, great black-backed gull, herring gull, lesser black backed gull, guillemot, razorbill, and puffin.

590. The key direct potential impacts and effects for avian receptors are predicted to arise during the operation and maintenance phase as a result of potential collisions (with rotating wind turbine blades which may result in direct mortality of individuals) and disturbance and displacement (caused by the physical presence of structures which may displace birds or prevent transit of birds between foraging and breeding sites, or on migration, respectively).

591. Based on the location of the Project and the key receptor and impact pathways identified, potential connectivity between non-UK breeding seabirds is considered limited based on species mean max plus one standard deviation foraging ranges (Woodward *et al*., 2019), leading to no potential for a significant effect to occur during the breeding bio-season, as concluded within the Project's HRA Screening report (Royal HaskoningDHV, 2024c).

592. During the non-breeding bio-seasons, key receptors are no longer limited in their foraging range and therefore non-UK seabirds may interact with the Project. When considering the overall small proportion of non-UK birds expected to be within the North Sea BDMPS as defined in Furness (2015), the level of effect which would be apportioned to each EEA state seabird population can be confidently concluded as **not significant**.

593. If the Project were to consider OWF projects outside of UK waters within cumulative assessments, the reference populations that are usually assessed against (Furness 2015) would be superseded for a larger North Sea population to account for population connectivity of non-UK projects. With this shift to a larger assessment population, the relative scale of impact from the Project would further reduce in comparison to an assessment against only UK North Sea project impacts. As part of the Strategic Environmental Assessment North Seas Energy (SEANSE) program, displacement and collision risk assessment scenarios were carried out for OWF projects within Belgium, Denmark, France, Germany, the Netherlands and the UK (Leemans *et al*., 2019). This assessment highlighted that UK projects produce the highest collision mortalities and displacement mortalities, for the modelled species, within the North Sea. Therefore, maintaining an assessment focussed on UK projects and the UK North Sea and Channel BDMPS is most appropriate and precautionary for cumulative assessment. Recent OWF project North Falls (RHDHV, 2024b) and Dogger Bank South (RWE, 2024a) have also concluded that due to this scale shift in assessment, transboundary assessment should not be taken forward.

594. A HRA screening exercise for Ramsar sites with intertidal and ornithological features was conducted for the Project (Royal HaskoningDHV, 2024c). All sites were screened out on the basis that there was no potential for LSE for the ornithological features of non-UK designated sites in relation to the Project. This is further justification as to why transboundary effects have not been considered further in this PEIR.

13.10 In-Combination Effects

13.10.1 Inter-Relationships

595. Inter-relationships are defined as effects arising from residual effects associated with different environmental topics acting together upon a single receptor or receptor group. Potential inter-relationships between offshore and intertidal ornithology and other environmental topics have been considered, where relevant, within the PEIR. **Table 13-77** provides a summary of key inter-relationships and signposts to where they have been addressed in the relevant chapters.

Table 13-77 Offshore and Intertidal Ornithology - Inter-Relationships with Other Topics

Impact ID	Impact	Related EIA Topic	Where Assessed in the PEIR Chapter	Rationale
Construction				
ORN-C-05	Indirect impacts via habitat or prey availability	**Chapter 10: Benthic and Intertidal Ecology and Chapter 11: Fish and Shellfish Ecology**	**Section 13.7.1**	Suspended sediment could cause disturbance to fish and benthic species through smothering. Underwater noise may lead to fish avoiding area.
Operation				
ORN-O-05	Indirect impacts via habitat or prey availability	**Chapter 10: Benthic and Intertidal Ecology and Chapter 11: Fish and Shellfish Ecology**	**Section 13.7.2**	Suspended sediment could cause disturbance to fish and benthic species through smothering. Underwater noise may lead to fish avoiding area.
Decommissioning				
ORN-D-05	Indirect impacts via habitat or prey availability	**Chapter 10: Benthic and Intertidal Ecology and Chapter 11: Fish and Shellfish Ecology**	**Section 13.7.3**	Suspended sediment could cause disturbance to fish and benthic species through smothering. Underwater noise may lead to fish avoiding area.

13.10.2 Interactions

596. The impacts identified and assessed in this chapter have the potential to interact with each other. Potential interactions between impacts are identified in **Table 13-78**. Where potential for interaction between impacts has been identified, summary of the combined assessment conclusion is presented in **Table 13-79** for each receptor or receptor group.

