2.12

Rampion 2 WIND FARM

Volume 2, Chapter 12

Offshore & intertidal ornithology

GoBe wood.

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12. Offshore & intertidal ornithology

12.1 Introduction

12.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the initial results of the assessment of the potential impacts of Rampion 2 with respect to offshore and intertidal ornithology, during construction, operation and maintenance, and decommissioning

12.1.2 It should be read in conjunction with: the project description provided in **Chapter 4: The Proposed Development** and the relevant parts of the following chapters:

- **Chapter 8: Fish and shellfish ecology** (due to the potential for indirect impacts from changes in abundance or distribution of prey species);
- **Chapter 9: Benthic, subtidal and intertidal ecology** (due to the intersections of habitats at mean high water springs (MHWS)); and
- **Chapter 23: Terrestrial ecology and nature conservation** (due to the presence of bird species that use both offshore and terrestrial habitats, as well as birds that migrate across the offshore environment).

12.1.3 This chapter describes:

- the legislation, planning policy and other documentation that has informed the assessment (**Section 12.2: Relevant legislation, policy and other**);
- the outcome of consultation engagement that has been undertaken to date, including how matters relating to offshore and intertidal ornithology within the Scoping Opinion received in August 2020 have been addressed (**Section 12.3: Consultation and engagement**);
- the scope of the assessment for offshore and intertidal ornithology (**Section 12.4: Scope of the assessment**);
- the methods used for the baseline data gathering **(Section 12.5: Methodology for baseline data gathering**);
- the overall baseline (**Section 12.6: Methodology for baseline data gathering** to **Section 12.8: Baseline conditions – offshore**)
- embedded environmental measures relevant to offshore and intertidal ornithology and the relevant maximum design scenario (**Section 12.9: Basis for PEIR assessment**);
- the assessment methods used for the PEIR **(Section 12.10:Methodology for PEIR assessment**);
- the assessment of offshore and intertidal ornithology effects (**Section 12.11 – 12.14: Preliminary assessment** and **Section 12.15: Cumulative effects**);
- consideration of transboundary effects (**Section 12.16: Transboundary effects**);
- consideration of inter-related effects (**Section 12.17: Inter-related effects**);

- a summary of residual effects for offshore and intertidal ornithology (**Section 12.18: Summary of residual effects**);
- an outline of further work to be undertaken for the Environmental Statement (ES) **(Section 12.19: Further work to be undertaken for ES**);
- a glossary of terms and abbreviations is provided in **Section 12.20: Glossary of terms and abbreviations**; and
- a references list is provided in **Section 12.21: References**.

12.1.4 The chapter is also supported by the following appendices:

- **Appendix 12.1: Offshore and Intertidal Ornithology Baseline Technical Report, Volume 4**;
- **Appendix 12.2: Offshore Ornithology Displacement Analysis, Volume 4**; and
- **Appendix 12.3: Offshore Ornithology Collision Risk Modelling, Volume 4.**

12.2 Relevant legislation, policy and other information and guidance

Introduction

12.2.1 This section identifies the legislation, policy and other documentation that has informed the assessment of potential impacts with respect to offshore and intertidal ornithology. Further information on policies relevant to Environmental Impact Assessment (EIA) and their status are provided in **Chapter 2: Policy and legislative context** of this PEIR.

Legislation and national planning policy

12.2.2 There are a number of UK laws and international conventions that need to be considered, specifically those regarding protection of wildlife and the marine environment. **Table 12-1** lists the legislation relevant to the assessment of the effects on offshore and intertidal ornithology receptors.

Table 12-1 Legislation relevant to offshore and intertidal ornithology.

Legislation description	Relevance to assessment
The Convention on Wetlands of International Importance especially as Waterfowl Habitat (the 'Ramsar Convention').	
The Ramsar Convention allows contracting parties to the convention to designate suitable wetlands within their own territory for inclusion in the 'List of Wetlands of International Importance' (the 'List'). Contracting parties are required to	The Proposed Development has the potential to affect the biodiversity features of Ramsar sites, specifically birds which breed or overwinter in a Ramsar site but may forage in or migrate through the Rampion 2 area. Rampion 2 is committed

Legislation description	Relevance to assessment
incorporate into their planning the conservation of the areas included in the List. In addition, 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."	to minimising potential impacts on Ramsar sites, and embedded environmental measures are described in **paragraph 12.9.4**. The potential for effects on Ramsar sites is considered in detail in the **Habitats Regulations Screening Report** (RED, 2020b) and the **Draft Report to Inform Appropriate Assessment (RIAA)** (RED, 2021).
The Convention on the Conservation of Migratory Species of Wild Animals (the 'Bonn Convention')	
The Bonn Convention provides for contracting parties to work together to conserve migratory species and their habitats by providing strict protection for endangered migratory species (listed in Appendix I of the Convention), by concluding multilateral agreements for the conservation and management of migratory species which require or would benefit from international cooperation (listed in Appendix II of the Convention), and by undertaking cooperative research activities.	The Proposed Development has the potential to impact on The Bonn Convention through acting as a barrier to migratory species and through the potential for collision with WTGs to adversely affect migratory species. Rampion 2 is committed to minimising potential impacts on migratory birds, and embedded environmental measures are described in **paragraph 12.9.4**. Within this chapter, migratory birds are given particular consideration in **paragraph 12.13.167.**
The Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention').	
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.	The Proposed Development has the potential to affect bird species which are protected under the Bern Convention. Rampion 2 is committed to minimising potential impacts on birds, and embedded environmental measures are described in **paragraph 12.9.4**. The potential for effects on birds protected under the Bern Convention is considered throughout the assessments in **Sections 12.11** to **12.17**.
European Council Directive 2009/147/EC on the Conservation of Wild Birds (the 'Birds Directive')	

Legislation description	Relevance to assessment
The Birds Directive provides a framework for the conservation and management of wild birds in EU member states. The most relevant provisions of the Directive are the identification and classification of Special Protection Areas (SPAs) for rare or vulnerable species listed in Annex I of the Directive and for all regularly occurring migratory species (required by Article 4). The Directive requires national Governments to establish SPAs and to have in place mechanisms to protect and manage them. The SPA protection procedures originally set out in Article 4 of the Birds Directive have been replaced by the Article 6 provisions of the Habitats Directive. The Birds Directive also establishes a general scheme of protection for all wild birds (required by Article 5). Both the EU Birds Directive and the Wildlife and Countryside Act 1981 (as amended) provide protection against killing of birds (with a few exceptions) and provide protection for sites that support either specific bird species or concentrations of birds.	The Proposed Development has the potential to impact on the objectives of the Birds Directive, specifically by affecting populations of birds which are designated features of SPAs and thereby having an Adverse Effect on Integrity of those SPAs. Rampion 2 is committed to minimising potential impacts on birds, and embedded environmental measures are described in **paragraph 12.9.4**. The potential for effects on birds protected under the Birds Directive is considered throughout the assessments in **Sections 12.11** to **12.17**.The potential for effects on Annex I species, migratory species and SPAs is considered in detail in the **Habitats Regulations Screening Report** and the **Draft RIAA**.
European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the 'Habitats Directive')	
The Habitats Directive provides a framework for the conservation and management of natural habitats, wild fauna (except birds) and flora in EU member states. The provisions of the Directive relevant to offshore ornithology are the procedures for the protection of Special Areas of Conservation (SACs) and SPAs (Article 6). The procedures require an appropriate assessment of any plan or project likely to affect a SAC or SPA and not to approve any plan or project that would have an adverse effect on a SAC or SPA except under very tightly constrained conditions. The procedures for the protection of SACs and SPAs are implemented in the United Kingdom (UK) through the Conservation of Habitats and	The principal relevance of the Habitats Directive to Rampion 2 is the procedures for the protection of SPAs, which sets out the steps which must be taken in order to assess the impact of any proposed development. The procedures will be addressed through this EIA and the Appropriate Assessment. Rampion 2 is committed to minimising potential impacts on designated features of SPAs, and embedded environmental measures are described in **paragraph 12.9.4**. The potential for effects on designated features of SPAs protected under the Habitats Directive is considered throughout the assessments in **Sections 12.11** to **12.17**.The potential for effects on designated features of SPAs is considered

Legislation description	Relevance to assessment
Species Regulations 2017 and the Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007 for waters beyond 12 nm.	in detail in the **Habitats Regulations Screening Report** and the **Draft RIAA**.
The Conservation of Habitats and Species Regulations 2017 (the 'Habitats Regulations)	
The Habitats Regulations transpose the Birds Directive and the Habitats Directive into national law in the terrestrial, coastal and inshore (out to 12 nm) environment, operating in conjunction with the Wildlife and Countryside Act 1981. The Habitats Regulations place an obligation on 'competent authorities' to carry out an appropriate assessment of any proposal likely to affect a SAC or SPA, to seek advice from Natural England (NE) and/or Joint Nature Conservation Committee (JNCC), and not to approve an application that would have an adverse effect on a SAC or SPA (except under very tightly constrained conditions that involve decisions by the Secretary of State, (SoS).	As the Habitats Regulations transpose the Birds Directive and the Habitats Directive into national law, they are relevant by virtue of the possibility for Rampion 2 to impact the objectives of those Directives. The Habitats Regulations further outline the assessment requirements for a proposed development, to which this document and the accompanying **Draft RIAA** are intended to inform. Rampion 2 is committed to minimising potential impacts on designated features of SPAs, and embedded environmental measures are described in **paragraph 12.9.4**. The potential for effects on designated features of SPAs protected under the Habitats Directive is considered throughout the assessments in **Sections 12.11** to **12.17**.The potential for effects on designated features of SPAs is considered in detail in the **Habitats Regulations Screening Report** and the **Draft RIAA**. Rampion 2 is committed to working with and seeking advice from Natural England and other relevant stakeholders through the Evidence Plan Process.
Conservation of Offshore Marine Habitats and Species Regulations 2017 (the 'Offshore Regulations')	
The Offshore Regulations transpose the Birds Directive and the Habitats Directive into national law in the offshore (beyond 12 nm) environment. The Offshore Regulations place an obligation on 'competent authorities' to carry out an appropriate assessment of any proposal likely to affect a SAC or SPA, to seek	As the Marine Regulations transpose the Birds Directive and the Habitats Directive into national law, they are relevant by virtue of the possibility for Rampion 2 to impact the objectives of those Directives. The Habitats Regulations further outline the assessment requirements for a

Legislation description	Relevance to assessment
advice from Natural England and/ or JNCC, and not to approve an application that would have an adverse effect on a SAC or SPA (except under very tightly constrained conditions that involve decisions by the Secretary of State).	proposed development, to which this document and the accompanying **RIAA** are intended to inform. Rampion 2 is committed to minimising potential impacts on designated features of SPAs, and embedded environmental measures are described in **paragraph 12.9.4**. The potential for effects on designated features of SPAs protected under the Habitats Directive is considered throughout the assessments in **Sections 12.11** to **12.17**.The potential for effects on designated features of SPAs is considered in detail in the **Habitats Regulations Screening Report** and the **Draft RIAA**. Rampion 2 is committed to working with and seeking advice from Natural England and other relevant stakeholders through the Evidence Plan Process.
The Wildlife and Countryside Act 1981 (as amended)	
The Wildlife and Countryside Act 1981 is the principal mechanism for the legislative protection of wildlife in Great Britain. 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 SACs on land and down to MLWS.	The Wildlife and Countryside Act 1981 is relevant as the project has a potential to impact on SSSIs, along with SPAs and SACs, both directly through the project's intertidal zone and indirectly by impacting on mobile species which may utilise the project area for foraging, on migration, or in other ways. The Wildlife and Countryside Act 1981 also provides protection to all birds. Rampion 2 is committed to minimising potential impacts on birds, and embedded environmental measures are described in **paragraph 12.9.4**. The potential for effects on birds protected under the Wildlife and Countryside Act 1981 is considered throughout the assessments in **Sections 12.11** to **12.17**.
The Natural Environment and Rural Communities Act 2006	

Legislation description	Relevance to assessment
The Natural Environment and Rural Communities Act 2006 imposes a duty on public bodies to conserve biodiversity, including a requirement to compile a list of habitats and species of principal importance for the purpose of conserving biodiversity.	The Natural Environment and Rural Communities Act 2006 is relevant to the project as there is the potential for the project to have an adverse effect on the conservation of biodiversity. Rampion 2 is committed to minimising potential impacts on birds, and embedded environmental measures are described in **paragraph 12.9.4**. Rampion 2 is committed to working with public bodies to ensure the conservation of biodiversity, including through the Evidence Plan Process.

12.2.3 Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to offshore and intertidal ornithology, is contained in the Overarching National Policy Statement (NPS) for Energy (EN-1; DECC 2011a), and the NPS for Renewable Energy Infrastructure (EN-3, DECC 2011b). NPS EN-1 and NPS EN-3 include guidance on what matters are to be considered in the assessment (i.e. scope provisions). NPS EN-3 also highlights several factors relating to the determination of an application and in relation to mitigation. These are summarised in **Table 12-2** below.

Table 12-2 National planning policy relevant to offshore and intertidal ornithology.

Policy description	Relevance to assessment
EN-1 National Policy Statement (NPS) for Energy (DECC, 2011a)	
EN-1 Paragraph 5.3.4 – requires the applicant to *"show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests."*	Rampion 2 has taken advantage of opportunities to conserve bird biodiversity interests as detailed in **Section 12.9**.
EN-1 Paragraph 5.3.6 – states that the IPC *"should take account of the context of the challenge of climate change: failure to address this challenge will result in significant adverse impacts to biodiversity."* It also notes that *"the benefits of nationally significant low carbon energy infrastructure development may include benefits for biodiversity and geological conservation interests and these benefits may outweigh harm to these interests. The IPC may take*	Rampion 2 delivers benefits as a nationally significant low carbon energy infrastructure development and does include benefits for bird biodiversity interests. These benefits do outweigh minor harm to these interests, as detailed in **Section 12.18.**

Policy description	Relevance to assessment
account of any such net benefit in cases where it can be demonstrated."	
EN-1 Paragraph 5.3.7 - moots that *"development should aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives… where significant harm cannot be avoided, then appropriate compensation measures should be sought."*	Rampion 2 has been designed to avoid significant harm to bird biodiversity interests, including through mitigation and consideration of reasonable alternatives where significant harm cannot be avoided, then appropriate compensation measures have been sought, as detailed in **Section 12.18.**
EN-1 Paragraph 5.3.8 – intimates that *"the IPC should ensure that appropriate weight is attached to designated sites of international, national and local importance; protected species; habitats and other species of principal importance for the conservation of biodiversity; and to biodiversity and geological interests within the wider environment."*	Protected sites are presented in **Section 12.7.** Assessment of the potential effects of Rampion 2 on the features of these protected sites is provided in **Sections 12.11** to **12.17.**
EN-1 Paragraph 5.3.9 – states that *"the most important sites for biodiversity are those identified through international conventions and European Directives. The Habitats Regulations provide statutory protection for these sites but do not provide statutory protection for potential Special Protection Areas (pSPAs) before they have been classified as a Special Protection Area. For the purposes of considering development proposals affecting them, as a matter of policy the Government wishes pSPAs to be considered in the same way as if they had already been classified. Listed Ramsar sites should, also as a matter of policy, receive the same protection."*	Protected sites are presented in **Section 12.7.** Assessment of the potential effects of Rampion 2 on the features of these protected sites is provided in **Sections 12.11** to **12.17.**
EN-1 Paragraph 5.3.15 – *"Development proposals provide many opportunities for building-in beneficial biodiversity or geological features as part of good design. When considering proposals, the IPC should maximise such opportunities in and*	Rampion Extension Development Ltd (RED) is exploring, developing and creating suitable opportunities for building-in beneficial biodiversity features as part of good design for Rampion 2.

Policy description	Relevance to assessment
around developments, using requirements or planning obligations where appropriate."	
EN-1 Paragraph 5.3.16 – reminds that *"many individual wildlife species receive statutory protection under a range of legislative provisions."*	RED has taken into account the statutory protection afforded to bird species under a range of legislative provisions, as detailed in **Section 12.2.**
EN-1 Paragraph 5.3.17 - explains that *"other species and habitats have been identified as being of principal importance for the conservation of biodiversity in England and Wales and thereby requiring conservation action. The IPC should ensure that these species and habitats are protected from the adverse effects of development by using requirements or planning obligations. The IPC should refuse consent where harm to the habitats or species and their habitats would result, unless the benefits (including need) of the development outweigh that harm. In this context the IPC should give substantial weight to any such harm to the detriment of biodiversity features of national or regional importance which it considers may result from a proposed development."*	RED has taken into account other bird species and habitats that have been identified as being of principal importance for the conservation of biodiversity in England and Wales and thereby requiring conservation action. RED has ensured that these species and habitats are protected from the potentially adverse effects of Rampion 2 by accepting the need for requirements or planning obligations as part of the consenting process. RED is committed to minimising potential impacts on birds, and embedded environmental measures are described in **paragraph 12.9.4**. The potential for effects on birds identified as being of principal importance for conservation is considered throughout the assessments in **Sections 12.11** to **12.17**.
EN-1 Paragraph 5.3.18 – states that EIAs should include effects on and opportunities to enhance and mitigation for biodiversity	Potential effects, opportunities and mitigation on birds considered through the assessment are incorporated into the assessment process where applicable. Mitigation measures are implemented through embedded environmental measures and commitments (see **Section 12.9**).
EN-3 NPS for Renewable Energy Infrastructure (DECC, 2011b)	
EN-3 Paragraph 2.6.64 - states that the "*assessment of offshore ecology and biodiversity should be undertaken by the applicant for all stages of the lifespan of the proposed offshore wind farm*."	The potentially significant aspects of offshore ecology and biodiversity have been described and considered within the EIA documentation for all stages of the lifespan of Rampion 2. Potential impacts assessed include all stages of the lifespan of the Proposed Development; during construction (**Section 12.12**), operation

Policy description	Relevance to assessment
	and maintenance (**Section 12.13**) and decommissioning (**Section 12.14**).
EN-3 Paragraph 2.6.65 – states that "*Consultation on the assessment methodologies should be undertaken at early stages with the statutory consultees as appropriate.*"	RED has agreement on the assessment approach and survey methods through discussions with Natural England and other interested parties through the Evidence Plan Process (**Section 12.3**)
EN-3 Paragraph 2.6.68 – states that *"the IPC should consider the effects of a proposal on marine ecology and biodiversity taking into account all relevant information made available to it."*	The offshore and intertidal ornithology aspects of marine ecology and biodiversity have been described and considered within this PEIR chapter for Rampion 2.
EN-3 Paragraph 2.6.69 – explains that *"the designation of an area as Natura 2000 site does not necessarily restrict the construction or operation of offshore wind farms in or near that area."*	Rampion 2 has been designed carefully to avoid and /or and mitigate significant effects on Natura 2000 sites.
EN-3 Paragraph 2.6.70 – *"mitigation may be possible in the form of careful design of the development itself and the construction techniques employed."*	Rampion 2 has been designed carefully (including with regard to the construction techniques employed) to avoid and /or and mitigate significant effects on Natura 2000 sites.
EN-3 Paragraph 2.6.71 –advises that *"ecological monitoring is likely to be appropriate during the construction and operational phases to identify the actual impact so that, where appropriate, adverse effects can then be mitigated and to enable further useful information to be published relevant to future projects."*	Future monitoring has been considered within the Rampion 2 assessment.
EN-3 Paragraph 2.6.101 – explains that *"offshore wind farms have the potential to impact on birds through:* *collisions with rotating blades;* *direct habitat loss;* *disturbance from construction activities such as the movement of construction/decommissioning vessels and piling;* *displacement during the operational phase, resulting in loss of foraging/roosting area; and*	These impacts are assessed in **Sections 12.12** to **12.17.**

Policy description	Relevance to assessment
impacts on bird flight lines (i.e. barrier effect) and associated increased energy use by birds for commuting flights between roosting and foraging areas."	
EN-3 Paragraph 2.6.102 - states that *"the scope, effort and methods required for ornithological surveys should have been discussed with the relevant statutory advisor."*	The survey methods have been discussed and agreed with Natural England and RSPB through the Evidence Plan Process (see **Section 12.3**)
EN-3 Paragraph 2.6.103 – states that *"relevant data from operational offshore wind farms should be referred to in the applicant's assessment."*	Relevant data from operational offshore wind farms has been referred to in the Rampion 2 EIA and HRA. The use of relevant data presented within published literature is considered throughout this PEIR to inform the impact assessment process.
EN-3 Paragraph 2.6.104 - states that *"it may be appropriate for the assessment to include collision risk modelling for certain bird species."*	Collision Risk Modelling has been undertaken and is presented in **Appendix 12.3, Volume 4**. Potential effects from collision risk are presented and assessed in **Section 12.13.**
NPS EN-3 Paragraph 2.6.107 – requires that *"aviation and navigation lighting be minimised to avoid attracting birds, taking into account impacts on safety."*	The need to minimise aviation and navigation lighting in order to avoid attracting birds will be taken into account for the design of Rampion 2, within the limits of lighting requirements for aviation and shipping purposes and with consideration of potential impacts on safety.
NPS EN-3 Paragraph 2.6.108 – notes that, *"subject to other constraints, wind turbines should be laid out within a site, in a way that minimises collision risk, where the collision risk assessment shows there is a significant risk of collision."*	The developable area for the Rampion 2 array area will be considered carefully so that the WTGs are within an area that minimises collision risk. The process of assessing the developable area and the changes accommodated between Scoping and the PEIR are described in **Section 12.1.**
NPS EN-3 Paragraph 2.6.109 – requires that *"construction vessels associated with offshore wind farms should, where practicable and compatible with operational requirements and navigational*	Construction vessels associated with Rampion 2 will, where practicable and compatible with operational requirements and navigational safety, avoid rafting seabirds during sensitive periods.

Policy description	Relevance to assessment
safety, avoid rafting seabirds during sensitive periods."	
NPS EN-3 Paragraph 2.6.110 – explains that *"the exact timing of peak migration events is inherently uncertain. Therefore, shutting down turbines within migration routes during estimated peak migration periods is unlikely to offer suitable mitigation."*	Mitigation measures for offshore and intertidal ornithological interests have been considered within the Rampion 2 assessment process (**Section 12.9).**

Other relevant information and guidance

12.2.4 This PEIR chapter has been compiled with attention to other relevant guidance for conducting EIA, particularly "The Guidelines for Ecological Impact Assessment in the UK and Ireland" (CIEEM, 2018) with regards to the structure and general approach for this EIA. Consideration has also been given to the latest guidance notes relating to displacement analysis and collision risk modelling, which are detailed in **Appendix 12.2, Volume 4** and **Appendix 12.3, Volume 4**, respectively.

12.3 Consultation and engagement

Overview

12.3.1 This section describes the outcome of, and response to, the Scoping Opinion in relation to offshore and intertidal ornithology assessment and also provides details of the ongoing consultation that has been undertaken with stakeholders and individuals. An overview of engagement undertaken can be found in **Section 1.5** of **Chapter 1: Introduction**.

12.3.2 Given the restrictions which have been in place due to the COVID-19 pandemic during this period, all consultation has taken the form of conference calls using online video conferencing software.

Scoping opinion

12.3.3 RED submitted a Scoping Report (RED, 2020a) and request for a Scoping Opinion to the Secretary of State (administered by the Planning Inspectorate (PINS)) on 2 July 2020 (RED, 2020a). A Scoping Opinion was received on 11 August 2020. The Scoping Report set out the proposed offshore and intertidal ornithology assessment methodologies, outline of the baseline data collected to date, programme of further surveys and the scope of the proposed impact assessments. The comments received in Section 4 of the PINS Scoping Opinion 'Aspect based scoping tables – Offshore' and how these have been addressed in this PEIR are set out in **Table 12-3**. A full list of the PINS Scoping Opinion comments and responses is provided in **Appendix 5.1: Response to the Scoping Opinion,**

Volume 4. Regard has also been given to other stakeholder comments that were received in relation to the Scoping Report.

Table 12-3 PINS Scoping Opinion responses – offshore and intertidal ornithology

PINS ID number	Scoping Opinion comment	How this is addressed in this PEIR
4.7.1	The Inspectorate is content that there is unlikely to be significant effects from maintenance of the offshore export cable during operation and therefore agrees that this matter can be scoped out of the assessment.	This comment is acknowledged.
4.7.2	The Inspectorate is content that there is unlikely to be significant effects from maintenance of the intertidal export cable during operation and therefore agrees that this matter can be scoped out of the assessment.	This comment is acknowledged.
4.7.3	The Scoping Report provides limited information and no evidence of agreement with relevant consultation bodies to scope this matter out of the ES. The Inspectorate does not agree to scope these matters from the assessment. Accordingly, the ES should include an assessment of these matters where significant effects are likely to occur.	Barrier effect: Array –The presence of the array area could create a barrier to movements of breeding seabirds during foraging trips or to migratory movements during operation. An assessment of the potential impact from barrier effects during operation is included in **paragraph 12.13.167**.
4.7.4	The study area for offshore ornithology is described as being the Proposed Development array survey area with a 4km buffer, the export cable corridor and the cable landfall area. The Inspectorate considers that the study area should be extended to take into consideration potential impacts on bird species which may use the area for foraging and not just on migration as suggested in para 5.8.7. It is recommended that effort should be made to agree the scope of the study area with relevant consultation bodies.	The study area is defined in **paragraph 12.4.3**. This assessment includes all bird species which may use the study area at any point, including using the study area for foraging, moulting, loafing, or whilst migrating. The study area has been agreed with stakeholders through the evidence plan process.

PINS ID number	Scoping Opinion comment	How this is addressed in this PEIR
4.7.5	The Inspectorate notes that aerial digital surveys are being undertaken to provide information regarding ornithological species in the study area. Details should be provided of the methodology used to undertake the surveys. This information should be clearly presented in the ES. The Applicant should make effort to agree the scope and adequacy of these surveys with relevant consultation bodies. Paragraph 5.8.5 and figures 5.8.3 – 5.8.6 show that a small part of the eastern area of the offshore study area has not been covered by digital survey. The ES should justify the extent of survey areas in supporting a robust assessment of significant effects on displacement of bird populations.	As a result of changes to the Proposed Development between Scoping and PEIR, the offshore part of the PEIR Assessment Boundary plus a 4km buffer are fully within the area covered by the digital aerial surveys. Full details of the changes made to the assessment boundary are presented in **paragraph 12.4.4**. Justification that the Study Area is suitable to support a robust assessment of significant effects of displacement is presented in **Sections 12.12** and **12.13**.
4.7.6	The exact method for CRM has not yet been defined. The ES and/or accompanying technical appendices should provide detailed information regarding the methodology undertaken for the CRM and analysis of the data used to inform the impact assessment, together with figures where appropriate.	Detailed information regarding the CRM methodology and additional supporting information is provided in **Appendix 12.3, Volume 4**. RED is seeking agreement, through discussion at the ETGs with the relevant stakeholders that the approach to CRM is suitable.
4.7.7	The ES should contain details of other developments assessed in the cumulative effects assessment. Given the far ranging nature of breeding and migratory birds, justification should be provided as to the spatial and temporal extent of the other developments considered.	Cumulative effects are assessed in **Section 12.15**. Full justification is given for the spatial and temporal extent of the other developments considered.

Evidence Plan Process (EPP) Expert Topic Group

Overview

12.3.4 The EPP has been set up to provide a formal, non-legally binding, independently chaired forum to agree the scope of the EIA and HRA, and the evidence required to support the DCO Application.

12.3.5 Following Scoping, the first ornithology Expert Topic Group (ETG) took place on 18 September 2020, for which the key discussions surrounded the approach to baseline data collection, the availability of baseline data for PEIR and the approach to assessment. The approach to assessment focused particularly on the consideration of an appropriate buffer zone surrounding Rampion 2 to account for Rampion 1 with regards to displacement analysis. RED's preferred approach to CRM was also presented. Concerns were raised regarding regional kittiwake colonies. Relevant details are summarised below.

12.3.6 A subsequent ETG meeting took place on 26th March 2021. The revisions to the boundary of the proposed development between scoping and this PEIR were presented. It was discussed that survey data from February 2019 may have been influenced by unusual weather (Storm Ciara) causing bird movements. An update on site-specific aerial digital surveys and intertidal surveys was presented.

Method statement

12.3.7 Prior to the first ETG, the **Rampion 2 Method Statement** was circulated to stakeholders. The method statement outlined the programme of baseline surveys, the amount of data from those surveys that would be available to inform this PEIR, and RED's proposed approach to displacement analysis and CRM. There were no significant disagreements regarding any of the proposals, although the RSPB stressed that the conclusions presented in the PEIR should be treated cautiously pending completion of the programme of baseline surveys.

Buffer zone surrounding Rampion 2

12.3.8 For most offshore wind farm EIAs, consideration of displacement accounts for birds within the array area and out to a specific buffer, that may be species-specific. This would typically be a buffer surrounding the entire array area. In this instance, the Rampion 2 study area is immediately adjacent to the existing Rampion 1 project, which has already been assessed for displacement and consented following the judgement of no significant effects from displacement. As the purpose of this PEIR is to understand the potential effect from Rampion 2 on seabird species with respect to displacement any birds residing in the Rampion 1 site should not be included in the abundances assessed for Rampion 2. Therefore, the approach to the assessment of potential displacement impacts excludes data from within the Rampion 1 site from the buffer zone for displacement analysis purposes. The attendees of the ETG meeting did not express any objections to this proposed approach.

Kittiwake

12.3.9 The Sussex Ornithological Society (SOS), raised several potential issues about several species, most notably kittiwake. SOS provided count data from the colony at Splash Point, Seaford, which demonstrated a decline in apparently occupied nests (AONs) from 1,120 AON in 2016 to 461 AON in 2020. SOS suggested that the construction and operation of Rampion 1 may have contributed to this decline through potential collisions and a potential barrier effect, although a causal relationship could not be demonstrated from the data provided. In response to this information it was noted that the count of 1,120 AONs was an unusual peak and the average annual count for this colony between 2002 and 2020 was 706 AONs or 542 AONs without the unusual peak.

Informal consultation and engagement

Overview

12.3.10 A summary of the informal consultation undertaken between the completion of the Scoping Report and up to and including March 2021 is outlined in this section

Informal consultation – January / February 2021

12.3.11 RED carried out an Informal Consultation exercise for a period of four weeks from 14 January 2021 to 11 February 2021. This Informal Consultation exercise aimed to engage with a range of stakeholders including the prescribed and non-prescribed consultation bodies, local authorities, Parish Councils and general public with a view to introducing the Proposed Development and seeking early feedback on the emerging designs.

12.3.12 Further detail about the results of the Informal Consultation exercise can be found in the **Informal consultation analysis.**

12.4 Scope of the assessment

Overview

12.4.1 This section sets out the scope of the PEIR assessment for offshore and intertidal ornithology. This scope has been developed as the Rampion 2 project design has evolved in response to stakeholder consultation received to date as set out in **Section 12.3**. As outlined in the Planning Inspectorate's (PINS) Advice Note Seven: Environmental Impact Assessment: Process, Preliminary Environmental Information and Environmental Statements (Version 7, the Planning Inspectorate, 2020), information presented in the PEIR is preliminary, therefore this scope will be reviewed and may be refined as Rampion 2 evolves further and as a result of ongoing consultation.

12.4.2 An overview of designated sites within close proximity to Rampion 2 is presented in **Figure 12.2, Volume 3**. Note that as bird species are highly mobile, there is potential for connectivity to a wider range of designated sites. Further, more detailed, consideration of the potential impact of Rampion 2 on the integrity of designated sites is provided in the **Draft RIAA** (RED, 2021).

Spatial scope and study area

Overview

12.4.3 The study area for offshore and intertidal ornithology is defined as the offshore part of the PEIR Assessment Boundary together with the Zones of Influence (ZOIs) and is based on an area which is considered to represent a realistic maximum spatial extent of potential impacts on ornithological receptors. The study area for the offshore and intertidal ornithology assessment includes the array area with a modified 4km buffer, the export cable corridor and the cable landfall area (**Figure 12.2, Volume 3**). The components are defined below.

12.4.4 The offshore part of the PEIR Assessment Boundary has changed from the Scoping Boundary as a result of stakeholders' responses to the Scoping Report. In particular, it has been reduced in size to ensure that the entire offshore part of the PEIR Assessment Boundary plus a 4km buffer is within the area covered by the programme of aerial digital surveys to provide data on birds.

Array area

12.4.5 The array area is where the offshore wind farm will be located, which will include the WTGs, array cables and up to three offshore substations. The array area consists of two main areas, but for the PEIR both are considered together as a single component.

Array area 4km buffer

12.4.6 The 4km buffer used to define the study area excludes Rampion 1 and the area immediately adjacent to it. This has been agreed with the ETG as the most appropriate buffer zone to use as the basis for impact assessments of ornithological features (see **Section 12.3**).

Offshore cable link area

12.4.7 The offshore cable link area is the area where the permanent linking cable(s), connecting the two parts of the array area, will be located. No permanent infrastructure above sea level will remain in the offshore cable link area during the operational phase.

Export cable corridor

12.4.8 The export cable corridor is where the permanent export cable(s) will be located, between the array area and the landfall area.

Cable landfall area

12.4.9 The cable landfall area is within the intertidal zone seaward of Mean High Water Spring (MHWS) and landward of Mean Low Water Spring (MLWS) where the offshore export cable will be connected to the onshore export cable. All aspects landward of MHWS are considered in **Chapter 23**. Temporal scope

12.4.10 The temporal scope of the assessment of offshore and intertidal ornithology is consistent with the period over which Rampion 2 will be carried out and therefore covers the construction, operation and decommissioning periods. The exact dates are unknown at this stage, but it is assumed that construction will begin no earlier than four years after the date of this report; construction activities will take a maximum of four years; the minimum operational lifetime of the windfarm will be 30 years; and decommissioning activities will take a maximum of four years.

Potential receptors

12.4.11 The spatial and temporal scope of the assessment enables the identification of receptors which may experience a change as a result of Rampion 2. A review of **Appendix 12.1, Volume 4** was undertaken to identify key receptors, based on their abundances within the study area and sensitivities to the potential impacts described in **paragraph 12.4.13**. The list of receptors identified for assessment was presented at the first ETG meeting (18/09/2020) and RED is seeking agreement through the EPP that it is considered appropriate for assessment to focus on the receptors identified. The receptors identified for offshore and intertidal ornithology impact assessment are outlined in **Table 12-4**.

Table 12-4 Receptors requiring assessment for offshore and intertidal ornithology

Receptor group	Receptors included within group
Most abundant bird species recorded in offshore aerial digital surveys	Gannet Fulmar Kittiwake Common gull Lesser black-backed gull Herring gull Great black-backed gull ‘Commic’ tern* Sandwich tern Guillemot Razorbill
Most abundant bird species identified through literature review and surveys as being present in the intertidal area	Sanderling Mediterranean gull
Migrating bird species and species groups with potential connectivity to the study area	Little gull Great skua Waders & waterfowl

* ‘Commic’ tern refers to either a common or Arctic tern.

12.4.12 The list of receptors will be kept under review following the PEIR as further data become available from the complete programme of 24 months of offshore aerial digital surveys, completed intertidal field surveys and other forms of data for the ES.

Potential impacts

12.4.13 Potential impacts and the level of any subsequent effect on offshore and intertidal ornithology receptors that have been scoped in for assessment are summarised in **Table 12-5**.

Table 12-5 Potential impacts and effects on offshore and intertidal ornithology receptors scoped in for further assessment.

Receptor	Activity or potential impact	Potential effect
Construction (maximum of four years)		
Those species identified as sensitive to disturbance and displacement (i.e. gannet and auks).	Disturbance and displacement: Array Construction activities within the array area associated with foundations and WTGs may lead to disturbance and displacement of species within the array and potentially within surrounding buffers to a lower extent.	Disturbance and displacement reduces the amount of functional habitat available for foraging, resting and other activities and may therefore reduce survival or reproductive fitness of the birds involved.
Those species identified as sensitive to disturbance and displacement (i.e. divers and sea ducks).	Disturbance and displacement: Offshore export cable Construction activities associated with export cable installation may lead to disturbance and displacement of species within the export cable corridor and potentially within surrounding buffers to a lower extent.	Disturbance and displacement reduces the amount of functional habitat available for foraging, resting and other activities and may therefore reduce survival or reproductive fitness of the birds involved.
Those species identified as sensitive to disturbance and displacement (i.e. intertidal waterbirds).	Disturbance and displacement: Intertidal export cable Construction activities associated with export cable installation may lead to disturbance and displacement of intertidal waterbird species within	Disturbance and displacement reduces the amount of functional habitat available for foraging, resting and other activities and may therefore reduce survival or reproductive fitness of the birds involved.

Receptor	Activity or potential impact	Potential effect
	the export cable corridor and potentially within close proximity surrounding the works.	
Those species identified as sensitive to effect.	Indirect impacts on bird species due to impacts on prey species habitat loss: Array Impacts include those resulting from underwater noise (e.g. during piling) or the production of suspended sediments (e.g. during preparation of the seabed for foundations) that may alter the distribution, physiology or behaviour of bird prey species and thereby have an indirect effect. These mechanisms could potentially result in less prey being available in the area adjacent to active construction works to foraging seabirds.	A reduction in prey availability may reduce the survival or reproductive fitness of the birds involved.
Those species identified as sensitive to effect.	Indirect impacts on bird species due to impacts on prey species habitat loss: Export cable route Impacts include the production of suspended sediments (e.g. during installation of cables) that may alter the distribution, physiology or behaviour of bird prey species and thereby have an indirect effect. These mechanisms could potentially result in less prey being available in the area adjacent to active construction works to foraging seabirds.	A reduction in prey availability may reduce the survival or reproductive fitness of the birds involved.

Receptor	Activity or potential impact	Potential effect
Operation and maintenance (30+ years)		
Those species identified as sensitive to disturbance and displacement (i.e. gannet and auks).	Disturbance and displacement: Array Activities associated with the operation and maintenance of WTGs and the presence of WTGs themselves may disturb and displace species within the array area and potentially within surrounding buffers to a lower extent.	Disturbance and displacement reduces the amount of functional habitat available for foraging, resting and other activities and may therefore reduce survival or reproductive fitness of the birds involved.
Those species identified as sensitive to collision (i.e. gulls, gannet, terns).	Collision risk: Array Seabirds flying through the array area during the operational phase of the Project may be at risk of collision with WTGs.	Collisions are assumed to be fatal.
Those species identified as sensitive to collision (i.e. migratory seabirds such as skuas, waterbirds such as swans and geese or non-seabirds such as nightjar).	Collision risk: Array Migrant seabirds, waterbirds and other non-seabirds flying through the array area during the operational phase of the Project may be at risk of collision with WTGs.	Collisions are assumed to be fatal.
Those species identified as sensitive to effect.	Barrier effect: Array The presence of the array area could create a barrier to movements of breeding seabirds during foraging trips or to migratory movements.	A barrier effect increases energy expenditure involved in foraging or migratory movement, and may reduce parental provisioning of dependent chicks. This may therefore reduce

Receptor	Activity or potential impact	Potential effect
		survival or reproductive fitness of the birds involved.
Those species identified as sensitive to effect.	Indirect impacts on ornithological features due to impacts on prey species habitat loss: Array Impacts include those resulting from underwater noise (e.g. during piling) or the production of suspended sediments (e.g. during preparation of the seabed for foundations) that may alter the distribution, physiology or behaviour of bird prey species and thereby have an indirect effect. These mechanisms could potentially result in less prey being available in the area adjacent to active construction works to foraging seabirds.	A reduction in prey availability may reduce the survival or reproductive fitness of the birds involved.
Those species identified as sensitive to effect.	Barrier effect: Array. The presence of the array area could create a barrier to movements of breeding seabirds during foraging trips or to migratory movements. This may result in increased energy expenditure.	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 the birds involved.

Receptor	Activity or potential impact	Potential effect
Decommissioning (maximum of four years)		
Those species identified as sensitive to disturbance and displacement (i.e. auks).	Disturbance and displacement: Array Decommissioning activities associated with foundations and WTGs may lead to the disturbance and displacement of species within the array area and potentially within surrounding buffers to a lower extent.	Disturbance and displacement reduces the amount of functional habitat available for foraging, resting and other activities and may therefore reduce survival or reproductive fitness of the birds involved.
Those species identified as sensitive to disturbance and displacement (i.e. red-throated diver).	Disturbance and displacement: Offshore export cable Indirect impacts during the decommissioning phase within the offshore export cable corridor and areas of intertidal landfall through effects on habitats and prey species.	Disturbance and displacement reduces the amount of functional habitat available for foraging, resting and other activities and may therefore reduce survival or reproductive fitness of the birds involved.
Those species identified as sensitive to effect.	Indirect impacts on bird species due to impacts on prey species habitat loss: Export cable route Impacts include those resulting from underwater noise or the production of suspended sediments that may alter the distribution, physiology or behaviour of prey species and thereby have an indirect effect. These mechanisms could potentially result in less prey being available in the area adjacent to active decommissioning works to foraging seabirds.	A reduction in prey availability may reduce the survival or reproductive fitness of the birds involved.