597. Interactions are assessed by development phase ("phase assessment") to see if multiple impacts could increase the overall effect significance experienced by a single receptor or receptor group during each phase. Following from this, a lifetime assessment is undertaken which considers the potential for multiple impacts to accumulate across the construction, operation and decommissioning phases and result in a greater effect on a single receptor or receptor group. When considering synergistic effects from interactions, it is assumed that the receptor sensitivity remains consistent, while the magnitude of different impacts is additive.

598. The only receptor to experience potential impact interactions is gannet, as this species is considered for both collision risk and displacement impact assessment. A thorough assessment of the 'in-combination' impacts for gannet is provided in **Section 13.7.2.5** from the Project alone and **Section 13.8.3.3** cumulatively with other projects.

Table 13-78 Offshore and Intertidal Ornithology - Potential Interactions between Impacts

Construction, Operation and Maintenance

	ORN-C-01	ORN-C-02	ORN-C-05	ORN-O-01	ORN-O-02	ORN-O-03	ORN-O-05	ORN-O-06
ORN-C-01		No	No	No	No	No	No	No
ORN-C-02	No		No	No	No	No	No	No
ORN-C-05	No	No		No	No	No	No	No
ORN-O-01	No	No	No		No	No	No	Yes (**Section 13.7.2.5** and **Section 13.8.3.3**)
ORN-O-02	No	No	No	No		No	No	No
ORN-O-03	No	No	No	No	No		No	No
ORN-O-05	No	No	No	No	No	No		No
ORN_O_06				No	Yes (**Section 13.7.2.5 and Section 13.8.3.3**)	No	No	

Decommissioning

The details and scope of offshore decommissioning works will be determined by the relevant regulations and guidance at the time of decommissioning and provided in the Offshore Decommissioning Plan (see Commitment ID CO21 in **Table 13-6**).

For this assessment, it is assumed that interactions during the decommissioning phase would be of similar nature to, and no worse than, those identified during the construction phase.

Table 13-79 Interaction Assessment - Phase and Lifetime Effects

Impact ID	Impact and Project Activity	Receptor	Highest Significance Level			Phase Assessment	Lifetime Assessment
			Construction	Operation & Maintenance	Decommissioning		
ORN-O-02 ORN-O-06	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure - offshore (red-throated diver, gannet, auks) from installation of offshore and landfall infrastructure Collision risk - offshore (kittiwake, gannet, migratory non-seabirds) from presence of wind turbines	Gannet	N/A	Moderate	N/A	**Construction**: N/A **Operation & Maintenance**: The outcome of the assessment is greater than the individually assessed impact for disturbance and displacement (ORN-O-02) but not greater than the significance outcome of individually assessed collision risk (ORN-O-06). **Decommissioning**: N/A	No greater than individually assessed impact.

13.11 Monitoring Measures

599. Potential monitoring measures for offshore and intertidal ornithology will be considered through the EIA process and identified in the ES where required.

13.12 Summary

600. **Table 13-80** presents a summary of the preliminary results of the assessment of likely significant effects on offshore and intertidal ornithology during the construction, operation and decommissioning of the Project.

13.13 Next Steps

601. Between the submission of the PEIR and the ES as part of the DCO application, the following actions are proposed by the Project:

- **Data updates:** The Project will continue to monitor published studies of relevance to ornithology receptors assessed within this Chapter and where appropriate, incorporate within assessments accordingly for ES.
- **Modelling:** PVA modelling is currently proposed to further inform population level effects, where the predicted impact exceeds a 1% increase in baseline mortality.
- **Ongoing and regular consultation with stakeholders:** This will be conducted throughout 2025 to explore options for refinement to assessment approach and reduce any key risks flagged by stakeholders for the Project.
- **Mitigation:** the Project will consider the potential for further effective mitigation, where feasible in relation to key risks flagged by stakeholders for the Project.

Table 13-80 Summary of Potential Effects Assessed for Offshore and Intertidal Ornithology

Impact ID	Impact and Project Activity	Embedded Mitigation Measures	Receptor	Receptor Sensitivity	Impact Magnitude	Effect Significance	Additional Mitigation Measures	Residual Effect	Monitoring Measures
Construction									
ORN-C-01	Direct disturbance and displacement due to work activity	CO30 CO92	Red-throated diver (Offshore ECC)	**High**	**Negligible**	**Minor (Not Significant)**	CO18 CO19	**Negligible (Not Significant)**	Due to the level of effect significance concluded, no monitoring is proposed at this stage.
			Red-throated diver (Landfall Site)	**High**	**Low**	**Moderate (Significant)**	Any additional mitigation measures identified by ECoW as a result of their oversight as part of CO19 and CO92.	**Minor (Not Significant)**	
			Common scoter (Landfall Site)	**High**	**Low**	**Moderate (Significant)**		**Minor (Not Significant)**	
			Sanderling (Landfall Site)	**Medium**	**Low**	**Minor (Not Significant)**	Not required based on assessment conclusion of no significant effect.	**Minor (Not Significant)**	
			Oystercatcher (Landfall Site)	**Medium**	**Low**	**Minor (Not Significant)**		**Minor (Not Significant)**	
ORN-C-02	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure	CO22 CO25 CO30	Guillemot	**Medium**	**Negligible - low**	**Minor (Not Significant)**	Not required based on assessment conclusion of no significant effect.	**Minor (Not Significant)**	Due to the level of effect significance concluded, no monitoring is proposed at this stage.
			Razorbill	**Medum**	**Negligible - low**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Puffin	**Medium**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Great northern diver	**Medium**	**Negligible - low**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Gannet	**Medium**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	

Impact ID	Impact and Project Activity	Embedded Mitigation Measures	Receptor	Receptor Sensitivity	Impact Magnitude	Effect Significance	Additional Mitigation Measures	Residual Effect	Monitoring Measures
ORN-C-05	Indirect impacts via habitat or prey availability	CO19 CO92	Greater Wash SPA supporting habitats (Landfall Site)	**Medium**	**Negligible**	**Minor (Not Significant)**	Not required based on assessment conclusion of no significant effect.	**Minor (Not Significant)**	Due to the level of effect significance concluded, no monitoring is proposed at this stage.
			Greater Wash SPA designated features (Landfall Site)	**High**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Common gull, black - headed gull, herring gull, great black-backed gull (Landfall Site)	**Medium**	**Low**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Sanderling, oystercatcher (Landfall Site)	**Medium**	**Low**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Red-throated diver (Offshore ECC)	**High**	**Negligible**	**Minor (Not Significant)**		**Negligible (Not Significant)**	
			Seabirds (Array Area; for full list, see **Table 13-26**)	**Low - medium**	**Negligible**	**Negligible – minor (Not Significant)**		**Negligible – minor (Not Significant)**	
			Great norther diver (Array Area)	**High**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
Operation & Maintenance									
ORN-O-01	Direct disturbance and displacement due to work activity	CO18 CO22 CO25 CO30	Red-throated diver (Offshore ECC)	**High**	**Low**	**Minor (Not Significant)**	Not required based on assessment conclusion of no significant effect.	**Minor (Not Significant)**	Due to the level of effect significance concluded, no monitoring is proposed at this stage.
			Red-throated diver (Landfall Site)	**High**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Common scoter (Landfall Site)	**High**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Sanderling (Landfall Site)	**Medium**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Oystercatcher (Landfall Site)	**Medium**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	