Activities or impacts scoped out of assessment

12.4.14 A number of impacts have been scoped out from further assessment, as they were determined as not having the potential to lead to a significant adverse effect (RED, 2020a) and these conclusions were agreed by the Planning Inspectorate (Planning Inspectorate, 2020). These conclusions have been made based on the knowledge of the baseline environment, the nature of planned works and strong evidence supporting no pathway to a potential significant adverse impact from other similar projects. The conclusions follow (in a site-based context) existing best practice. Each scoped out activity or impact is considered in turn below and an indication given of whether the scope has evolved since Scoping.

Table 12-6 Activities or impacts scoped out of assessment

Activity or impact	Rationale for scoping out	PINS ID
Disturbance and displacement: Offshore export cable. **Maintenance activities associated with the export cable during the operational stage of the Project may lead to disturbance and displacement of species within the export cable corridor and potentially within surrounding buffers to a lower extent. (Operation).**	Given that potential impacts along the offshore and intertidal export cable route **will** be highly localised and episodic (i.e. limited to any maintenance or repair of the export cables) and do not overlap with any SPAs or Ramsar sites it was proposed that this impact should be scoped out from further consideration within the EIA in relation to the cable, with the focus of operational disturbance-displacement on the array only. The Planning Inspectorate agreed that disturbance as a result of maintenance of the offshore export cable during operation can be scoped out of the EIA in the Scoping Opinion (Planning Inspectorate, 2020).	4.7.1
Disturbance and displacement: Intertidal export cable. **Maintenance activities associated with the export cable during the operational phase of the Project may lead to disturbance and displacement of intertidal waterbird species within the export cable corridor and potentially within close proximity surrounding the works. (Operation).**	Given that potential impacts along the offshore and intertidal export cable route will be highly localised and episodic (i.e. limited to any maintenance or repair of the export cables) and do not overlap with any SPAs or Ramsar sites it was proposed that this impact should be scoped out from further consideration within the EIA in relation to the cable, with the focus of operational disturbance-displacement on the array only. The Planning Inspectorate agreed that	4.7.2

Activity or impact	Rationale for scoping out	PINS ID
	disturbance and displacement as a result of maintenance of the intertidal export cable during operation can be scoped out of the EIA in the Scoping Opinion (Planning Inspectorate, 2020).	

12.5 Methodology for baseline data gathering: intertidal

Overview

12.5.1 Baseline data collection has been undertaken to obtain information over the intertidal study areas described in **Section 12.4**. The current baseline conditions presented in **Section 12.7** set out data currently available from the study areas.

Desk study

12.5.2 The data sources that have been collected and used to inform this intertidal ornithology assessment are summarised in **Table 12-7**.

Table 12-7 Data sources used to inform the intertidal ornithology PEIR assessment.

Source	Date	Summary	Coverage of study area
BTO Non-Estuarine Waterbird Surveys (NEWS)	1984 – 2016	NEWS were conducted in 1984/1985, 1997/98, 2006/07 and 2015/16 and provide records focused on intertidal habitats along the UK coastline.	Covers the export cable corridor landfall area.
Wetland Bird Survey (WeBS)	Annual Reports	Annual survey reports of wetland waterbirds. Most recent being Frost *et al.* (2019).	Coverage of UK intertidal and wetland zones. Source contains information which can be drawn upon at a Rampion 2 specific scale, or a wider regional scale.
Local bird reports	Annual Reports	Annual publications produced by local birdwatching groups (e.g. Sussex Ornithological Society) which summarise sightings and surveys results for Sussex and the wider south coast region.	Coverage across region at various intertidal and wetland and coastal areas.

Source	Date	Summary	Coverage of study area
Wildfowl and Wetlands Trust – Aerial surveys of waterbirds in the UK	2004 – 2009	Aerial surveys of waterbirds around the UK. Surveys undertaken by WWT on behalf of DTI (now BEIS but also previously referred to as BERR and DECC).	Coverage of inshore waters relevant to Rampion 2 from survey grids SE3, SE4 and SE5.
Existing OWF grey literature	Various dates	Information obtained from various OWF Environmental Statements (i.e. Rampion 1, Thanet Extension, Kentish Flats, Greater Gabbard).	No coverage of Rampion 2 study area but provides information on birds in the context of the English south east coast.
Designated sites	Various dates	Information of Special Protection Areas (SPAs) and other designations relevant to ornithological features with potential connectivity to Rampion 2. Key source of information will be Natural England designated sites portal. Available from: https://designatedsites.naturalengland.org.uk/SiteSearch.aspx	Country wide information on designated sites.
National Bird Atlas (Balmer *et al.*, 2013)	2007-2011	Results of five years of breeding season and wintering surveys across the UK at a 10km resolution.	Intertidal export cable corridor overlaps with 20km squares TQ_A and TQ_F.

Intertidal site surveys

12.5.3 Surveys of the intertidal study area were undertaken during the winter of 2020/21, as shown in **Table 12-8**. The programme of surveys began in September 2020 and were completed in March 2021. For this PEIR, data from the first 12 surveys have been considered, as presented in **Appendix 12.1, Volume 4**. Data from the full set of surveys will be used to inform the ES.

12.5.4 A total of 39 species have been recorded in the site-specific surveys analysed so far. The only count which exceeded the threshold for significance based on 1% of the GB population is Mediterranean gull, which had a peak count of 151.

Table 12-8 Site surveys undertaken covering the intertidal study area

Survey type	Scope of survey	Coverage of study area	Survey status
Intertidal ornithology surveys (winter 2020/21)	A programme of monthly surveys to collect baseline data on bird assemblages associated with the intertidal study area.	Full coverage of intertidal study area	Surveys ongoing.

Data limitations

12.5.5 The results from the site-specific intertidal surveys are not yet all compiled and so the data available do not cover the entire winter period. The results should therefore be treated with caution. However, the results available are largely consistent with those obtained through the desk-based study and therefore, within the limitations set out in this section, would appear to be reliable.

12.5.6 The assessment presented in this chapter is therefore largely reliant on data gathered as part of the desk study. There is an inherent limitation in such an approach as the data available have not been specifically collected to inform this EIA and therefore the temporal scale, spatial scale, and methodological approaches might not be optimised for that purpose.

12.5.7 The biological environment can be highly variable, both spatially and temporally, meaning that bird 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.

12.6 Methodology for baseline data gathering: offshore

Overview

12.6.1 Baseline data collection has been undertaken to obtain information over the offshore study areas described in **Section 12.1**. The current baseline conditions presented in **Section 12.8** sets out data currently available information from the study area/s.

Desk study

12.6.2 The data sources that have been collected and used to inform this offshore ornithology assessment are summarised in **Table 12-9**.

Table 12-9 Data sources used to inform the offshore ornithology PEIR assessment

Source	Date	Summary	Coverage of study area
Local bird reports	Annual Reports	Annual publications produced by local birdwatching groups (e.g. Sussex Ornithological Society) which summarise sightings and surveys results for Sussex and the wider south coast region.	Coverage across region at various intertidal and wetland and coastal areas.
Wildfowl and Wetlands Trust – Aerial surveys of waterbirds in the UK	2004 – 2009	Aerial surveys of waterbirds around the UK. Surveys undertaken by WWT on behalf of DTI (now BEIS but also previously referred to as BERR and DECC).	Coverage of inshore waters relevant to Rampion 2 from survey grids SE3, SE4 and SE5.
Existing OWF grey literature	Various dates	Information obtained from various OWF Environmental Statements (i.e. Thanet Extension, Kentish Flats, Greater Gabbard).	No coverage of Rampion 2 study area but provides information on birds in the context of the English south east coast.
Designated sites	Various dates	Information of Special Protection Areas (SPAs) and other designations relevant to ornithological features with potential connectivity to Rampion 2. Key source of information will be Natural England designated sites portal. Available from: https://designatedsites.naturalengland.org.uk/SiteSearch.aspx	Country wide information on designated sites.
National Bird Atlas (Balmer *et al.*, 2013)	2007 – 2011	Results of five years of breeding season and wintering surveys across the UK at a 10km resolution.	Cable route PEIR Assessment Boundary overlaps with 20km squares TQ_A and TQ_F.
Potential impacts of OWFs on birds	Various dates	Published, peer reviewed scientific literature on bird behaviour and potential impacts from OWF e.g. Garthe and Hüppop (2004); Drewitt	Generic information applicable to Rampion 2

Source	Date	Summary	Coverage of study area
		and Langston (2006); Stienen *et al.* (2007); Speakman *et al.* (2009); Langston (2010); Band (2012); Cook *et al.* (2012); Furness and Wade (2012); Wright *et al.* (2012); Furness *et al.* (2013); Johnston *et al.* (2014a,b); Cook *et al.* (2014); Dierschke *et al.* (2017); SNCB (2017); Jarrett *et al.* (2018); Leopold & Verdaat (2018); Mendel *et al.* (2019).	ornithological features.
Large scale survey data sets	2014	Large scale seabird sensitivity mapping as part of the SeaMaST project (Bradbury *et al.*, 2014).	UK wide coverage with information that can be drawn upon at a Rampion 2 specific scale, or a wider regional scale.
Bird distributio n	Various dates	Publicly available reports of seabird distribution in UK waters e.g. Stone *et al.* (1995); Brown and Grice (2005); Kober *et al.* (2010); Waggitt *et al.* (2019); Cleasby *et al.* (2020).	UK wide coverage with information that can be drawn upon at a Rampion 2 specific scale, or a wider regional scale.
Bird breeding ecology	Various dates	Information on the breeding ecology of various bird species e.g. Cramp and Simmons (1977-94); Del Hoyo *et al.* (1992-2011); Robinson (2005).	Generic information applicable to Rampion 2 ornithological features.
Bird population estimates and demograp hic rates	Various dates	Data on seabird populations and demographic rates for use in assessments e.g. Mitchell *et al.*, 2004; BirdLife International, 2004; Holling *et al.*, 2011; Frost *et al.*, 2019; Musgrove *et al.*, 2013; Furness, 2015; Horswill *et al.*, 2017, JNCC, 2020.	These sources contain information which can be drawn upon at a Rampion 2 specific scale, or

Source	Date	Summary	Coverage of study area
			a wider regional scale.
Bird migration and foraging movements	Various dates	Bird movements during breeding season foraging trips and migratory movements e.g. Wernham *et al.*, 2002; Thaxter *et al.*, 2012; Wright *et al.*, 2012; Furness *et al.*, 2018; Woodward *et al.*, 2019; Wakefield *et al.*, 2017; Wakefield *et al.*, 2013; RSPB FAME and STAR tracking data.	These sources contain information which can be drawn upon at a Rampion 2 specific scale, or a wider regional scale.

Offshore site surveys

12.6.3 Species accounts presented on offshore ornithology consist of the data collected during 15 site-specific aerial digital surveys of the Rampion 2 array area plus 4km buffer carried out between 2019 and 2020, from which the data relevant to this PEIR assessment has been extracted, as detailed in **Appendix 12.1, Volume 4**. For the subsequent ES, these data will be updated with a further nine months of survey data to a total of 24 months.

12.6.4 Data from aerial visual surveys and boat-based surveys conducted for the existing Rampion 1 project and the wider Zone 6 area overlap with the offshore part of the PEIR Assessment Boundary for Rampion 2 and were therefore also used to inform the EIA where appropriate. A summary of these sources is given in **Table 12-10**.

12.6.5 Additional sources of information for the purpose of impact assessment were identified and details are provided in **Appendix 12.1, Volume 4**.

Table 12-10 Site surveys undertaken

Survey type	Scope of survey	Coverage of study area	Survey status
Rampion 2 – Digital aerial survey data (2019 – 2021)	Aerial digital surveys conducted by APEM Ltd. on a monthly basis between April 2019 and March 2021.	Rampion 2 array area plus 4km buffer.	Surveys completed but analysis in progress. Data available for this PEIR assessment: April 2019 to June 2020.
Existing Rampion 1 project – Baseline characterisation	Boat-based surveys across Zone 6 (Rampion 1) and 5km buffer plus an adjacent control zone to the east of	Approximately 40% coverage of	Complete

Survey type	Scope of survey	Coverage of study area	Survey status
surveys (2010 – 2012)	the project. Data collection initiated in March 2010 for two years (end date February 2012).	the Rampion 2 array area.	
	Aerial visual surveys across Rampion zone and 5km buffer plus an adjacent control zone to the east of the Proposed Development. Data collected for one year (August 2010 – August 2011).	Approximately 40% coverage of the Rampion 2 array area.	Complete

Data limitations

12.6.6 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. The data presented in this report for the purpose of baseline characterisation of Rampion 2 was collected over a 15-month period and the method used to collect these data (aerial digital still imagery) may be considered to represent a snapshot of each month.

12.6.7 However, the most recent survey data used for describing the existing baseline are consistent with data obtained from surveys conducted for other offshore wind farm applications in UK waters and are in general agreement with information from the literature and previous surveys conducted within the existing Rampion 1 project. Thus, these data are considered to be representative of the site for the purpose of baseline characterisation and impact assessment of Rampion 2.

12.6.8 For the ES, a full 24 months of aerial digital survey data will be available to provide a robust and appropriate baseline in support of the DCO Application.

12.7 Baseline conditions: intertidal

Current baseline intertidal

Data sources

12.7.1 For this PEIR, a desk-based approach to data collection has been used, compiling data from a number of sources, including BTO Non-Estuarine Waterbird Surveys (NEWS), local bird reports, and information presented in the Rampion 1 Environmental Statement (see **Table 12-7**). Full details of the data sources and results are presented in the **Appendix 12.1, Volume 4**.

12.7.2 Site specific surveys over the 2020/21 non-breeding period were not available during the drafting of this assessment, but the results from those surveys will be used to inform the ES.

Key findings

12.7.3 The most robust data available at this stage are the results of the NEWS surveys, presented in **Table 12-11**.

Table 12-11 NEWS results between Climping beach and West beach Littlehampton

Species	Survey 1997/98	2006/07	2015/16	GB 1% threshold (Frost *et al.*, 2019)
Red-breasted merganser	1 to 3	0	0	100
Oystercatcher	81 to 120	21 to 40	1 to 30	2,900
Grey plover	0	1 to 50	1 to 50	330
Ringed plover	21 to 30	31 to 60	0	420
Turnstone	1 to 30	121 to 180	1 to 60	400
Sanderling	121 to 180	61 to 120	1 to 200	200
Dunlin	1 to 400	0	0	3,400
Redshank	1 to 4	1 to 10	0	940
Black-headed gull	nc	nc	1 to 200	22,000
Mediterranean gull	nc	nc	11 to 20	40
Common gull	nc	nc	1 to 30	7,000
Great black-backed gull	nc	nc	1 to 10	760
Herring gull	nc	nc	1 to 300	7,300
Lesser black-backed gull	nc	nc	0	1,200
Cormorant	0	1 to 10	0	620

Nc = Not counted

12.7.4 Together with the other results presented in **Appendix 12.1, Volume 4**, these data provide evidence that waterbird occurrence is generally very low and insignificant on a regional and national scale within the intertidal environment at the proposed landfall area. The only species potentially occurring above 1% of the national wintering population was sanderling during the winter (1% of the national population being the threshold for consideration within impact assessments).

12.7.5 The site-specific survey data are currently preliminary, but they suggest that Mediterranean gull is also found in sufficient numbers to warrant further consideration. This is confirmed by other data sources identified in **Appendix 12.1, Volume 4**, particularly the Sussex Bird Report 2018.

Future baseline intertidal

12.7.6 There are currently no known other proposed developments likely to influence the intertidal study area. In the absence of significant local impacts, it is likely that the populations of bird species present will evolve in accordance with regional and national trends.

12.8 Baseline conditions: offshore

Current baseline offshore

Data sources

12.8.1 A programme of 24-months of aerial digital surveys has been completed, covering the Rampion 2 array area plus a buffer of at least 4km. Full details of these surveys, along with other data sources considered, are presented in the **Appendix 12.1, Volume 4**. At the PEIR stage, data from the first 15 months of surveys (April 2019 – June 2020) have been analysed and used to inform this impact assessment, although the full 24 months will be used to inform the ES.

Key results

12.8.2 The following bird species (**Table 12-12**) were recorded within the study area between April 2019 and June 2020. A number of species were only recorded in the study area in trivial numbers or numbers determined by expert judgement to be too low to warrant detailed species accounts (these species are in italic font within the table). Those species highlighted in bold in **Table 12-12** form the basis of detailed accounts for this report.

Table 12-12 Bird species recorded in site-specific digital aerial surveys of Rampion 2 study area.

Divers and pelagic species	Gulls	Terns	Auks	Other
Red-throated diver	**Kittiwake**	**Sandwich tern**	**Guillemot**	*Cormorant*
Great northern diver	**Little gull**	*Common tern*	**Razorbill**	*Brent goose*
Gannet	**Common gull**	***'Commic' tern**	*Puffin*	*Shelduck*

Divers and pelagic species	Gulls	Terns	Auks	Other
Fulmar	*Mediterranean gull*			
Manx shearwater	**Herring gull**			
	Great black-backed gull			
	Lesser black-backed gull			

* 'Commic' tern represents tern sightings of unidentified Arctic tern and common tern.

12.8.3 Although not observed within the study area in the aerial digital surveys, based on other data sources considered (particularly the Rampion 1 ES), great skua has also been considered for impact assessment.

12.8.4 Details of the estimated abundances of all species, along with information about recorded behaviours, are presented in the **Appendix 12.1, Volume 4**.

Conservation status of offshore ornithology receptors

12.8.5 The conservation status of the key species recorded during the survey programme is provided in **Table 12-13** below. Red list status is from Eaton et al. (2015).

Table 12-13 Summary of nature conservation value of species considered at potential risk of impacts

Species	Conservation Status
Fulmar	BoCC Amber listed, Birds Directive Migratory Species
Gannet	BoCC Amber listed, Birds Directive Migratory Species
Great skua	BoCC Amber listed, Birds Directive Migratory Species
Kittiwake	BoCC Red listed, Birds Directive Migratory Species
Little gull	BoCC Green listed, Birds Directive Migratory Species
Common gull	BoCC Amber listed, Birds Directive Migratory Species
Great black-backed gull	BoCC Amber listed, Birds Directive Migratory Species
Herring gull	BoCC Red listed, Birds Directive Migratory Species

Species	Conservation Status
Lesser black-backed gull	BoCC Amber listed, Birds Directive Migratory Species
Common tern	BoCC Amber listed, Birds Directive Migratory Species, Birds Directive Annex 1
Arctic tern	BoCC Amber listed, Birds Directive Migratory Species, Birds Directive Annex 1
Guillemot	BoCC Amber listed, Birds Directive Migratory Species
Razorbill	BoCC Amber listed, Birds Directive Migratory Species

Biological seasons, populations and demographics for offshore ornithology receptors

12.8.6 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 PEIR in order to establish the level of importance any seabird species has within the offshore ornithology study area 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 12-15**). The bio-seasons are defined within this PEIR as: return migration, migration-free breeding, post-breeding migration, migration-free winter bio-seasons, extended breeding and extended 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;
- extended breeding and extended 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, two bio-seasons are defined:
  - extended breeding from modal arrival to the colony at the beginning of breeding to modal departure from the colony; and
  - extended non-breeding from modal departure from the colony at the end of breeding to modal return to the colony the following year.

12.8.7 Furness (2015) also provides population estimates for each species in each non-breeding bio-season in each BDMPS region. Total population sizes for the biogeographic population with connectivity to UK waters are also provided in Furness (2015).

12.8.8 Breeding population sizes are based on colony counts from the national Seabird Monitoring Programme database (JNCC, 2021) for all colonies within mean-max foraging range (Woodward *et al.*, 2019). One apparently occupied nest (AON) was assumed to equal two breeding birds. Where possible, the average count from 2019 and 2020 was used (i.e. corresponding to the same years as the available aerial digital survey data), or the most recent count otherwise.

12.8.9 During the breeding season, in addition to birds associated with breeding colonies, there will be immature birds, juvenile birds and “sabbatical” birds (mature birds not breeding in a given year) present within the region. It was assumed that, of the BDMPS population in the bio-season immediately before the breeding season (usually the return migration bio-season), all mature birds return to breeding colonies, but all immature birds remain within the BDMPS.

12.8.10 The total regional population within the breeding season is therefore the sum of breeding adults associated with nearby colonies plus the proportion of immature birds from the BDMPS population. This is shown in **Table 12-14**. The bio-seasons, BDMPS population sizes and biogeographic population for each of the key species are provided in **Table 12-15**.

Table 12-14 Calculation of regional population during the breeding season.