Impact ID	Impact and Project Activity	Embedded Mitigation Measures	Receptor	Receptor Sensitivity	Impact Magnitude	Effect Significance	Additional Mitigation Measures	Residual Effect	Monitoring Measures
ORN-O-05	Indirect impacts via habitat or prey availability	None	Greater Wash SPA supporting habitats (Landfall Site)	**Medium**	**Negligible**	**Minor (Not Significant)**	Not required based on assessment conclusion of no significant effect.	**Minor (Not Significant)**	Due to the level of effect significance concluded, no monitoring is proposed at this stage.
			Greater Wash SPA designated features (Landfall Site)	**High**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Common gull, black - headed gull, herring gull, great black-backed gull (Landfall Site)	**Medium**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Sanderling, oystercatcher (Landfall Site)	**Medium**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Red-throated diver (Offshore ECC)	**High**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Seabirds (Array Area; for full list, see **Table 13-26**)	**Low - medium**	**Negligible**	**Negligible – minor (Not Significant)**		**Negligible – minor (Not Significant)**	
			Great norther diver (Array Area)	**High**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
ORN-O-06	Collision risk due to presence of wind turbines	CO13 CO22 CO25 CO30	Kittiwake	**Medium**	**Low**	**Minor (Not Significant)**	Not required based on assessment conclusion of no significant effect.	**Minor (Not Significant)**	Due to the level of effect significance concluded, no monitoring is proposed at this stage.
			Great black-backed gull	**Medium**	**Negligible**	**Negligible (Not Significant)**		**Negligible (Not Significant)**	
			Herring gull	**Medium**	**Negligible**	**Negligible (Not Significant)**		**Negligible (Not Significant)**	
			Lesser black-backed gull	**Medium**	**Negligible**	**Negligible (Not Significant)**		**Negligible (Not Significant)**	
			Gannet	**Medium**	**Negligible**	**Negligible (Not Significant)**		**Negligible (Not Significant)**	

Impact ID	Impact and Project Activity	Embedded Mitigation Measures	Receptor	Receptor Sensitivity	Impact Magnitude	Effect Significance	Additional Mitigation Measures	Residual Effect	Monitoring Measures
ORN-O-02 and ORN-O-06	Combined operational displacement and collision risk	CO13 CO22 CO25 CO30	Gannet	**Medium**	**Negligible - low**	**Minor (Not Significant)**	Not required based on assessment conclusion of no significant effect.	**Minor (Not Significant)**	Due to the level of effect significance concluded, no monitoring is proposed at this stage.
ORN-O-02 (Cumulative assessment)	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure	CO13 CO22 CO25 CO30	Guillemot	**Medium**	**Low - High**	**Minor – Major (Significant)**	Where it is reasonable and feasible, additional mitigation measures will be consulted on post PEIR.	Following post PEIR consultation on additional mitigation measures, residual effects will be updated accordingly.	An Outline OMP will be developed to address uncertainty, where it is possible and reasonable for such uncertainties to be monitored for the Project, specifically relating to ornithology.
			Razorbill	**Medum**	**Low - Medium**	**Minor – Moderate (Significant)**			
			Puffin	**Medium**	**Low - Medium**	**Minor – Moderate (Significant)**			
			Great northern diver	**Medium**	Screened out from cumulative assessment due to limited presence in Projects screened into the assessment (see **Section 13.8.3.1.1**).				
			Gannet	**Medium**	**Low - Medium**	**Minor – Moderate (Significant)**	Where it is reasonable and feasible, additional mitigation measures will be consulted on post PEIR.	Following post PEIR consultation on additional mitigation measures, residual effects will be updated accordingly.	An Outline OMP will be developed to address uncertainty, where it is possible and reasonable for such uncertainties to be monitored for the Project, specifically relating to ornithology.

Impact ID	Impact and Project Activity	Embedded Mitigation Measures	Receptor	Receptor Sensitivity	Impact Magnitude	Effect Significance	Additional Mitigation Measures	Residual Effect	Monitoring Measures
ORN-O-06 (Cumulative assessment)	Collision risk due to presence of wind turbines	CO13 CO22 CO25 CO30	Kittiwake	**Medium**	**Medium**	**Moderate (Significant)**	Where it is reasonable and feasible, additional mitigation measures will be consulted on post PEIR.	Following post PEIR consultation on additional mitigation measures, residual effects will be updated accordingly.	An Outline OMP will be developed to address uncertainty, where it is possible and reasonable for such uncertainties to be monitored for the Project, specifically relating to ornithology.
			Great black-backed gull	**Medium**	**Negligible**	**Minor (Not Significant)**	Not required based on assessment conclusion of no significant effect.	**Minor (Not Significant)**	Due to the level of effect significance concluded, no monitoring is proposed at this stage.
			Herring gull	**Medium**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Lesser black-backed gull	**Medium**	**Negligible**	**Minor (Not Significant)**		**Minor (Not Significant)**	
			Gannet	**Medium**	**Medium**	**Moderate (Significant)**	Where it is reasonable and feasible, additional mitigation measures will be consulted on post PEIR.	Following post PEIR consultation on additional mitigation measures, residual effects will be updated accordingly.	An Outline OMP will be developed to address uncertainty, where it is possible and reasonable for such uncertainties to be monitored for the Project, specifically relating to ornithology.
ORN-O-02 and ORN-O-06 (Cumulative assessment)	Combined operational displacement and collision risk	CO13 CO22 CO25 CO30	Gannet	**Medium**	**Medium**	**Moderate (Significant)**	Where it is reasonable and feasible, additional mitigation measures will be consulted on post PEIR.	Following post PEIR consultation on additional mitigation measures, residual effects will be updated accordingly.	An Outline OMP will be developed to address uncertainty, where it is possible and reasonable for such uncertainties to be monitored for the Project, specifically relating to ornithology.