Species	Breeding population at colonies within mean-max foraging range (JNCC, 2021)	BDMPS return migration population size (Furness, 2015)	Proportion of juvenile, immature and non-breeding individuals (Furness, 2015)	Juvenile, immature and non-breeding individuals	Potential total regional baseline population during non-migratory breeding bio-season
Gannet	17,372	248,385	0.45	111,156	128,528
Kittiwake	1,344	691,526	0.47	323,693	325,037
Common gull	0	45,000*	0.32***	14,217	14,217
Lesser black-backed gull	356	197,483	0.40	79,934	80,289
Herring gull	3,394	466,511**	0.52	243,300	246,694
Great black-backed gull	48	17,742	0.56	9,892	9,940
Common tern	0	144,911	0.40	58,138	58,138
Arctic tern	0	163,930	0.37	60,177	60,177
Sandwich tern	532	38,051	0.39	14,707	15,239
Guillemot	600	1,617,306**	0.43	687,820	688,420
Razorbill	0	591,874	0.43	253,660	253,660

* Not in Furness (2015); used Stienen et al. (2007)
** Extended non-breeding bio-season population used
*** Not in Furness (2015); proportion of juveniles based on population structure given in **Table 12-16.**

Table 12-15 Bio-seasons, BDMPS population sizes and biogeographic population sizes. Furness (2015) unless stated otherwise.

Species	Return Migration	Migration-free Breeding	Post-breeding Migration	Migration-free Winter	Extended Breeding	Extended Non-breeding	Biogeographic population
Fulmar (UK Western waters plus Channel)	December to March (828,194)	April to August (N/A)	September to October (828,194)	November (556,367)	-	-	8,055,000
Gannet (UK North Sea and Channel)	December to March (248,385)	April to August (128,528)	September to November (456,298)	-	-	-	1,180,000
Great skua (UK North Sea and Channel)	March to April (8,485)	May to July (N/A)	August to October (19,556)	November to February (143)	-	-	73,000
Kittiwake (UK Western waters plus Channel)	January to April (691,526)	May to July (325,037)	August to December (911,586)	-	-	-	5,100,000
Common gull*	January to April (45,000)	May to July (14,217)	August to December (45,000)	-	-	-	1,600,000
Little gull**	January to April (30,500)	May to July (8,444)	August to October (30,500)	-	-	-	75,000
Lesser black-backed gull (UK North Sea and Channel)	March to April (197,483)	May to July (80,289)	August to October (209,007)	November to February (39,314)	-	-	864,000

Species	Return Migration	Migration-free Breeding	Post-breeding Migration	Migration-free Winter	Extended Breeding	Extended Non-breeding	Biogeographic population
Herring gull (UK North Sea and Channel)	-	-	-	-	March to August (5,164)	September to February (246,694)	1,098,000
Great black-backed gull (UK South-west & Channel)	January to April (17,742)	May to July (9,940)	August to November (17,742)	December (17,742)	-	-	235,000
'Commic' tern* (UK North Sea and Channel)**	April to May (308,841)	June (118,315)	July to September (308,841)	-	-	-	1,108,000
Sandwich tern (UK North Sea and Channel)	March to May (38,051)	June (15,239)	July to September (38,051)		-	-	148,000
Guillemot (UK North Sea and Channel)	-	-	-	-	March to July (688,420)	August to February (1,617,306)	4,125,000
Razorbill (UK North Sea and Channel)	January to March (591,874)	April to June (253,660)	August to October (591,874)	November to December (218,622)	-	-	1,707,000

** Common gull is not included in Furness (2015). BDMPS population estimates and biogeographic population based on Stienen et al. (2007).
** Little gull is not included in Furness (2015). BDMPS population estimates based on unpublished research by APEM. Biogeographic population based on Stienen et al. (2007).
*** 'Commic' tern population sizes are based on sum of common tern and Arctic tern population sizes presented in Furness (2015). The same bio-seasons are appropriate for either species.

12.8.11 The method to assess the potential impact from additional mortality to the population due to Rampion 2 is assessed in terms of any change in relation to the baseline mortality rate for any given species within each of the recognised bio-seasons. The average mortality across all age classes for each species are presented in **Table 12-16**. The method presented assumes all age classes are at risk to the possible impacts of the Proposed Development equally and as such the baseline mortality rate is a weighted average based on all age classes. Demographic rates for each species were those provided in Horswill and Robinson (2015). These data were used to calculate the expected stable proportions in each age class for each species. Each age class survival rate was then multiplied by its stable age proportion and the total for all ages summed to give the weighted average survival rate converted to an average mortality rate.

Table 12-16 Demographic rates and population age ratios for each key species assessed in this report

Species	Parameter	Survival (age class)							Productivity (chicks per pair)	Average mortality
		0-1	1-2	2-3	3-4	4-5	5-6	Adult		
Gannet	Demographic rate	0.424	0.829	0.891	0.895	0.895	-	0.919	0.700	0.188
	Population age ratio	0.191	0.081	0.067	0.060	0.054	-	0.547	-	-
Kittiwake	Demographic rate	0.790	0.854	0.854	0.854	-	-	0.854	0.690	0.157
	Population age ratio	0.153	0.121	0.103	0.088	-	-	0.535	-	-
Little gull*	Demographic rate	0.410	0.710	-	-	-	-	0.800	0.543	0.284
	Population age ratio	0.196	0.080	-	-	-	-	0.723	-	-
Common gull	Demographic rate	0.410	0.710	0.828	-	-	-	0.828	0.543	0.259
	Population age ratio	0.186	0.076	0.054	-	-	-	0.684	-	-
Great black-	Demographic rate	0.798	0.930	0.930	0.930	0.930	-	0.930	1.139	0.093

Species	Parameter	Survival (age class)							Productivity (chicks per pair)	Average mortality
		0-1	1-2	2-3	3-4	4-5	5-6	Adult		
backed gull**	Population age ratio	0.178	0.142	0.132	0.123	0.114	-	0.312	-	-
Herring gull	Demographic rate	0.798	0.834	0.834	0.834	0.834	-	0.834	0.920	0.172
	Population age ratio	0.177	0.141	0.118	0.098	0.082	-	0.384	-	-
Lesser black-backed gull	Demographic rate	0.820	0.885	0.885	0.885	0.885	-	0.885	0.530	0.124
	Population age ratio	0.113	0.109	0.096	0.085	0.075	-	0.501	-	-
Common tern	Demographic rate	0.441	0.441	0.850	-	-	-	0.883	0.764	0.268
	Population age ratio	0.235	0.104	0.046	-	-	-	0.615	-	-
Arctic tern***	Demographic rate	0.441	0.837	0.837	0.837	-	-	0.837	0.380	0.217
	Population age ratio	0.135	0.060	0.050	0.042	-	-	0.713	-	-
Sandwich tern	Demographic rate	0.358	0.741	0.741	-	-	-	0.898	0.702	0.245

Species	Parameter	Survival (age class)							Productivity (chicks per pair)	Average mortality
		0-1	1-2	2-3	3-4	4-5	5-6	Adult		
	Population age ratio	0.224	0.080	0.059	-	-	-		-	-
Great skua	Demographic rate	0.730	0.730	0.730	0.730	0.730	0.882	0.882	0.651	0.219
	Population age ratio	0.161	0.117	0.086	0.063	0.046	0.033	0.494	-	-
Guillemot	Demographic rate	0.560	0.792	0.917	0.917	0.939	0.939	0.939	0.672	0.138
	Population age ratio	0.160	0.090	0.071	0.065	0.061	0.057	0.496	-	-
Razorbill	Demographic rate	0.630	0.630	0.630	0.895	0.895	-	0.895	0.570	0.193
	Population age ratio	0.163	0.103	0.065	0.041	0.037	-	0.591	-	-

* Little gull juvenile survival rates and productivity rates not provided in Horswill & Robinson (2015) so common gull rates used.
** Great black-backed gull juvenile survival rate not provided in Horswill & Robinson (2015) so herring gull rate used.
*** Arctic tern juvenile survival rate not provided in Horswill & Robinson (2015) so common tern rate used.

Future baseline offshore

12.8.12 There are currently no known other proposed developments likely to influence the offshore study area. In the absence of significant local impacts, it is likely that the populations of bird species present will evolve in accordance with regional and national trends.

12.9 Basis for PEIR assessment

Maximum design scenario

12.9.1 Assessing using a parameter-based design envelope approach means that the assessment considers a maximum design scenario (MDS) whilst allowing the flexibility to make improvements in the future in ways that cannot be predicted at the time of submission of the DCO Application. The assessment of the maximum adverse scenario establishes the maximum potential adverse impact and as a result effects of greater adverse significance will not arise should any other development scenario to that assessed within this chapter be taken forward in the final scheme design.

12.9.2 The maximum assessment assumptions that have been identified to be relevant to offshore and intertidal ornithology are outlined in **Table 12-17** below and are in line with the Project Design Envelope (**Chapter 4**).

12.9.3 Potential impacts on ornithology receptors include indirect impacts as a result of potential impacts on prey species including fish and benthic organisms. The maximum impact on ornithological receptors will result from the maximum impact on fish and benthic organisms. The maximum assessment assumptions given in **Table 12-17** below should therefore be considered alongside the MDS assessment assumptions given in **Chapter 8** and **Chapter 9**.

Table 12-17 Maximum assessment assumptions for impacts on offshore and intertidal ornithology

Project phase and area	Maximum assessment assumptions	Justification
Construction (Intertidal)	Method: Horizontal Directional Drill (HDD; see **Chapter 4**) Number of HDD drills: 4 Landfall construction compound (m^2): 100m x 75m	The maximum area and duration of works in the intertidal zone will lead to the maximum disturbance of birds. As no formal commitments have been made as to the period of working or time of year works will be carried out, the assessment assumption is that works will occur for 24 hours a day, and that the six-month period will coincide with winter, when key ornithological receptors are present in the intertidal study area. This assumption is precautionary, as for health and safety reasons it is likely that the majority of works will be undertaken during daylight conditions and/or periods of clement weather.
Operation and Maintenance (Intertidal)	Operational lifetime: around 30 years Routine maintenance: minimal	The maximum amount of routine maintenance and repairs will lead to the greatest disturbance to key ornithological receptors.
Decommissioning (Intertidal)	It is anticipated that the electrical cables passing through the landfall area will be left in-situ with ends cuts, sealed and buried to minimise environmental effects associated with removal.	The maximum area and duration of works in the intertidal zone will lead to the maximum disturbance of birds.
Construction (Offshore array area)	Installation vessel - maximum number of vessels: 3 (foundations); 2 (WTGs) + 3 (offshore substation) = 8 (maximum number at any one time). Installation vessel - maximum number of return trips: 60 (foundations) + 40	The greatest number of vessels and greatest total number of trips will lead to the greatest disturbance to ornithological receptors. The assessment assumption is that all foundations are complete before WTG installation commences. It is further assumed that array area cable installation and offshore

Project phase and area	Maximum assessment assumptions	Justification
	(WTGs) + 12 (offshore substation) = 112 (total). Support vessels - maximum number of vessels: 10 (foundations); 10 (WTGs) + 13 (array area cables) + 20 (offshore substation) = 43 (maximum number at any one time). Support vessels - maximum number of return trips: 60 (foundations) + 100 (WTGs) + 300 (array area cables) + 12 (offshore substation) = 472 (total). Transport vessels - maximum number of vessels: 6 (foundations) + 6 (offshore substation) = 12 (maximum number at any one time). Transport vessels - maximum number of return trips: 40 (foundations) + 12 (offshore substation) = 52 (total). Crew Transfer vessels - maximum number of vessels: 6 (foundations); 10 (WTGs) + 6 (offshore substation) = 16 (maximum number at any one time). Crew Transfer vessels - maximum number of return trips: 500 (foundations) + 1,200 (WTGs) + 60 (offshore substation) = 1,760 (total). Helicopters - maximum number of vessels: 2 (WTGs) + 2 (offshore substation) = 4.	substation installation may occur concurrently with each other and either foundation construction or WTG installation. Therefore, the total number of vessels at any one time includes either vessels involved in foundation construction or WTG installation, but not both, in addition to vessels involved in array area cable installation and offshore substation installation.

wood.

Project phase and area	Maximum assessment assumptions	Justification
	Helicopters - maximum number of return trips: 500 (WTGs) + 30 (offshore substation) = 530 (total).	
Operation and Maintenance (Offshore array area)	Operational lifetime: >30 years Helicopter total trips (per year): 60 Jack-up WTG visits (per year): 12 Jack-up platform visits (per year): 6 Jack-up total trips (per year): 18 Crew vessels WTG visits (per year): 1,095 Number of WTGs: 116 Rotor diameter: 172m Minimum height of lowest blade tip above HAT (m): 22 m Maximum blade tip height above LAT (m): 210 Minimum WTG spacing: 860m Maximum developable array area (km^2): 270	The greatest number of vessels and greatest total number of trips will lead to the greatest disturbance to ornithological receptors. For more details on the vessels involved, see **Chapter 4**. Most scheduled maintenance is expected to occur April – September. For collision risk, the worst-case scenario is the greatest number of smaller WTGs. Although the total frontal area is higher using larger WTGs, the vast majority of bird flights are at low-heights e.g. for kittiwake 90.7% are below 25m ASL and 99.995% are below 100m ASL (Cook *et al.*, 2012). Therefore, a greater number of smaller WTGs creates a higher collision risk (Johnston *et al.*, 2016).
Decommissioning (Offshore array area)	As per construction	The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment. The greatest number of vessels and greatest total number of trips will lead to the greatest disturbance to ornithological receptors.
Construction (Offshore cable export area)	Length of offshore cable corridor, link to shore (km): 19km	The greatest number of vessels and greatest total number of trips will lead to the greatest disturbance to ornithological

Project phase and area	Maximum assessment assumptions	Justification
	Width of offshore cable corridor, link to shore (km): 2km Main Laying vessels: Number: 1 Main laying vessels (return trips): 6 Main jointing vessels: Number: 1 Main jointing vessels (return trips): 6 Main burial vessels: Number: 2 Main burial vessels (return trips): 6 Number of multicat-type vessels: 4 Multicat-type vessels (return trips): 16 Number of spoil barges (for floatation pits): 4 Spoil barges (return trips): 128 Support vessels: Number: 10 Support vessels (return trips): 60 Duration: 4 months	receptors. For more details on the vessels involved, see **Chapter 4.**
Operation and Maintenance (Offshore cable export area)	Maximum number of remedial burial events (lifetime quantity): 3 per cable x 4 cables = 12. Maximum length of cable subject to jetting remediation per remedial burial event (m): 2,000. Maximum number of cable repairs (lifetime quantity): 4. Predicted duration of each cable repair event: 3 months.	The maximum amount of remedial work will lead to the greatest impact through disturbance.

Project phase and area	Maximum assessment assumptions	Justification
Decommissioning (Offshore cable export area)	As for construction.	The maximum design scenario assumes all offshore cables will be removed, which will be a similar process to the construction process in reverse. This will therefore entail a similar amount of disturbance over a similar period of time.

Embedded environmental measures

12.9.4 As part of the Rampion 2 design process, a number of embedded environmental measures have been adopted to reduce the potential for impacts on offshore and intertidal ornithology receptors. These embedded environmental measures will evolve over the development process as the EIA progresses and in response to consultation. They will be fed iteratively into the assessment process.

12.9.5 These measures typically include those that have been identified as good or standard practice and include actions that will be undertaken to meet existing legislation requirements. As there is a commitment to implementing these embedded environmental measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Rampion 2 and are set out in this PEIR.

12.9.6 **Table 12-18** sets out the relevant embedded environmental measures within the design and how these affect the offshore and intertidal ornithology assessment.

Table 12-18 Relevant offshore and intertidal ornithology embedded environmental measures

ID	Environmental measure proposed	Project phase measure introduced	How the environmental measures will be secured	Relevance to ornithology assessment
C-4	Horizontal Directional Drill (HDD) technique will be used at the landfall location.	Scoping	DCO works plans, description of development and requirements	HDD minimises disturbance to ornithological features using the intertidal area during construction.
C-25	All aspects of the construction work will be in accordance with the Construction (Design and Management) Regulations 2015.	Scoping	Outline COCP and DCO requirement	Adherence to the Construction (Design and Management) Regulations 2015 ensures construction is carried out efficiently with minimal disturbance to ornithological features.
C-36	The number of wind turbine generators (WTGs) will not exceed that of the existing Rampion 1 project.	Scoping	DCO requirements or DML conditions.	The lower the number of WTGs, the lower the collision risk to ornithological features.
C-37	Maximum blade tip height is 325m from lowest astronomical tide (LAT) and rotor diameter of 275m.	Scoping - updated at PEIR	DCO requirements or DML conditions.	As bird flight heights tend to be skewed towards lower altitudes, collision risk is reduced if the majority of the rotor swept area is higher.
C-43	The subsea export cable ducts will be drilled underneath the beach using horizontal	Scoping	DCO requirements or DML conditions.	HDD techniques minimise direct disturbance impacts on ornithological features,

ID	Environmental measure proposed	Project phase measure introduced	How the environmental measures will be secured	Relevance to ornithology assessment
	directional drilling (HDD) techniques.			and also minimise indirect impacts through impacts on prey species and sediments.
C-52	A piling Marine Mammal Mitigation Protocol (MMMP) will be implemented during construction and will be developed in accordance with Joint Nature Conservation Committee (JNCC, 2010) guidance and with the latest relevant guidance and information and in consultation with stakeholders. The piling MMMP will include details of soft starts to be used during piling operations with lower hammer energies used at the beginning of the piling sequence before increasing energies to the higher levels.	Scoping - updated at PEIR	DCO requirements or DML conditions.	The MMMP also minimises direct disturbance impacts on ornithological features during construction, and indirect impacts through impacts on prey species and sediments.
C-53	An Outline Marine Pollution Contingency Plan (MPCP) will be developed. This MPCP will outline procedures to protect personnel working and to safeguard the marine	Scoping	DCO requirements or DML conditions.	The MPCP aims to minimise potential impacts on ornithological features from potential pollution incidents.

ID	Environmental measure proposed	Project phase measure introduced	How the environmental measures will be secured	Relevance to ornithology assessment
	environment and mitigation measures in the event of an accidental pollution event arising from offshore operations relating to Rampion 2. The MPCP will also include relevant key emergency contact details.			
C-63	An Outline COCP will be developed to reduce direct and indirect disturbance and displacement effects to ornithological features.	Scoping - updated at PEIR	DCO requirements or DML conditions.	Reduces direct and indirect disturbance and displacement effects to ornithological features.
C-65	The proposed offshore cable corridor and cable landfall (below mean high water springs [MHWS])) will avoid all statutory marine designated areas.	Scoping	DCO requirements or DML conditions.	Minimises potential impacts on ornithological features which are designated features of protected areas by avoiding any direct works or operations from being within such sites.
C-89	There will be a minimum blade tip clearance of at least 22m above highest astronomical tide (HAT).	Scoping	Secured in the description of the development	As bird flight heights tend to be skewed towards lower altitudes, collision risk is reduced if the minimum blade tip height is larger.

ID	Environmental measure proposed	Project phase measure introduced	How the environmental measures will be secured	Relevance to ornithology assessment
C-94	Marking and lighting the Proposed Development offshore will be undertaken in accordance with relevant industry guidance and as advised by relevant stakeholders, in line with C-49, C-110 and C-157.	Scoping - updated at PEIR	DCO requirements or DML conditions.	Guidance includes designing lighting to minimise attraction of ornithological features, which therefore reduces collision risk.

12.10 Methodology for PEIR assessment

Introduction

12.10.1 The project-wide generic approach to impact assessments at the PEIR stage are set out in **Chapter 5: Approach to the EIA**. The assessment methodology for offshore and intertidal ornithology for the PEIR is consistent with that provided in the Scoping Report (RWE, 2020).

12.10.2 The assessment approach will use a 'source-pathway-receptor' model, which identifies likely impacts on bird species resulting from the proposed construction, operation and decommissioning of the offshore infrastructure. The parameters of this 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 cable installation and a resultant effect such as re-suspension of sediments.
- Pathway – the means by which the effect of the activity could impact the receptor e.g. for the example above, re-suspended sediment could settle and smother the seabed, killing benthic prey species or burying them out of reach.
- Receptor – the element of the receiving environment that is impacted e.g. for the above example, bird species which are unable to forage effectively due to reduction in prey availability.

Assessment criteria and assignment of significance

12.10.3 The sensitivity of the receptors to sources of effect is defined in **Table 12-19** below, through reference to an example potential impact from disturbance activities.

Table 12-19 Definition of Level of Sensitivity for Ornithological Receptors.

Sensitivity	Definition used in this chapter
High	Bird species has very limited tolerance of sources of disturbance such as noise, light, vessel movements and the sight of people.
Medium	Bird species has limited tolerance of sources of disturbance such as noise, light, vessel movements and the sight of people.
Low	Bird species has some tolerance of sources of disturbance such as noise, light, vessel movements and the sight of people.
Very Low	Bird species is generally tolerant of sources of disturbance such as noise, light, vessel movements and the sight of people.

12.10.4 The sensitivity of a receptor is one of the core components of the assessment of potential impacts and their effects on ornithological receptors. Account has also to be taken of each receptor's conservation value when coming to a reasoned judgement on the definition of the overall sensitivity of any particular receptor to any potential impact or effect. In that reasoned judgement account has to be taken on a species-by-species basis, noting that a particular species with a high conservation value may not be sensitive to a specific effect and vice versa. An example of this is herring gull that is an interest feature of some SPAs and has a conservation concern listing of 'Red' because of recent population declines but cannot be judged to be sensitive to disturbance given its propensity to exploit food resources made available by people and to nest on buildings even while considerable efforts are made to deter them. This reasoned judgement is an important part of the overall narrative used to determine the potential impact significance and can be used where relevant as a mechanism for modifying the sensitivity of an effect assigned to a specific receptor.

12.10.5 The conservation value of ornithological receptors is based on the population from which individuals are predicted to be drawn. This reflects current understanding of the movements of species, with site-based protection (e.g. SPAs) generally limited to specific periods of the year (e.g. the breeding season). Therefore, conservation value can vary through the year depending on the relative sizes of the number of individuals predicted to be at risk of impact and the population from which they are estimated to be drawn. Ranking therefore corresponds to the degree of connectivity which is predicted between the wind farm site 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. The criteria for defining conservation value in this chapter are outlined in **Table 12-20** below.

Table 12-20 Definition of conservation value levels for ornithological receptors.

Value	Definition used in this chapter
High	A species for which individuals at risk can be clearly connected to a particular SPA or is found in numbers of international importance within the Rampion 2 array area.
Medium	A species for which individuals at risk are probably drawn from particular SPA populations or found in numbers of national importance within the Rampion 2 array area, although other colonies (both SPA and non-SPA) may also contribute to individuals observed in the offshore and intertidal ornithology study area.
Low	A species for which it is not possible to identify in the SPAs and may be found in regionally or locally important numbers from which individuals on the wind farm have been drawn, or for which no SPAs are designated.

12.10.6 For assessment, expert judgement is used to combine both the sensitivity given in **Table 12-19** with the value given in **Table 12-20** to produce an overall score for value, importance, and sensitivity for each receptor**.**

12.10.7 The criteria for defining magnitude in this chapter are outlined in **Table 12-21** below. In addition to those levels of magnitude defined in **Table 12-21**, additional consideration is given to circumstances of no change, where no loss of (or gain) in the size or extent of distribution of the relevant biogeographic population that is the interest feature of a protected site may occur.

Table 12-21 Definition of levels of potential magnitude of change for ornithological receptors.

Magnitude	Definition Used in This Chapter
Major	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.
Moderate	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.
Minor	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 circa six months) following cessation of the development activity.

12.10.8 The potential significance of the effect upon offshore and intertidal ornithology receptors is determined by correlating the magnitude of the change and the sensitivity of the receptor. The method employed for this assessment is presented in **Table 12-22**. Where a range of significance of effect is presented in **Table 12-22**, the final assessment for each effect is based upon expert judgement.

12.10.9 For the purposes of this assessment, any effects with a significance level of 'minor' or less have been concluded to be not significant in terms of the EIA Regulations.

Table 12-22 Matrix used for the assessment / assignment of the potential significance of effect.

Value, Importance, Sensitivity	Magnitude of Change: Negligible	Minor	Moderate	Major
Low	Negligible (Not Significant)	Negligible (Not Significant)	Minor (Not Significant)	Minor (Not significant)
Medium	Negligible (Not Significant)	Minor (Not Significant)	Minor (Not Significant)	Moderate (Potentially significant)
High	Minor (Not Significant)	Minor (Not Significant)	Moderate (Potentially significant)	Major (Significant)
Very high	Minor (Not Significant)	Moderate (Potentially significant)	Major (Significant)	Major (Significant)

12.10.10 Further modifications have been introduced in the interest of proportionate assessment and in accordance with guidance presented in PD 6900:2015 Environmental impact assessment for offshore renewable energy projects - Guide (British Standards Institute (BSI) 2015) such that:

- a magnitude of change of **no change** is not assessed since it will always lead to a not significant effect;
- a magnitude of change of **negligible** is not considered further since it will always lead to a not significant effect; and
- resources and receptors of **low** importance, value or sensitivity are not considered further since any magnitude of change on them will not lead to a significant effect.

12.10.11 Where Natura 2000 sites (i.e. internationally designated sites) are considered, this chapter summarises the assessments made on the interest features of internationally designated sites as described within this chapter (with the assessment on the site itself deferred to the **Draft RIAA**.

12.10.12 With respect to nationally and locally designated sites, where these sites fall within the boundaries of an internationally designated site (e.g. SSSIs which have not been assessed within the HRA Report for Rampion 2), only the international site has been taken forward for assessment. This is because potential effects on the integrity and conservation status of the nationally designated site are assumed to be inherent within the assessment of the internationally designated site (i.e. a separate assessment for the national site is not undertaken). However, where a nationally designated site falls outside the boundaries of an international site, but within the offshore and intertidal study area, an assessment of the impacts on the overall site is made in this chapter using the EIA methodology.

12.10.13 The **Draft RIAA** has been prepared in accordance with Advice Note Ten: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects (PINS, 2017) and will be submitted as part of the Application for Development Consent.

Proportionate approach to EIA

12.10.14 This impact assessment aims to follow a proportionate approach, by focusing on those sources that are most likely to lead to a significant effect. To this end, certain impacts have been screened out from detailed assessment. Based on the Scoping Report and the Scoping Opinion, the impacts given in **Table 12-6** have been screened out from further assessment.

12.10.15 Following the matrix approach presented in **Table 12-22**, impacts for which the magnitude of change is determined to be negligible will always lead to a conclusion that the effect is Not Significant, regardless of the value, importance or sensitivity of the receptor. As there is no possibility of a significant effect, in line with the principals of a proportionate approach to EIA, in such cases no assessment is made of the value, importance or sensitivity of the receptor.

12.11 Preliminary assessment: Construction phase – intertidal

Disturbance and displacement: Intertidal cable corridor

Overview

12.11.1 Construction activities associated with export cable laying through the intertidal zone may lead to disturbance and displacement of species within the export cable corridor and different degrees of buffers surrounding it.

12.11.2 The baseline assessment of the intertidal environment within and in close proximity to the cable landfall area shows that few waterbirds of any species reside within this coastal region in anything other than numbers of local importance. In this instance, the cable landfall area is the area of intertidal beach landward of MLWS tide level and seaward of MHWS tide level. Of those bird species recorded in peak numbers on migration or during the non-breeding (wintering) period, only sanderling and Mediterranean gull may occur at levels exceeding 1% of the national population, the threshold widely considered as the basis for including a species in an impact assessment. All other intertidal bird species were recorded well below the national and international population level 1% importance thresholds, so are not considered further in this ES.

12.11.3 The assessment of the potential impacts and effects on intertidal ornithology receptors arising from the construction of Rampion 2 within the landfall area therefore includes two receptor species: sanderling and Mediterranean gull.

Sanderling

Introduction

12.11.4 Based on the Maximum Design Scenario (MDS) (**Table 12-17**), the key potential impacts from the construction activities within the intertidal environment are in relation to disturbance and displacement of sanderlings feeding or roosting within and near the construction site. Such potential impacts may be caused by noise and physical presence of workers, vehicles and machinery deployed during the construction phase within the active landfall works area, those within any works compounds immediately landward of the MHWS mark, and vehicles and people moving between the two areas. Although the maximum duration of works is six months, it must be considered that these six months could coincide with the winter period when the intertidal area is being used by sanderling. The MDS states that HDD will be used, and this is confirmed in Commitment C-4 (**Table 12-18**).

Magnitude of change

12.11.5 The use of HDD means that no machinery or construction workers will need to directly access the intertidal area. However, it is possible that there will be some disturbance as a result of visual or acoustic disturbance from the onshore compound or from the offshore drilling vessel.

12.11.6 The potential disturbance and displacement of sanderling through construction activities is spatially limited as the extent of the construction activities is limited to a very narrow corridor in relation to the length and width of the wider intertidal zone available to sanderling. As there is no pattern suggesting that sanderling occurrence is consistently at levels of national importance, within or in close proximity to the cable landfall area, it is likely that this area is not of primary importance for either feeding or resting. Sanderling records fluctuate both in abundance and spatially along the coast. As a consequence, considering that this species spends large amounts of time along the active tideline during low water periods, it demonstrates that the food resources they utilise are widely distributed. Consequently, the limited zone of possible visual and acoustic influences from which sanderling may be displaced will not result in a significant reduction in the overall area available for them to forage or rest.

12.11.7 It is therefore concluded that any direct disturbance and/or displacement of sanderling caused by the planned construction activities (physical presence and noise of workers, vehicles, and machinery) is of local spatial extent, of short-term duration, intermittent and reversible. The magnitude of change is therefore considered to be **negligible**.

Significance of residual effect

12.11.8 Given a magnitude of change of **negligible**, following the matrix approach set out in **Table 12-22**, the potential residual effect of construction in the intertidal zone on sanderlings has been assessed as **Not Significant** regardless of the sensitivity of the receptor.

Mediterranean gull

Introduction

12.11.9 Mediterranean gull numbers at breeding colonies on the south coast have increased dramatically in recent years, with a minimum of 1,737 breeding pairs within the Chichester and Langstone Harbour SPA alone in 2018 (RSPB, 2018). In comparison, Woodward *et al.* (2020) report a total UK population of only 1,200 breeding pairs based on data from 2013 – 2017. It is therefore important to consider the rapidly changing national and regional population when assessing any potential impact.

12.11.10 It is likely that significant numbers of birds recorded in and around the intertidal study area (see **Appendix 12.1, Volume 4**) consist primarily of post-breeding aggregations from local colonies, although an unknown proportion of the birds may be non-resident birds on migration.

Magnitude of change

12.11.11 The use of HDD means that no machinery or construction workers will need to directly access the intertidal area. However, it is possible that there will be some disturbance as a result of visual or acoustic disturbance from the onshore compound or from the offshore drilling vessel.

12.11.12 The potential disturbance and displacement of Mediterranean gulls through construction activities is spatially limited as the extent of the construction activities is limited to a very narrow corridor in relation to the length and width of the wider intertidal zone available to Mediterranean gulls.

12.11.13 In addition, Mediterranean gulls are generalist feeders (Robinson, 2005; BirdLife International, 2021)) and not dependent on the intertidal zone for foraging. The amount of habitat unavailable at any point is a therefore a negligible proportion of the total available habitat.

12.11.14 It is therefore concluded that any direct disturbance and/or displacement of Mediterranean gulls caused by the planned construction activities (physical presence and noise of workers, vehicles, and machinery) is of local spatial extent, of short-term duration, intermittent and reversible. The magnitude of change is therefore considered to be **negligible**.

Significance of residual effect

12.11.15 Given a magnitude of change of **negligible**, following the matrix approach set out in **Table 12-22**, the potential residual effect of construction in the intertidal zone on Mediterranean gulls has been assessed as **Not Significant** regardless of the sensitivity of the receptor.

12.12 Preliminary assessment: Construction phase – offshore

Disturbance and displacement: Offshore export cable corridor

12.12.1 Construction activities associated with export cable laying may lead to disturbance and displacement of species within the export cable corridor and different degrees of buffers surrounding it.

12.12.2 The laying of the export cable between the array area and the cable landfall area for Rampion 2 will involve a cable laying vessel being *in situ* for the entire construction period of up to four months (**Table 12-17**). There is the potential for construction activities associated with export cable laying, namely the physical presence of the cable laying vessel(s), to lead to disturbance and displacement of more sensitive species surrounding the cable laying vessel and out to differing buffers surrounding it dependent upon the species present.

12.12.3 This potential impact is only considered where an export cable corridor runs through offshore areas that play host to higher densities of the more sensitive seabird species, so is not regularly included within offshore wind farm EIAs. Data sourced through the desk study for this assessment did not identify any vulnerable species in significant numbers (see **Appendix 12.1, Volume 4**).

12.12.4 Therefore, **no significant effect** on any species is predicted.

Disturbance and displacement: Array area

Overview

12.12.5 The activities within an array area associated within the construction of WTGs has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea where Rampion 2 is proposed to be developed. During this phase of the development, this in effect represents a temporary indirect habitat loss, which will potentially reduce the area available to those seabirds to forage, loaf and / or moult that currently occur within and around Rampion 2 and may be susceptible to displacement from such a development.

12.12.6 Displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals, though during the construction phase of an offshore wind farm such activities are spatially and temporally restricted.

12.12.7 Some species are more susceptible than others to disturbance, from construction activities, 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 offshore wind farms. A screening process was undertaken for Rampion 2 to identify those species that may be more susceptible than others and therefore which species may be considered for further assessment (**Table 12-23**). Of the seabirds recorded in significant numbers within the array area fulmar, gannet, large and small gulls are not considered susceptible to disturbance, as they are often associated with fishing boats (e.g. Camphuysen, 1995; Hüppop and Wurm, 2000;) and have been noted in association with construction vessels at the Greater Gabbard Offshore Wind Farm (GGOWL, 2011) and close to active foundation piling activity at the Egmond aan Zee (OWEZ) wind farm, where they showed no noticeable reactions to the works (Leopold and Camphuysen, 2007). Therefore, these species, with the exception of gannet, are not considered further for the potential effect of displacement from the array area during the proposed construction phase of Rampion 2.

12.12.8 Gannet has also been screened in for assessment of potential displacement during the construction phase of Rampion 2. This is not due to evidence suggesting that this species is at risk from effects during the construction phase, but in order to provide Natural England and the RSPB with confidence that any potential effects on gannet during the construction phase are considered in a quantitative manner.

12.12.9 Auk species, in this instance guillemot and razorbill, have been noted to respond to offshore wind farm construction activities and be displaced as a consequence. Therefore, these species are considered further for the potential effect of displacement from the array area during the proposed construction phase of Rampion 2.

12.12.10 There are a number of different measures used to assess bird disturbance and displacement from areas of sea in response to activities associated with an offshore wind farm. Garthe and Hüppop (2004) developed a scoring system for such disturbance factors, which is used widely in offshore wind farm EIAs. Furness and Wade (2012) developed disturbance ratings for particular species, alongside scores for habitat flexibility and conservation importance in Scottish waters. These factors were used to define an index value that highlights the sensitivity of a species to disturbance and displacement. As many of these references relate to disturbance from helicopter and vessel activities, these are considered relevant to this assessment. Bradbury *et al.* (2014) provided an update to the Furness and Wade (2012) paper to consider seabirds in English waters. More recently a joint SNCB interim displacement advice note (SNCBs 2017) provides the latest advice for UK development applications on how to consider, assess and present information and potential consequences of seabird displacement from offshore wind farms.

Table 12-23 Screening of seabird species recorded within Rampion 2 array area for risk of disturbance and displacement during the construction phase.

Receptor	Sensitivity to Disturbance & Displacement (During Construction Phase)	Maximum bio-season mean peak density	Screening Result (In or Out)
Fulmar	Very low	0.03 birds/km^2 Very low	Out
Gannet	Low to medium	0.37 birds/km^2 Low	In
Kittiwake	Very low	1.37 birds/km^2 Medium	Out

Receptor	Sensitivity to Disturbance & Displacement (During Construction Phase)	Maximum bio-season mean peak density	Screening Result (In or Out)
Great black-backed gull	Very low	0.38 birds/km^2 Low	Out
Herring gull	Very low	2.69 birds/km^2 Medium	Out
Sandwich tern	Medium	0.07 birds/km^2 Very low	Out
Guillemot	Medium	27.16 birds/km^2 High	In
Razorbill	Medium	5.95 birds/km^2 Medium	In

12.12.11 Following the screening process an assessment of displacement has been carried out for Rampion 2, though the methods and results are based on the following set of scenarios that recognise construction activities being restricted:

- construction activities being undertaken within only a small portion of the array area at any one time;
- any potential displacement is likely to only occur within the array area, where vessels and construction activities are present; and
- construction activities are temporally restricted (over approximately 36 months).

12.12.12 In recognition of the potential disturbance activities being of a lesser extent to that of an active offshore wind farm then the levels of displacement are also of lesser extent.

12.12.13 Few studies have provided definitive empirical displacement rates for the construction phase of offshore wind farm developments. Disturbance during construction phase is primarily centred around where construction vessels and piling activities are occurring with differences also seen for disturbance effects of non-operational versus operational WTGs. For example, Krijgsveld *et al*. (2011) demonstrated higher flight paths of gannets next to operating vs non-operating WTGs. Displacement rates for auks during construction have been shown to be either significantly lower or comparable to the operation phase (Royal Haskoning (2013) and Vallejo *et al*. (2017). These studies would suggest that although the level of disturbance from construction activities can be high it is focussed around a limited area of the development site. Therefore, displacement rates for the entire site reflect reduced displacement within the site away from construction areas including areas where built non-operational WTGs are present.

12.12.14 As actual rates of displacement during the construction of offshore wind farms are difficult to determine from the available studies, the following methodology is proposed. The method considers that as the construction phase of Rampion 2 is limited both spatially and temporarily and that any potential effects will be unlikely to reach the same level as those estimated during the operational phase of Rampion 2. Therefore, for the purpose of providing a precautionary approach to assessing the potential effects on gannets and auks during the construction phase of Rampion 2, the level to be used is half that of the operational phase assessments.

12.12.15 Therefore, reference to the assessments within the operational and maintenance phase (**paragraph 12.12.42**) should be considered to understand the assessments for the construction phase in this section. For gannet, the evidence-based approach as detailed in **paragraph 12.12.42** suggests that displacement should only be considered within the array area itself. For auk species, the evidence based approach as detailed in **paragraph 12.12.42** suggests that displacement should be considered for the array area plus a 2km buffer. The level of displacement for gannets and auk species are provided below:

- for gannet consideration is provided to half of the operation and maintenance displacement rates (range of 60-80%), which is 30-40% displacement during the construction phase;
- for auk species (guillemot and razorbill) consideration is also provided to half of the operation and maintenance displacement rate of 50% displacement (with a range of 30-70%), which is 25% displacement (with a range of 15-35%) during the construction phase; and
- for all three species the level of mortality applied for this assessment is 1% of those displaced, though this is likely to be over precautionary.

Gannet

Magnitude of change

12.12.16 The annual estimated mortality rate for gannet is one individual, which is further broken down into relevant bio-seasons in **Table 12-24**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations. The overall baseline mortality rates are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-24 Bio-season displacement estimates for gannet for Rampion 2 (construction).

Bio-season (months)	Seasonal abundance (array area only)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated number of gannets subject to mortality (individuals)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Return Migration (Dec-Mar)	45	248,385	46,696	0	0
Migration-free Breeding (Apr-Aug)	98	25,146	4,727	0	0
Post-breeding migration (Sep-Nov)	78	456,298	85,784	0	0
Annual (BDMPS)	**221**	**456,298**	85,784	**1**	**0.001**
Annual (biogeographic)	**221**	**1,180,000**	**221,840**	**1**	**<0.001**

12.12.17 During the return migration bio-season a peak abundance of 45 gannets are estimated to be at risk of displacement. Using displacement rates between 30 – 40% and a mortality rate of 1% will result in approximately zero gannets being subject to mortality. As this represents no change, there is no effect in the return migration bio-season.

12.12.18 During the migration-free breeding bio-season, a peak abundance of 98 gannets within the array area are estimated to be at risk of displacement. Using displacement rates between 30 – 40% and a mortality rate 1% will result in approximately zero gannets being subject to mortality. As this represents no change, there is no effect in the migration-free breeding bio-season.

12.12.19 During the post-breeding migration bio-season, a peak abundance of 78 gannets within the array area are estimated to be at risk of displacement. Using displacement rates between 30 – 40% and a mortality rate 1% will result in approximately zero gannets being subject to mortality. As this represents no change, there is no effect in the post-breeding migration bio-season.

12.12.20 For all seasons combined, the maximum number of gannets subject to mortality due to displacement from the Rampion 2 array is approximately one. Using the largest UK North Sea and English Channel BDMPS of 456,298 individuals (**Table 12-15**) and using the average baseline mortality rate of 0.188 (**Table 12-16**), the natural predicted mortality across all seasons is 85,784. The addition of one mortality will increase the baseline mortality rate by 0.001%. When considering displacement effects at the wider biogeographic population scale, then based on a population of 1,180,000, the natural annual mortality rate will be 221,840 individuals. The addition of between one mortality will increase the biogeographic baseline mortality rate by less than 0.001%.

12.12.21 This level of change is considered to be of **negligible** magnitude overall, as it represents no discernible increase to baseline mortality levels as a result of displacement.