Impact ID	Impact and Project Activity	Embedded Mitigation Measures	Receptor	Receptor Sensitivity	Impact Magnitude	Effect Significance	Additional Mitigation Measures	Residual Effect	Monitoring Measures
Decommissioning									
ORN-C-01	Direct disturbance and displacement due to work activity	The details and scope of offshore decommissioning works will be determined by the relevant regulations and guidance at the time of decommissioning and provided in the Offshore Decommissioning Plan (see Commitment ID CO21 in **Table 13-5**). This will include a detailed assessment of decommissioning impacts and appropriate mitigation measures to avoid significant effects. For this assessment, it is assumed that impacts during the decommissioning phase would be of similar nature to, and no worse than, those identified during the construction phase.							
ORN-C-02	Direct disturbance and displacement due to presence of wind turbines and other offshore infrastructure								
ORN-C-05	Indirect impacts via habitat or prey availability								

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List of Acronyms

Acronym	Definition
ADD	Acoustic Deterrent Device
BDMPS	Biologically Defined Minimum Population Scales
BEIS	Department for Business, Energy and Industrial Strategy
BoCC	Birds of Conservation Concern
BoCC5	UK Birds of Conservation Concern 5
CEA	Cumulative Effect Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CRA	Chemical Risk Assessment
CRM	Collision Risk Modelling
DAS	Digital Aeiral Survey
DBA	Dogger Bank A
DBB	Dogger Bank B
DBC	Dogger Bank C
DBD	Dogger Bank D
DBS	Dogger Bank South
DCO	Development Consent Order
DEFRA	Department of Environmental, Food and Rural Affairs
DESNZ	Department for Energy Security and Net Zero
dML	Deemed Marine License
DVI	Disturbance Vulnerability Index
ECC	Offshore Export Cable Corridor
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EOWDC	European Offshore Wind Deployment Centre
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
EU	European Union
GSD	Ground Sampling Distance
HDD	Horizontal Directional Drilling
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitat Regulation Assessment
JNCC	Joint Nature Conservation Committee
JUV	Jack-Up Vessel
LSE	Likely Significant Effect
MARPOL	International Convention for the Prevention of Pollution from Ships
MCZ	Marine conservation zone
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MPCP	Marine Pollution Contingency Plan
NPS	National Policy Statements
ODMP	Office of the Deputy Prime Minister
OMP	Ornithological Monitoring Plan
ORE	Offshore Renewable Energy

Acronym	Definition
ORJIP	Offshore Renewables Joint Industry Programme
OP	Offshore Platforms
OWCE	Offshore Wind Evidence and Change Program
OWEZ	Offshore Wind farm Egmond aan Zee
OWF	Offshore Wind Farm
PEIR	Preliminary Environmental Information Report
PEMP	Pollution Environmental Management Plan
PTS	Permanent Threshold Shift
PVA	Population Viability Analysis
RIAA	Report to Inform Appropriate Assessment
RSPB	Royal Society for the Protection of Birds
SAC	Special Areas of Conservation
ScotMER	Scottish Marine Energy Research
sCRM	Stochastic Collision Risk Model
SEA	Strategic Environmental Assessment
SEANSE	Strategic Environmental Assessment North Seas Energy
SNCB	Statutory Nature Conservation Bodies
SoS	Secretary of State
SOV	Service Operations Vessels
SPA	Special Protection
SSSI	Sites of Special Scientific Interest
TJB	Transition Joint Bays
USV	Unmanned Surface Vehicle
VMP	Vessel Management Plan
ZOI	Zone of Influence