Significance of residual effect

12.12.22 Given a magnitude of change of **negligible**, following the matrix approach set out in **Table 12-22**, the potential residual effect of displacement and disturbance from construction activities in the array area on gannets has been assessed as **Not Significant** regardless of the sensitivity of the receptor.

Guillemot

Magnitude of change

12.12.23 The annual estimated mortality rate as a consequence of displacement during the operation and maintenance phase of Rampion 2 for guillemot is 33 individuals, which is further broken down into relevant bio-seasons in **Table 12-25**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the most appropriate regional / BDMPS population scales. The overall baseline mortality rates are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-25 Construction phase bio-season displacement estimates for guillemot from Rampion 2.

Bio-season (months)	Seasonal abundance (array area & 2km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated mortality rate/s (individuals)	Increase in baseline mortality (%)
		Population	**Baseline mortality**		
Breeding (Mar-Jul)	185	688,420	98,444	0 (0 – 1)	0 (0.000 – 0.001%)
Non-breeding (Aug-Feb)	13,020	1,617,306	231,275	33 (20 – 46)	0.014 (0.009 – 0.020)
Annual (BDMPS)	**13,205**	**1,617,306**	231,275	**33 (20 – 46)**	**0.014 (0.009 – 0.020)**

Bio-season (months)	Seasonal abundance (array area & 2km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated mortality rate/s (individuals)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Annual (biogeographic)	**13,205**	**4,125,000**	**589,875**	**33 (20 – 46)**	**0.006 (0.003 – 0.008)**

12.12.24 During the breeding bio-season, the mean peak abundance for guillemot is 185 individuals within the array area plus 2km buffer. When considering displacement and mortality rates of 25% and 1%, respectively, this will result in approximately zero guillemots being subject to mortality. As this represents no change, there is no effect in the breeding bio-season.

12.12.25 During the non-breeding bio-season, the mean peak abundance for guillemot is 13,020 individuals within the array area and 2km buffer. When considering displacement and mortality rates of 25% and 1%, respectively, this will result in approximately 33 guillemots being subject to mortality. The UK North Sea and English Channel BDMPS for the non-breeding bio-season is defined as 1,617,306 individuals (**Table 12-15**) and using the average baseline mortality rate of 0.143 (**Table 12-16**), the natural predicted mortality in the non-breeding bio-season is 231,275. The addition of 33 mortalities will increase the baseline mortality rate by 0.014%.

12.12.26 This level of change is considered to be of **negligible** magnitude during the non-breeding and breeding bio-season, as it represents between only a slight difference to the baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

12.12.27 For all seasons combined, the estimated number of guillemots subject to mortality due to displacement from the Rampion 2 array area plus 2km buffer is 33 individuals per annum. Using the largest UK North Sea and English Channel BDMPS population of 1,617,306 individuals (**Table 12-15**) as a proxy for the total BDMPS population across the year, with an average baseline mortality rate of 0.143 (**Table 12-16**), the natural predicted mortality across all seasons is 231,275. The addition of 33 mortalities will increase the baseline mortality rate by 0.014% at the BDMPS scale. When considering the annual potential magnitude of change at the biogeographic scale, the natural predicted mortality of the biogeographic population of 4,125,000 across all seasons is 589,875 individuals per annum. The addition of 33 mortalities will increase the biogeographic baseline mortality rate by 0.006%.

12.12.28 This level of change is considered to be of **negligible** at the UK North Sea and English Channel BDMPS scale and **negligible** at the biogeographic scale, as it represents between only a slight to a minor difference to the baseline conditions due to the number of individuals subject to potential mortality as a result of displacement.

Significance of residual effect

12.12.29 Given a magnitude of change of **negligible**, following the matrix approach set out in **Table 12-22**, the potential residual effect of displacement and disturbance from construction activities in the array area on guillemots has been assessed as **Not Significant** regardless of the sensitivity of the receptor.

Razorbill

Magnitude of change

12.12.30 The annual estimated mortality rate for razorbill is 11 individuals, which is further broken down into relevant bio-seasons in **Table 12-26**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations. The overall baseline mortality rates are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-26 Bio-season displacement estimates for razorbill from Rampion 2 during the construction phase.

Bio-season (months)	Seasonal abundance (array area & 2km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated mortality rate/s (individuals)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Return Migration (Jan-Mar)	2,130	591,874	105,354	5 (3 – 7)	0.005 (0.003 – 0.007)
Migration-free Breeding (Apr-Jul)	44	253,660	45,151	0	0
Post-breeding migration (Aug-Oct)	18	591,874	105,354	0	0
Migration-free Winter (Nov-Dec)	22	218,622	38,915	0	0
Annual (BDMPS)	**2,214**	**591,874**	**105,354**	**6 (3 – 8)**	**0.006 (0.003 – 0.008)**

Bio-season (months)	Seasonal abundance (array area & 2km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated mortality rate/s (individuals)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Annual (biogeographic)	**2,214**	**1,707,000**	**303,846**	**6 (3 – 8)**	**0.002 (0.001 – 0.003)**

12.12.31 During the return migration bio-season, the mean peak abundance for razorbill is 2,130 individuals within the array area and 2km buffer. When considering displacement and mortality rates of 25% and 1%, respectively, this will result in approximately five razorbills being subject to mortality. The UK North Sea and English Channel BDMPS for the return migration bio-season is defined as 591,874 (**Table 12-15**) and using the average baseline mortality rate of 0.178 (**Table 12-16**), the natural predicted mortality in the return migration bio-season is 105,354. The addition of five mortalities will increase the baseline mortality rate by 0.005%.

12.12.32 This level of change is considered to be of **negligible** magnitude during the return 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.

12.12.33 During the migration-free breeding bio-season, the mean peak abundance for razorbill is 44 individuals within the array area and 2km buffer. When considering displacement and mortality rates of 25% and 1%, respectively, this will result in approximately zero razorbills being subject to mortality. As this represents no change, there is no effect in the migration-free breeding bio-season.

12.12.34 During the post-breeding migration bio-season, the mean peak abundance for razorbill is 18 individuals within the array area and 2km buffer. When considering the evidence-based displacement and mortality rate of 25% and 1% respectively, this will result in approximately zero razorbills being subject to mortality. As this represents no change, there is no effect in the post-breeding migration bio-season.

12.12.35 During the migration-free winter bio-season, the mean peak abundance for razorbills is 22 individuals within the array area and 2km. Using the evidence-based displacement and mortality rate of 25% and 1% will result in approximately zero razorbills being subject to mortality. As this represents no change, there is no effect in the migration-free winter bio-season.

12.12.36 For all seasons combined, the maximum number of razorbills subject to mortality due to displacement from the Rampion 2 array area plus 2km buffer is six individuals per annum. Using the largest UK North Sea and English Channel BDMPS population of 591,874 individuals (**Table 12-15**), as a proxy for the total BDMPS population across the year, with an average baseline mortality rate of 0.178 (**Table 12-16**), the natural predicted mortality across all seasons is 105,354. The addition of six mortalities will increase the baseline mortality rate by 0.006% at the BDMPS scale. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality of the biogeographic population of 1,707,000 across all seasons is 303,846 per annum. The addition of six mortalities will increase the biogeographic baseline mortality rate by 0.002%.

12.12.37 This level of change is considered to be of **negligible** magnitude at the UK North Sea and English Channel BDMPS scale and **negligible** magnitude at the biogeographic scale, as it represents between only a slight to a minor difference to the baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

Significance of residual effect

12.12.38 Given a magnitude of change of **negligible**, following the matrix approach set out in **Table 12-22**, the potential residual effect of displacement and disturbance from construction activities in the array area on razorbills has been assessed as **Not Significant** regardless of the sensitivity of the receptor.

Indirect effects: Offshore cable corridor

12.12.39 During the construction phase of Rampion 2 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.

12.12.40 However, 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 8** and **Chapter 9**, respectively) then there is no potential for any indirect effects of an adverse significance to occur on offshore and intertidal ornithology receptors.

Indirect effects: Array area

12.12.41 During the construction phase of Rampion 2 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.

12.12.42 However, 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 8** and **Chapter 9**, respectively) then there is no potential for any indirect effects of an adverse significance to occur on offshore and intertidal ornithology receptors.

12.13 Preliminary assessment: Operation and maintenance phase

Introduction

12.13.1 The potential effects of the offshore operation and maintenance of Rampion 2 have been assessed on offshore and intertidal ornithology. The potential environmental effects arising from the operation and maintenance of Rampion 2 are listed in **Table 12-5** and the MDS against which each operation and maintenance phase impact has been assessed is presented in **Table 12-17**.

Disturbance and displacement: Array area

12.13.2 The presence of WTGs has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea where Rampion 2 is proposed to be developed. This in effect represents indirect habitat loss, which will potentially reduce the area available to those seabirds to forage, loaf and / or moult that currently occur within and around Rampion 2 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.

12.13.3 Seabird species vary in their response to the presence of operational infrastructure associated with offshore wind farms, such as WTGs and shipping activity related to maintenance activities. Offshore wind farms are a new feature in the marine environment and as a result there is limited evidence as to the effects of disturbance and displacement by operational infrastructure in the long-term.

12.13.4 Garthe and Hüppop (2004) developed a scoring system for such disturbance factors, which has been widely applied in offshore wind farm 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.

12.13.5 Natural England and JNCC issued a joint Interim Displacement Guidance Note (Natural England and JNCC 2012), which provides recommendations for presenting information to enable the assessment of displacement effects in relation to offshore wind farm developments. This has been superseded more recently by a joint SNCB interim displacement advice note (SNCBs, 2017), which provides the latest advice for UK development applications on how to consider, assess and present information and potential consequences of seabird displacement from offshore wind farms. These guidance notes have shaped the assessment provided below.

12.13.6 Some species are more susceptible than others to disturbance, from construction activities, 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 offshore wind farms. A screening process was undertaken for Rampion 2 to identify those species that may be more susceptible than others and therefore which species may be considered for further assessment (**Table 12-27**). Of the seabirds recorded in significant numbers within the array area fulmar, gannet, large and small gulls are not considered susceptible to disturbance, as they are often associated with fishing boats (e.g. Camphuysen, 1995; Hüppop and Wurm, 2000;) and have been noted in association with construction vessels at the Greater Gabbard Offshore Wind Farm (GGOWL, 2011) and close to active foundation piling activity at the Egmond aan Zee (OWEZ) wind farm, where they showed no noticeable reactions to the works (Leopold and Camphuysen, 2007). Therefore, these species are not considered further for the potential effect of displacement from the array area during the proposed operational phase of Rampion 2.

Table 12-27 Screening of seabird species recorded within Rampion 2 array area for risk of disturbance and displacement during the operational phase.

Receptor	Sensitivity to Disturbance & Displacement (During Operational Phase)	Maximum bio-season mean peak density	Screening Result (In or Out)
Fulmar	Very low	0.03 birds/km^2 Very low	Out
Gannet	Low to medium	0.37 birds/km^2 Low	In
Kittiwake	Very low	1.37 birds/km^2 Medium	Out
Great black-backed gull	Very low	0.38 birds/km^2 Low	Out
Herring gull	Very low	2.69 birds/km^2 Medium	Out
Sandwich tern	Medium	0.07 birds/km^2 Very low	Out
Guillemot	Medium	27.16 birds/km^2 High	In
Razorbill	Medium	5.95 birds/km^2 Medium	In

12.13.7 Following the screening process, an assessment of displacement was carried out for Rampion 2, with detailed methods and results presented in **Appendix 12.2, Volume 4**, to provide information for four seabird species of interest identified as potentially at risk and of interest for impact assessment.

12.13.8 The three species that were identified as the species of focus for displacement are gannet, guillemot and razorbill.

12.13.9 For each of the three species a review was undertaken of recent displacements rates applied by other assessments of displacement for offshore wind farms. A further review of the displacement values derived from multiple post-consent monitoring reports was undertaken to quantify a suitable evidence-led approach and to provide SNCBs with transparency on how the displacement rates were calculated for this assessment.

Gannet

Overview

12.13.10 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 OWEZ established that 64% of gannets avoided entering the wind farm (macro-avoidance). The results of the post-consent monitoring surveys for Thanet offshore wind farm found that gannet densities reduced within the site in the third year, but the report did not quantify this (Royal HaskoningDHV, 2013). A more recent study by APEM (APEM, 2014) provided evidence that during their migration most gannets will avoid flying into areas with operational WTGs (macro-avoidance), with the estimated macro avoidance being 95%. For the purpose of this assessment, the level of displacement considered across all bio-seasons is between 60-80%.

12.13.11 **Table 12-28** has been populated with data for gannets during each of the return migration, non-migratory and post-breeding migration bio-seasons within the Rampion 2 array area only, as there is no evidence that gannets are displaced beyond offshore wind farm site boundaries.

12.13.12 A mortality rate of 1% was selected for this assessment, based on expert judgement supported by additional evidence that suggests that gannet have a large mean max (315km) and maximum (709km) foraging range (Woodward *et al.*, 2019) and feed on a variety of different prey items that provide sufficient alternative foraging opportunities despite the potential loss of habitat within the Rampion 2 array area.

Magnitude of change

12.13.13 The annual estimated mortality rate for gannet is between one and two individuals, which is further broken down into relevant bio-seasons in **Table 12-28**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations. The overall baseline mortality rates are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-28 Bio-season displacement estimates for gannet for Rampion 2 (operation & maintenance).

Bio-season (months)	Seasonal mean peak abundance (array area only)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated number of gannets subject to mortality (individuals)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Return Migration (Dec-Mar)	45	248,385	46,696	0	0
Migration-free Breeding (Apr-Aug)	98	128,528	24,163	1	0.004
Post-breeding migration (Sep-Nov)	78	456,298	85,784	0 – 1	0.000 – 0.001
Annual (BDMPS)	**221**	**456,298**	85,784	**1 – 2**	**0.001 – 0.002**
Annual (biogeographic)	**221**	**1,180,000**	**221,840**	**1 – 2**	**0.001 – 0.002**

12.13.14 During the return migration bio-season a peak abundance of 45 gannets are estimated to be at risk of displacement. Using displacement rates between 60 – 80% and a mortality rate 1% will result in approximately zero gannets being subject to mortality. As this represents no change, there is no effect in the return migration bio-season.

12.13.15 During the migration-free breeding bio-season, a peak abundance of 98 gannets within the array area are estimated to be at risk of displacement. Using displacement rates between 60 – 80% and a mortality rate of 1% will result in approximately one gannet being subject to mortality. During the migration-free breeding bio-season, the total regional baseline population of breeding adults and immature gannets is predicted to be 128,528 individuals (**Table 12-15**). When the average baseline mortality rate of 0.188 (**Table 12-16**) is applied, the natural predicted mortality in the migration-free breeding bio-season is 24,163. The addition of one mortality will increase the mortality relative to the baseline mortality rate by 0.004%.

12.13.16 This level of potential change is considered to be of **negligible** magnitude during the non-migratory breeding bio-season, as it represents no discernible increase to baseline mortality levels due to the very small number of individuals subject to potential mortality as a result of displacement.

12.13.17 During the post-breeding migration bio-season, a peak abundance of 78 gannets within the array area are estimated to be at risk of displacement. Using displacement rates between 60 – 80% and a mortality rate 1% will result in approximately zero to one gannets being subject to mortality. The UK North Sea and English Channel BDMPS for the post-breeding migration bio-season is defined as 456,298 individuals (**Table 12-15**) and using the average baseline mortality rate of 0.188 (**Table 12-16**), the natural predicted mortality in the return migration bio-season is 85,784. The addition of between zero and one mortalities will increase the mortality relative to the baseline mortality rate by 0.000% to 0.001%.

12.13.18 This level of potential change is considered to be of **negligible** magnitude during the post-breeding migration bio-season, as it represents no discernible increase to baseline mortality levels as a result of displacement.

12.13.19 For all seasons combined, the maximum number of gannets subject to mortality due to displacement from the Rampion 2 array is between one and two. Using the largest UK North Sea and English Channel BDMPS of 456,298 individuals (**Table 12-15**) and using the average baseline mortality rate of 0.188 (**Table 12-16**), the natural predicted mortality across all seasons is 85,784. The addition of between one to two additional mortalities will increase the mortality relative to the baseline mortality rate by 0.001% to 0.002%. When considering displacement impacts at the wider biogeographic population scale, then based on a population of 1,180,000, the natural annual mortality rate will be 221,840 individuals. On a biogeographic scale the addition of between one and two mortalities will increase mortality relative to the baseline mortality rate by 0.001% to 0.002%.

12.13.20 This level of potential change per annum is considered to be of negligible at the UK North Sea and English Channel BDMPS scale and negligible at the biogeographic scale, as it represents between only a slight to a minor difference to the baseline conditions due to the number of individuals subject to potential mortality as a result of displacement.

12.13.21 In each bio-season and on an annual basis, the potential change is considered to be of **negligible** magnitude, as it represents no discernible increase to baseline mortality levels as a result of displacement.

Significance of residual effect

12.13.22 Given a magnitude of change of **negligible**, following the matrix approach set out in **Table 12-22**, the potential residual effect of displacement and disturbance from construction activities in the array area on gannets has been assessed as **Not Significant** regardless of the sensitivity of the receptor.

Auk species

12.13.23 Auk species (guillemot and razorbill) show a medium level of sensitivity to ship and helicopter traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012; Langston, 2010; and Bradbury et al, 2014). Displacement impacts from post-consent monitoring studies were collated and reviewed by Dierschke *et al.* (2016). That review includes evidence for auk displacement obtained from studies of twelve different offshore wind farm sites published up to 2016 that compared seabird abundances within and outside European offshore wind farms post-construction with baseline data from before construction. The evidence is clear: auks do tend to avoid offshore wind farms; however, a range in displacement rates from 0% to 95% for the operational phase is reported. This variability is likely to be a response to differences in ecological conditions between studies, such as the season in which data were collected, distance of site from breeding colony, number of years of post-construction data used, etc., together with WTG layout and methodology used to assess the displacement rate itself. It is evident from the review that deriving a displacement rate for assessing a development site should only use evidence from sites that are directly comparable to the site being assessed. For instance, the high auk displacement rates of 55% to 75% reported from non-UK waters (Bligh Bank, Thorntonbank, Prinses Amalia and Alpha Ventus) and which have considerably smaller footprint sizes (<17km2), are therefore not applicable, considering that their site configurations and ecology are not comparable to the Rampion 2 site. Dierschke *et al.* (2016) concluded that the mean outcome across all offshore wind farms was a 50% reduction in density post-construction compared to pre-construction data.

12.13.24 A recent submission to provide an update to the operational displacement assessment for Norfolk Vanguard (MacArthur Green 2019) and also applied in Norfolk Boreas, East Anglia One North and East Anglia Two, reviewed the same evidence (Dierschke *et al.* 2016) for displacement effects for guillemot and razorbill. The report concluded that appropriate rates of displacement for these species are 50% from within the wind farm itself and 30% within a 1km buffer.

12.13.25 Since the Dierschke *et al.* (2016) review, a further study has been published using data from offshore wind farms in the German North Sea indicating guillemot displacement rates are reduced during the breeding season compared to the non-breeding season by ~20% (Peschko et al, 2020). This is of important consideration as the mean displacement rates derived from the Dierschke *et al.* (2016) review was predominantly from data collected in the non-breeding season. Therefore, by applying a single displacement rate across all bio-seasons of 50% within the Rampion 2 array area and out to a 2km buffer will ensure a precautionary rate is used for the assessment of displacement.

12.13.26 Furthermore, evidence that an auk displacement rate of 50% is precautionary comes from studies that indicate auk habituation to offshore wind farms. This was recently demonstrated at Thanet offshore wind farm, 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 Haskoning 2013). There is also further emerging evidence as additional post-construction monitoring of offshore wind farms continues, with reports of auk numbers increasing and observations of foraging behaviour within the wind farm itself (Leopold & Verdaat 2018). This would suggest that displacement rates are expected to diminish over the operational life of offshore wind farms. Given that Rampion 2 is immediately adjacent to Rampion 1, some habituation may already have occurred within local populations that would transfer to reduced avoidance of Rampion 2 compared to a new windfarm in a previously unimpacted region.

12.13.27 Therefore, there is good evidence to support an auk displacement rate of 50% within offshore wind farm array areas and out to a 2km buffer, which would still be considered as precautionary, and is more precautionary than the approach that has been proposed for some other developments currently within the planning process.

12.13.28 Given that Rampion 2 is immediately adjacent to Rampion 1, it is evident that an appropriate method needs to be devised to account for buffer effects. A 2km buffer around Rampion 2 will extend into Rampion 1. It is unlikely that birds which remain within the footprint of the existing, operational Rampion 1 will then be displaced by the operation of WTGs within Rampion 2 that are further away than Rampion 1 WTGs which the birds are already tolerating.

12.13.29 Furthermore, if there is a displacement effect up to 2km out from Rampion 1, then the density of birds currently within the portion of the Rampion 2 within 2km of Rampion 1 will already have been reduced by displacement, and it is likely that the remaining birds are more tolerant of WTGs and therefore less likely to be displaced by the presence of Rampion 2's WTGs.

12.13.30 The solution, which in light of the above is considered to be precautionary, is to apply the standard displacement rates as discussed above to all birds within the Rampion 2 footprint and a 2km buffer, except for the area of buffer that directly overlaps with Rampion 1. **Figure 12.2, Volume 3** shows the area considered in calculating auk displacement.

Guillemot

Overview

12.13.31 For the purpose of this assessment, an evidence-led displacement and mortality rate of 50% and 1% respectively was applied to each bio-season based on evaluation of the published literature and in line with values used by other offshore wind farm displacement assessments. Additional consideration is provided by reference to Natural England's preferred method of assessing potential impacts from displacement using a range of between 30% to 70% displacement and between 1% and 10% mortality rates.

12.13.32 However, it should be noted that due to the large expanse of available habitat outside of the array area, the mortality rate due to displacement could be as low as 0% as the increase in density outside of the array area in comparison to the whole of the English Channel will be negligible.

12.13.33 A complete range of displacement matrices are presented in **Appendix 12.2, Volume 4**, whilst **Table 12-29** has been populated with data for guillemots during the breeding and non-breeding season within the Rampion 2 array area as well as out to a 2km buffer (excluding Rampion 1).

Magnitude of change

The annual estimated mortality rate as a consequence of displacement during the operation and maintenance phase of Rampion 2 for guillemot is 66 individuals, which is further broken down into relevant bio-seasons in **Table 12-29**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the most appropriate regional/BDMPS population scales. The overall baseline mortality rates are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-29 Bio-season displacement estimates for guillemot from Rampion 2.

Bio-season (months)	Seasonal abundance (array area & 2km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated mortality rate/s (individuals)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Breeding (Mar-Jul)	185	688,420	98,444	1 (1 – 13)	0.001 (0.001 – 0.013%)
Non-breeding (Aug-Feb)	13,020	1,617,306	231,275	65 (39 – 911)	0.028 (0.017 – 0.394)
Annual (BDMPS)	**13,205**	**1,617,306**	231,275	**66 (40 – 924)**	**0.029 (0.017 – 0.400)**
Annual (biogeographic)	**13,205**	**4,125,000**	**589,875**	**66 (40 – 924)**	**0.011 (0.007 – 0.157)**

12.13.34 During the breeding bio-season, the mean peak abundance for guillemot is 185 individuals within the array area plus 2km buffer. When considering evidence-based displacement and mortality rates of 50% and 1%, respectively, this will result in approximately one guillemot being subject to mortality. During the breeding bio-season the total guillemot regional baseline population, including breeding adults and immature birds, is predicted to be 688,420 individuals (**Table 12-15**). Using the average baseline mortality rate of 0.143 (**Table 12-16**), the natural predicted mortality of guillemots in the breeding bio-season is 98,444. The addition of one mortality will increase the mortality relative to the baseline mortality rate by 0.001%.

12.13.35 This level of potential change is considered to be of **negligible** magnitude during the breeding 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.

12.13.36 During the non-breeding bio-season, the mean peak abundance for guillemot is 13,020 individuals within the array area and 2km buffer. When considering evidence-based displacement and mortality rates of 50% and 1%, respectively, this will result in approximately 65 guillemots being subject to mortality. The UK

North Sea and English Channel BDMPS for the non-breeding bio-season is defined as 1,617,306 individuals (**Table 12-15**) and using the average baseline mortality rate of 0.143 (**Table 12-16**), the natural predicted mortality in the non-breeding bio-season is 231,275. The addition of 65 mortalities will increase the mortality relative to the baseline mortality rate by 0.028%.

12.13.37 This level of potential change is considered to be of **negligible** magnitude during the non-breeding and breeding bio-season, as it represents between only a slight difference to the baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

12.13.38 For all seasons combined, the estimated number of guillemots subject to mortality due to displacement from the Rampion 2 array area plus 2km buffer is 66 individuals per annum. Using the largest UK North Sea and English Channel BDMPS population of 1,617,306 individuals (**Table 12-15**) as a proxy for the total BDMPS population across the year, with an average baseline mortality rate of 0.143 (**Table 12-16**), the natural predicted mortality across all seasons is 231,275. The addition of 66 mortalities will increase the mortality relative to the baseline mortality rate by 0.029% at the BDMPS scale. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality of the biogeographic population of 4,125,000 across all seasons is 589,875 individuals per annum. On a biogeographic scale, the addition of 66 mortalities will increase the mortality relative to the baseline mortality rate by 0.007%.

12.13.39 This level of potential change per annum is considered to be of **negligible** at the UK North Sea and English Channel BDMPS scale and **negligible** at the biogeographic scale, as it represents between only a slight to a minor difference to the baseline conditions due to the number of individuals subject to potential mortality as a result of displacement.

12.13.40 In each bio-season and on an annual basis, the magnitude of the potential change is therefore considered to be **negligible**, as it represents no discernible increase to baseline mortality levels as a result of displacement.

Significance of residual effect

12.13.41 Given a magnitude of change of **negligible**, following the matrix approach set out in **Table 12-22**, the potential residual effect of displacement and disturbance from construction activities in the array area on guillemots has been assessed as **Not Significant** regardless of the sensitivity of the receptor.

Razorbill

Overview

12.13.42 For the purpose of this assessment, an evidence led displacement and mortality rate of 50% and 1% respectively was applied to each bio-season based on evaluation of the published literature and in line with values used by other offshore wind farm displacement assessments. Additional consideration is given to Natural England's preferred method of assessing potential impacts from displacement using a range of between 30% to 70% displacement and between 1% and 10% mortality rates.

12.13.43 However, it should be noted that due to the large expanse of available habitat outside of the offshore wind farm area, the mortality rate due to displacement could be as low as 0% as the increase in density outside of the offshore wind farm area, in comparison to the whole of the English Channel, will be negligible.

12.13.44 A complete range of displacement matrices are presented in **Appendix 12.2, Volume 4**, whilst **Table 12-30** has been populated with data for razorbills during each of the return migration, non-migratory breeding, post-breeding migration and non-migration wintering bio-seasons within the Rampion 2 array area as well as out to a 2km buffer (excluding Rampion 1).

Magnitude of change

12.13.45 The annual estimated mortality rate for razorbill is 11 individuals, which is further broken down into relevant bio-seasons in **Table 12-30**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations. The overall baseline mortality rates are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-30 Bio-season displacement estimates for razorbill from Rampion 2.

Bio-season (months)	Seasonal abundance (array area & 2km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated mortality rate/s (individuals)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Return Migration (Jan-Mar)	2,130	591,874	105,354	11 (6 – 149)	0.010 (0.006 – 0.141)
Migration-free Breeding (Apr-Jul)	44	253,660	45,151	0 (0 – 3)	0 (0 – 0.006)
Post-breeding migration (Aug-Oct)	18	591,874	105,354	0 (0 – 1)	0 (<0.001)
Migration-free Winter (Nov-Dec)	22	218,622	38,915	0 (0 – 2)	0 (0.000 – 0.005)
Annual (BDMPS)	**2,214**	**591,874**	**105,354**	**11 (7 – 155)**	**0.010 (0.007 – 0.147)**

Bio-season (months)	Seasonal abundance (array area & 2km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated mortality rate/s (individuals)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Annual (biogeographic)	2,214	1,707,000	303,846	11 (7 – 155)	0.004 (0.002 – 0.051)

12.13.46 During the return migration bio-season, the mean peak abundance for razorbill is 2,130 individuals within the array area and 2km buffer. When considering evidence-based displacement and mortality rates of 50% and 1%, respectively, this will result in approximately 11 razorbills being subject to mortality. The UK North Sea and English Channel BDMPS for the return migration bio-season is defined as 591,874 (**Table 12-15**) and using the average baseline mortality rate of 0.178 (**Table 12-16**), the natural predicted mortality in the return migration bio-season is 105,354. The addition of 11 mortalities will increase the mortality relative to the baseline mortality rate by 0.020%.

12.13.47 This level of potential change is considered to be of **negligible** magnitude during the return 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.

12.13.48 During the migration-free breeding bio-season, the mean peak abundance for razorbill is 44 individuals within the array area and 2km buffer. When considering evidence-based displacement and mortality rates of 50% and 1%, respectively, this will result in approximately zero razorbills being subject to mortality. As this represents no change, there is no effect in the migration-free breeding bio-season.

12.13.49 During the post-breeding migration bio-season, the mean peak abundance for razorbill is 18 individuals within the array area and 2km buffer. When considering the evidence-based displacement and mortality rate of 50% and 1% respectively, this will result in approximately zero razorbills being subject to mortality. As this represents no change, there is no effect in the post-breeding migration bio-season.

12.13.50 During the migration-free winter bio-season, the mean peak abundance for razorbills is 22 individuals within the array area and 2km. Using the evidence-based displacement and mortality rate of 50% and 1% will result in approximately zero razorbills being subject to mortality. As this represents no change, there is no effect in the migration-free winter bio-season.

12.13.51 For all seasons combined, the maximum number of razorbills subject to mortality due to displacement from the Rampion 2 array area plus 2km buffer is 11 individuals per annum. Using the largest UK North Sea and English Channel BDMPS population of 591,874 individuals (**Table 12-15**), as a proxy for the total BDMPS population across the year, with an average baseline mortality rate of 0.178 (**Table 12-16**), the natural predicted mortality across all seasons is 105,354.

The addition of 11 mortalities will increase the mortality relative to the baseline mortality rate by 0.010% at the BDMPS scale. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality of the biogeographic population of 1,707,000 across all seasons is 303,846 per annum. On a biogeographic scale, the addition of 11 mortalities will increase the mortality relative to the baseline mortality rate by 0.004%.

12.13.52 This level of potential change per annum is considered to be of **negligible** magnitude at the UK North Sea and English Channel BDMPS scale and **negligible** magnitude at the biogeographic scale, as it represents between only a slight to a minor difference to the baseline conditions due to the small number of individuals subject to potential mortality as a result of displacement.

12.13.53 In each bio-season and on an annual basis, the magnitude of the potential change is therefore considered to be **negligible**, as it represents no discernible increase to baseline mortality levels as a result of displacement.

Significance of residual effect

12.13.54 Given a magnitude of change of **negligible**, following the matrix approach set out in **Table 12-22**, the potential residual effect of displacement and disturbance from construction activities in the array area on razorbills has been assessed as **Not Significant** regardless of the sensitivity of the receptor.

Collision risk: Array area

Overview

12.13.55 There is potential risk to birds from offshore wind farms through collision with WTGs and associated infrastructure described in the MDS (**Table 12-17**) resulting in injury or fatality. This may occur when birds fly through the Rampion 2 array area whilst foraging for food, commuting between breeding sites and foraging areas, or during migration.

12.13.56 CRM has been carried out for Rampion 2, with detailed methods and results presented in **Appendix 12.3, Volume 4**, to provide information for seven seabird species of interest identified as potentially at risk and of interest for impact assessment. A screening 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), and the result presented in **Table 12-31**. This screening process screened out the species for which the risk of collision is considered as very low, such as for fulmar that fly very close to the sea surface so are unlikely to interact with WTGs. Species were also screened out if their densities in flight within the array area were very low, as this also provides evidence of very low risk of collision. Following this screening process, five species were identified as following the screening criteria for CRM assessment; gannet, kittiwake, common gull, great black-backed gull and herring gull. A further four species were screened in as a precaution to test the risk at the PEIR stage; little gull, lesser black-backed gull, 'commic' tern and Sandwich tern. Should the risk for the latter four species be assessed as being minimal then it is likely that they will be screened after the PEIR stage assessments.

Table 12-31 Screening of seabird species recorded in Rampion 2 array area for risk of collision.

Receptor	Risk of collision (Garthe & Huppop, 2004; Furness & Wade, 2012; Wade et al, 2016)	Estimated peak density of birds in flight in Rampion 2 array area (birds/km^2)	Screening Result (In or Out)
Fulmar	Very low	0.04 birds/km^2 Low to very low	Out
Gannet	Medium	0.26 birds/km^2 Low to medium	In
Kittiwake	Medium	0.58 birds/km^2 Medium	In
Common gull	Medium	0.48 birds/km^2 Medium	In
Little gull	Medium	0.06 birds/km^2 Low	In (precautionary approach at PEIR)
Great black-backed gull	High	0.07 birds/km^2 Low	In
Herring gull	High	0.52 birds/km^2 Medium	In
Lesser black-backed gull	High	0.07 birds/km^2 Low	In (precautionary approach at PEIR)
'Commic' tern (common and / or Arctic tern)	Low	0.07 birds/km^2 Low	In (precautionary approach at PEIR)
Sandwich tern	Low	0.07 birds/km^2 Low	In (precautionary approach at PEIR)
Great skua	Medium	<0.01 birds/km^2 Very low (seasonally restricted)	Out
Guillemot	Very low	0.53 birds/km^2 Medium	Out
Razorbill	Very low	0.12 birds/km^2 Low	Out
Puffin	Very low	<0.01 birds/km^2 Very low	Out

12.13.57 CRM was undertaken using the sCRM, developed by Marine Scotland (McGregor, 2018), run deterministically for each seabird species, to determine the risk of collision when in flight. The development and testing of the sCRM was funded by MSS and provides the most up-to-date version of the CRM originally created by

Band (2012) and addresses the uncertainty in developments and other key input parameters as progressed initially by Masden (2015).

12.13.58 The sCRM is run through an online interface referred to as the 'Shiny app', which is a user-friendly graphical user interface accessible via a standard web-browser that uses an R coded programme operating behind the interface to estimate collision risk. The advantages are that users are not required to use any R code themselves, are not required to install or maintain R and any updates to the model are made directly to the server, so are immediately available to users (Donovan, 2018).

12.13.59 CRM accounts for a number of different species-specific behavioural aspects of the seabirds being assessed, including the height at which birds fly, their ability to avoid moving or static structures and how active they are diurnally and nocturnally. Details of these considerations are provided in **Appendix 12.3, Volume 4**.

12.13.60 The assessment of collision risk follows an evidence-led approach making use of a mixture of site-specific data collected from within the Rampion 2 array area and the most recent literature on seabirds and their behaviour in relation to offshore wind farms (**Appendix 12.3, Volume 4**).

12.13.61 In order to provide a range of values to capture variability for each species, the key input parameters were reviewed in order to provide 'mean', 'minimum' and 'maximum' estimates of collision rates for each species. Full details of the parameters used to calculate each estimate are given in **Appendix 12.3, Volume 4**.

12.13.62 All estimates are presented using "Band Option 2" (BO2). BO2 applies a uniform distribution of bird flights between the lowest and the highest levels of the rotors. The PCH was determined from the results of the Strategic Ornithological Support Services SOSS-02 project (Cook *et al.*, 2012) that analysed the flight height measurements taken from boat surveys conducted around the UK. The project was updated following Johnston *et al.* (2014), and the revised published spreadsheet is used to determine the 'generic' percentage of flights at PCH for each species based on the maximum assessment assumptions.

Precautionary Nature to CRM

12.13.63 It must be noted that a number of elements of additional precaution were included in the input parameters applied in the sCRM for this assessment, including considering a range of nocturnal activity factors and lower avoidance rates than that currently predicted from the latest scientific evidence. The nature of such precaution is evidenced through the findings of the Bird Collision Avoidance Study funded by ORJIP (Offshore Renewables Joint Industry Programme), which undertook a study to understand seabird behaviour at sea around offshore wind farms. The ORJIP project studied birds around Thanet offshore wind farm for a two-year period (between 2014 and 2016) recording over 12,000 bird movements throughout the day and night. The findings of this study (Skov *et al.*, 2018) presented updated values for both nocturnal activity and avoidance behaviour from an empirical data source, which it recommended for future incorporation in

CRM. It also reported that only six birds (all gull species) collided with WTGs from over 12,000 birds recorded during the two year period, providing evidence of the precautionary nature of collision risk modelling for all species of seabirds.

12.13.64 A further review of the data from the ORJIP project was undertaken by Bowgen and Cook (2018), which analysed all the data collected across the two year period to understand more about seabird behaviour and provide evidence to support updates to the previous avoidance rates from Cook *et al.* (2014). The findings from this study were that for gannet and kittiwake higher avoidance rates were more appropriate of 99.5% and 99.0%, respectively. It concluded that even when applying these higher rates of avoidance, they considered that precaution remained within the estimated number of collision mortality rates.

12.13.65 Another recent study on gannets by APEM Ltd during the migratory period (APEM, 2014) found that overall avoidance of WTGs was certainly higher than the SNCBs recommended use of 98.9%. This study found that all gannets avoided the WTGs within the study area, which provided evidence that gannets may actually have an avoidance rate as high as 100% during migratory periods at least. However, the concluding recommendation from APEM's research suggested that if it was not appropriate to use a 100% avoidance rate, then a rate of 99.5% for the autumn migration will still offer suitable precaution in collision estimates. This indicates that when estimating gannet collision mortality rates, the use of an avoidance rate of 98.9% is understood to overestimate the risk to this species, as noted by Cook *et al.* (2014), who acknowledged that precaution remained within the avoidance rates put forward for gannets and gull species.

12.13.66 Therefore, it is considered that the CRM input parameters used in the assessment of collision risk to seabirds for Rampion 2 and those from other developments at the cumulative level incorporate a high degree of precaution. The monthly collision rates and total annual collisions for all species assessed is shown in **Table 12-32**.

Table 12-32 Monthly and annual collision estimates for each species considered. Collision estimates are central estimate (minimum – maximum).

Month	Gannet	Kittiwake	Common gull	Little gull	Herring gull	Lesser black-backed gull	Great black-backed gull	'Commic' tern	Sandwich tern
Jan	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.55 (0.13 – 1.72)	0.00 (0.00 – 0.00)	0.68 (0.16 – 1.27)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)
Feb	0.65 (0.31 – 2.10)	6.78 (3.59 – 15.35)	6.21 (2.11 – 16.68)	0.35 (0.05 – 0.99)	3.84 (0.76 – 12.05)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)
Mar	0.73 (0.27 – 2.31)	0.49 (0.18 – 1.30)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	5.59 (1.54 – 15.87)	1.20 (0.26 – 3.59)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)
Apr	1.79 (0.00 – 6.44)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.92 (0.16 – 1.51)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)
May	0.88 (0.14 – 2.79)	0.32 (0.00 – 1.18)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	1.47 (0.00 – 4.73)	0.64 (0.00 – 2.32)	0.00 (0.00 – 0.00)	0.13 (0.00 – 1.10)	0.16 (0.00 – 1.33)
Jun	1.15 (0.21 – 3.50)	0.83 (0.00 – 3.09)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	4.95 (0.00 – 16.83)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)

wood.

Month	Gannet	Kittiwake	Common gull	Little gull	Herring gull	Lesser black-backed gull	Great black-backed gull	'Commic' tern	Sandwich tern
Jul	2.31 (1.22 – 5.64)	0.59 (0.13 – 1.48)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	12.12 (6.40 – 25.85)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)
Aug	3.60 (2.00 – 9.03)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.68 (0.14 – 3.61)
Sep	1.40 (0.55 – 4.17)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	1.73 (0.59 – 2.90)	0.48 (0.07 – 2.90)	0.00 (0.00 – 0.00)
Oct	1.45 (0.78 – 4.30)	0.46 (0.11 – 1.26)	0.00 (0.00 – 0.00)	0.77 (0.12 – 2.15)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)
Nov	1.18 (0.54 – 4.05)	1.16 (0.34 – 3.28)	1.29 (0.27 – 4.15)	0.00 (0.00 – 0.00)	0.55 (0.13 – 1.70)	0.00 (0.00 – 0.00)	0.68 (0.03 – 1.25)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)
Dec	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.54 (0.13 – 1.70)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)
Annual Total	**15.13 (6.01 – 44.33)**	**10.63 (94.29 – 26.95)**	**7.50 (2.37 – 20.83)**	**1.12 (0.17 – 3.14)**	**29.61 (9.10 – 80.45)**	**1.84 (0.26 – 5.91)**	**4.01 (0.94 – 6.94)**	**0.61 (0.07 – 4.00)**	**0.84 (0.14 – 4.94)**

Gannet

sCRM outputs

12.13.67 The monthly estimated mortality rates are presented in **Table 12-32**, which vary from a minimum of zero individuals in January and December to a maximum of approximately four individuals in August. On an annual basis, the estimated mortality rate for collision risk from Rampion 2 is 15 individuals, with a range of between six and 44 individuals using the minimum and maximum sCRM outputs (**Table 12-32**), which is further broken down into relevant bio-seasons in **Table 12-33.** The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional BDMPS populations and their overall baseline mortality rates as described in Section **12.8.10**, which are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-33 Bio-seasons collision risk estimates for gannet for Rampion 2

Bio-season (months)	Collisions (min – max)	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
		Population	Baseline Mortality	
Return Migration (December – March)	1.39 (0.58 – 4.41)	248,385	46,696	0.003 (0.001 – 0.009)
Migration-free Breeding (April – August)	9.73 (3.57 – 27.40)	128,528	24,163	0.040 (0.014 – 0.113)
Post-breeding Migration (September-November)	4.02 (1.86 – 12.52)	456,298	85,784	0.005 (0.002 – 0.015)
Annual (BDMPS)	15.13 (6.01 – 44.33)	456,298	85,784	0.018 (0.007 – 0.052)
Annual (Biogeographic)	15.13 (6.01 – 44.33)	1,180,000	221,840	0.007 (0.003 – 0.020)

Magnitude of change

12.13.68 During the return migration bio-season, between approximately one gannet may be subject to mortality. The BDMPS for the return migration bio-season is defined as 248,385 (Furness, 2015) and using the average baseline mortality rate of 0.187 (**Table 12-16**), the natural predicted mortality in the return migration bio-season is

46,696. The addition of 1.39 mortalities will increase the mortality relative to the baseline mortality rate by 0.003%.

12.13.69 This level of potential change is considered to be of **negligible** magnitude during the return migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.70 During the migration-free breeding bio-season, approximately 10 gannets may be subject to mortality. During the migration-free breeding bio-season, the total regional baseline population of breeding adults and immature birds is predicted to be 128,528 gannets (**Table 12-15**). When the average baseline mortality rate of 0.188 (**Table 12-16**) is applied, the natural predicted mortality in the migration-free breeding bio-season is 24,163. The addition of 9.73 mortalities will increase the mortality relative to the baseline mortality rate by 0.040%.

12.13.71 This level of potential change is considered to be of **negligible** magnitude during the migration-free breeding bio-season, as it represents only a slight difference to the baseline conditions due to the small number of estimated collisions.

12.13.72 During the post-breeding migration bio-season, approximately four gannets may be subject to mortality. The BDMPS for the post-breeding migration bio-season is defined as 456,298 (Furness, 2015) and using the average baseline mortality rate of 0.188 (**Table 12-16**), the natural predicted mortality in the post-breeding migration bio-season is 85,784. The addition of 4.02 mortalities will increase the mortality relative to the baseline mortality rate by 0.005%.

12.13.73 This level of potential change is considered to be of **negligible** magnitude during the post-breeding migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.74 The annual total of gannets subject to mortality due to collision is estimated to be approximately 15. Using the largest BDMPS population of 456,298, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.188 (**Table 12-16**), the natural predicted mortality is 85,784. The addition of 15.13 mortalities will increase the mortality relative to the baseline mortality rate by 0.0.018%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 1,180,000 across all seasons is 221,840. On a biogeographic scale, the addition of 15.13 mortalities will increase the mortality relative to the baseline mortality rate by 0.007%.

12.13.75 Consideration has also been given to the range of uncertainty surrounding collision risk. Considering the minimum and maximum scenarios, the possible total annual range of gannets subject to mortality due to collision is estimated between six and 44. Using the largest BDMPS population of 456,298, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.188 (**Table 12-16**), the natural predicted mortality is 85,784. The addition of between six and 44 mortalities will increase the mortality relative to the baseline mortality rate by 0.007% to 0.052%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 1,180,000 across all seasons is 221,840. The addition of between six and 44 mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.003% to 0.020%.

12.13.76 This level of potential change is considered to be **negligible** on an annual basis at both the BDMPS and bio-geographic scales, as it represents no discernible increase to baseline mortality levels due to the small number of estimated collisions.

Significance of residual effect

12.13.77 Therefore, the magnitude of change resulting from collision risk in each bio-season alone and on an annual basis is considered to be **negligible**. Irrespective of the sensitivity of the receptor, the significance of the residual effect is **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**) and is not considered further in this assessment.

Kittiwake

sCRM Outputs

12.13.78 The monthly estimated mortality rates are presented in **Table 12-32**, which vary from a minimum of zero individuals in several months to a maximum of approximately seven individuals in February. On an annual basis, the estimated mortality rate for collision risk from Rampion 2 is approximately 11 individuals, with a range of between four and 27 individuals using the minimum and maximum sCRM outputs (**Table 12-32**), which is further broken down into relevant bio-seasons in **Table 12-34**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional BDMPS populations and their overall baseline mortality rates as described in **paragraph 12.8.10**, which are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-34 Bio-seasons collision risk estimates for kittiwake for Rampion 2

Bio-season (months)	Collisions (min – max)	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
		Population	Baseline Mortality	
Return Migration (January – April)	7.26 (3.71 – 16.65)	691,526	108,570	0.007 (0.003 – 0.015)
Migration-free Breeding (May – July)	1.74 (0.13 – 5.75)	325,037	51,031	0.562 (0.000 – 0.011)
Post-breeding Migration (August – December)	1.62 (0.45 – 4.55)	911,586	143,119	0.001 (0.000 – 0.003)

Bio-season (months)	Collisions (min – max)	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
		Population	Baseline Mortality	
Annual (BDMPS)	10.63 (4.29 – 26.95)	911,586	143,119	0.007 (0.003 – 0.019)
Annual (Biogeographic)	10.63 (4.29 – 26.95)	5,100,000	800,700	0.001 (0.001 – 0.003)

Magnitude of change

12.13.79 During the return migration bio-season, approximately seven kittiwakes may be subject to mortality. The BDMPS for the return migration bio-season is defined as 691,626 (Furness, 2015) and using the average baseline mortality rate of 0.157 (**Table 12-16**), the natural predicted mortality in the return migration bio-season is 108,570. The addition of 7.26 mortalities will increase the mortality relative to the baseline mortality rate by 0.007%.

12.13.80 This level of potential change is considered to be of **negligible** magnitude during the return migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.81 During the migration-free breeding bio-season, approximately two kittiwakes may be subject to mortality. During the migration-free breeding bio-season, the total regional baseline population of breeding adults and immature birds is predicted to be 325,037 kittiwakes (**Table 12-15**). When the average baseline mortality rate of 0.157 (**Table 12-16**) is applied, the natural predicted mortality in the migration-free breeding bio-season is 51,031. The addition of 1.74 mortalities will increase the mortality relative to the baseline mortality rate by 0.562%.

12.13.82 This level of potential change is considered to be of **negligible** magnitude during the non-migratory breeding bio-season, as it represents only a slight difference to the baseline conditions due to the small number of estimated collisions.

12.13.83 During the post-breeding migration bio-season, approximately two kittiwakes may be subject to mortality. The BDMPS for the post-breeding migration bio-season is defined as 911,586 (**Table 12-15**) and using the average baseline mortality rate of 0.157 (**Table 12-16**), the natural predicted mortality in the post-breeding migration bio-season is 143,119. The addition of between zero and five mortalities will increase the mortality relative to the baseline mortality rate by 0.001%.

12.13.84 This level of potential change is considered to be of **negligible** magnitude during the post-breeding migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.85 The annual total of kittiwakes subject to mortality due to collision is estimated to be approximately 11. Using the largest BDMPS population of 911,586, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.157

(**Table 12-16**), the natural predicted mortality is 143,119. The addition of between 10.63 mortalities will increase the mortality relative to the baseline mortality rate by 0.007%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 5,100,000 across all seasons is 800,700. The addition of 10.63 mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.001%.

12.13.86 Consideration has also been given to the range of uncertainty surrounding collision risk. Considering the minimum and maximum scenarios, the possible total annual range of kittiwakes subject to mortality due to collision is estimated between four and 27. Using the largest BDMPS population of 911,586, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.157 (**Table 12-16**), the natural predicted mortality is 143,119. The addition of between four and 27 mortalities will increase the mortality relative to the baseline mortality rate by 0.003% to 0.019%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 5,100,000 across all seasons is 800,700. The addition of between four and 27 mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.001% to 0.003%.

12.13.87 This level of potential change is considered to be **negligible** on an annual basis at both the BDMPS and bio-geographic scales, as it represents no discernible increase to baseline mortality levels due to the small number of estimated collisions.

Significance of residual effect

12.13.88 Therefore, the magnitude of change resulting from collision risk in each bio-season alone and on an annual basis is considered to be **negligible**. Irrespective of the sensitivity of the receptor, the significance of the residual effect is **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**) and is not considered further in this assessment.

Assessment of potential impact on SSSIs

12.13.89 There are two SSSIs within the Rampion 2 ZOI (Seaford to Beachy Head SSSI and Brighton to Newhaven Cliffs SSSI) that contain or did contain breeding kittiwake colonies.

12.13.90 Brighton to Newhaven Cliffs SSSI was notified in 1986 and has not been revised since (Natural England, 1986). One of the reasons for the original notification was due to the Meeching Court Farm/Newhaven Cliffs area supporting the only colony of breeding kittiwakes in Sussex. Since the notification, more recent reports show that the kittiwake colony formerly at Newhaven Cliffs no longer exists, and it is suggested that the birds from that colony joined with the more recent colony at Seaford Head (Natural England, 2018). SMP data shows that Newhaven Cliffs was surveyed in 2016 and no breeding kittiwakes were found (JNCC, 2021). As this colony no longer exists, it is impossible for Rampion 2 to have an adverse impact on it.

12.13.91 Seaford to Beachy Head SSSI was notified in 1953 and has had multiple revisions since, with the latest in 1999 (Natural England, 1999), though kittiwake were not noted as a reason for the notification. Since the 1999 notification the kittiwake colony has developed at Seaford to Beachy Head, with varying colony counts from 431 and 1,120 AONs recorded between 2002 and 2020 (JNCC, 2021). The colony counts from years that correspond to site-specific survey data collected for Rampion 2 were of 528 AONs in 2019 and 461 AONs in 2020, or 1,056 breeding adults in 2019 and 922 breeding adults in 2020. Therefore, the average number of breeding adults at the Seaford to Beachy Head SSSI is 989.

12.13.92 To assess the potential impact of collision risk from Rampion 2 on kittiwakes from the Seaford to Beachy Head SSSI it is necessary to apportion any risk accordingly between breeding birds from the colony and other birds. The apportionment process followed the Scottish Natural Heritage methodology (SNH, 2018), which accounts for colony size, proportion of foraging range as sea and distance from the colony to the offshore wind farm in order to determine the proportion of birds originating from each colony within mean-max foraging range. The total collision risk to kittiwake from Rampion 2 during the breeding bio-season is 1.74 individual birds (range: 0.13 to 5.75 individuals). Of these, 53.5% are expected to be adult birds (**Table 12-16**). Of these, using the SNH (2018) method, 98.1% are apportioned to the colony at Seaford Head. Therefore, the total number of breeding adults from the Seaford to Beachy Head SSSI subject to collision risk is estimated to be 0.91 (range: 0.07 to 3.02).

12.13.93 Using an adult baseline mortality rate of 0.146 (**Table 12-16**) and a population of 989 adults, the baseline annual mortality rate will be 144 birds. The addition of 0.91 birds will increase the mortality relative to the baseline by 0.63%. As the addition of less than one breeding adult mortality per year will not be considered a detectable increase in mortality relative to the baseline it can be concluded that Rampion 2 will have no discernible effect on the stability of this kittiwake colony at the Seaford to Beachy Head SSSI.

Common gull

sCRM Outputs

12.13.94 The monthly estimated mortality rates are presented in **Table 12-32**, which vary from a minimum of zero individuals in several months to a maximum of approximately six individuals in February. On an annual basis, the estimated mortality rate for collision risk from Rampion 2 is under eight individuals, with a range of between two and 21 individuals using the minimum and maximum sCRM outputs (**Table 12-32**), which is further broken down into relevant bio-seasons in **Table 12-34**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional BDMPS populations and their overall baseline mortality rates as described in **paragraph 12.8.10**, which are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-35 Bio-seasons collision risk estimates for common gull for Rampion 2

Bio-season (months)	Collisions (min – max)	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
		Population	Baseline Mortality	
Return Migration (January – April)	6.21 (2.11 – 16.68)	45,000	11,655	0.053 (0.018 – 0.143)
Migration-free Breeding (May – July)	0.00 (0.00 – 0.00)	14,217	3,682	0
Post-breeding Migration (August – December)	1.29 (0.27 – 4.15)	45,000	11,655	0.011 (0.002 – 0.036)
Annual (BDMPS)	7.50 (2.37 – 20.83)	45,000	11,655	0.064 (0.020 – 0.179)
Annual (Biogeographic)	7.50 (2.37 – 20.83)	1,600,000	414,400	0.002 (0.001 – 0.005)

Magnitude of change

12.13.95 During the return migration bio-season, approximately six common gulls may be subject to mortality. Stienen *et al.* (2007) estimate the maximal number of birds using the straits of Dover on migration to be from 45,000 to 100,000. As a precautionary approach, taking the lower estimate of 45,000 and using the average baseline mortality rate of 0.259 (**Table 12-16**), the natural predicted mortality in the return migration bio-season is 11,655. The addition of 6.21 mortalities will increase the mortality relative to the baseline mortality rate by 0.053%.

12.13.96 This level of potential change is considered to be of **negligible** magnitude during the return migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.97 During the migration-free breeding bio-season, zero common gulls are estimated to be subject to mortality. There is therefore no change in the breeding bio-season and so this effect is not assessed further.

12.13.98 During the post-breeding migration bio-season, approximately one common gull may be subject to mortality. Stienen *et al.* (2007) estimate the maximal number of birds using the straits of Dover on migration to be from 45,000 to 100,000. As a precautionary approach, taking the lower estimate of 45,000 and using the average baseline mortality rate of 0.259 (**Table 12-16**), the natural predicted mortality in the post-breeding migration bio-season is 11,655. The addition of 1.29

mortalities will increase the mortality relative to the baseline mortality rate by 0.011%.

12.13.99 This level of potential change is considered to be of **negligible** magnitude during the post-breeding migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.100 The annual total of common gulls subject to mortality due to collision is to be approximately eight. Using the largest seasonal population of 45,000, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.259 (**Table 12-16**), the natural predicted mortality is 11,655. The addition of 7.50 mortalities will increase the mortality relative to the baseline mortality rate by 0.064%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the flyway population of 1,600,000 across all seasons is 414,400. The addition of 7.50 mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.002%.

12.13.101 Consideration has also been given to the range of uncertainty surrounding collision risk. Considering the minimum and maximum scenarios, the possible total annual range of common gulls subject to mortality due to collision is estimated between two and 21. Using the largest seasonal population of 45,000, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.259 (**Table 12-16**), the natural predicted mortality is 11,655. The addition of between two and 21 mortalities will increase the mortality relative to the baseline mortality rate by 0.020% to 0.179%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the flyway population of 1,600,000 across all seasons is 414,400. The addition of between two and 21 mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.001% to 0.005%.

12.13.102 This level of potential change is considered to be **negligible** on an annual basis at both the BDMPS and bio-geographic scales, as it represents no discernible increase to baseline mortality levels due to the small number of estimated collisions.

Significance of residual effect

12.13.103 Therefore, the magnitude of change resulting from collision risk in each bio-season alone and on an annual basis is considered to be **negligible**. Irrespective of the sensitivity of the receptor, the significance of the residual effect is **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**) and is not considered further in this assessment.

Little gull

sCRM outputs

12.13.104 The monthly estimated mortality rates are presented in **Table 12-32**, which vary from a minimum of zero individuals in several months to a maximum of less than one individual in October. On an annual basis, the estimated mortality rate for collision risk from Rampion 2 is a single individual with a range of between zero and three individuals using the minimum and maximum sCRM outputs (**Table 12-32**), which is further broken down into relevant bio-seasons in **Table 12-34**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional BDMPS populations and their overall baseline mortality rates as described in **Section 12.8.10**, which are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-36 Bio-seasons collision risk estimates for little gull for Rampion 2

Bio-season (months)	Collisions (min – max)	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
		Population	Baseline Mortality	
Return Migration (February – June)	0.35 (0.05 – 0.99)	30,500	8,662	0.004 (0.001 – 0.011)
Post-breeding Migration (July – October)	0.77 (0.12 – 2.15)	30,500	8,662	0.009 (0.001 – 0.025)
Annual (BDMPS)	1.12 (0.17 – 3.14)	30,500	8,662	0.013 (0.002 – 0.036)
Annual (Biogeographic)	1.12 (0.17 – 3.14)	75,000	21,300	0.005 (0.001 – 0.015)

Magnitude of change

12.13.105 During the return migration bio-season, less than one little gull is estimated to be subject to mortality. The BDMPS for the return migration bio-season is defined as 30,500 (**Table 12-15**) and using the average baseline mortality rate of 0.284 (**Table 12-16**), the natural predicted mortality in the return migration bio-season is 8,662. The addition of 0.35 mortalities will increase the mortality relative to the baseline mortality rate by 0.004%.

12.13.106 This level of potential change is considered to be of **negligible** magnitude during the return migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.107 During the post-breeding migration bio-season, less than little gull may be subject to mortality. The BDMPS for the post-breeding migration bio-season is defined as 30,500 (**Table 12-15**) and using the average baseline mortality rate of 0.284 (**Table 12-16**), the natural predicted mortality in the post-breeding migration bio-season is 8,662. The addition of 0.77 mortalities will increase the mortality relative to the baseline mortality rate by 0.009%.

12.13.108 This level of potential change is considered to be of **negligible** magnitude during the post-breeding migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.109 The annual total of little gulls subject to mortality due to collision is estimated to be approximately one. Using the largest BDMPS population of 30,500, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.284 (**Table 12-16**), the natural predicted mortality is 8,662. The addition of 1.12 mortalities will increase the mortality relative to the baseline mortality rate by 0.013%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 75,000 across all seasons is 21,300. The addition of 1.12 mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.005%.

12.13.110 Consideration has also been given to the range of uncertainty surrounding collision risk. Considering the minimum and maximum scenarios, the possible total annual range of little gulls subject to mortality due to collision is estimated between zero and three. Using the largest BDMPS population of 30,500, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.284 (**Table 12-16**), the natural predicted mortality is 8,662. The addition of between zero and three mortalities will increase the mortality relative to the baseline mortality rate by 0.001% to 0.015%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 75,000 across all seasons is 21,300. The addition of between zero and three mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.001% to 0.015%.

12.13.111 This level of potential change is considered to be **negligible** on an annual basis at both the BDMPS and bio-geographic scales, as it represents no discernible increase to baseline mortality levels due to the small number of estimated collisions.

Significance of residual effect

12.13.112 Therefore, the magnitude of change resulting from collision risk in each bio-season alone and on an annual basis is considered to be **negligible**. Irrespective of the sensitivity of the receptor, the significance of the residual effect is **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**) and is not considered further in this assessment.

Lesser black-backed gull

sCRM Outputs

12.13.113 The monthly estimated mortality rates are presented in **Table 12-32**, which vary from a minimum of zero individuals in several months to a maximum of approximately one individual in March. On an annual basis, the estimated mortality rate for collision risk from Rampion 2 is under two individuals with a range of between zero and six individuals using the minimum and maximum sCRM outputs (**Table 12-32**), which is further broken down into relevant bio-seasons in **Table 12-34**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional BDMPS populations and their overall baseline mortality rates as described in **paragraph 12.8.10**, which are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-37 Bio-seasons collision risk estimates for lesser black-backed gull for Rampion 2

Bio-season (months)	Collisions (min – max)	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
		Population	Baseline Mortality	
Return Migration (March – April)	1.20 (0.26 – 3.59)	197,483	24,488	0.005 (0.001 – 0.015)
Migration-free Breeding (May – July)	0.64 (0.00 – 2.32)	80,289	9,956	0.006 (0.000 – 0.023)
Post-breeding Migration (August – October)	0.00 (0.00 – 0.00)	209,700	25,917	0.000
Migration-free Winter (November – February)	0.00 (0.00 – 0.00)	39,314	4,875	0.000
Annual (BDMPS)	1.84 (0.26 – 5.91)	209,007	25,917	0.007 (0.001 – 0.023)
Annual (Biogeographic)	1.84 (0.26 – 5.91)	864,000	107,136	0.002 (0.000 – 0.006)

Magnitude of change

12.13.114 During the return migration bio-season, approximately one lesser black-backed gull is estimated to be subject to mortality. The BDMPS for the return migration bio-season is defined as 197,483 (**Table 12-15**) and using the average baseline mortality rate of 0.124 (**Table 12-16**), the natural predicted mortality in the return migration bio-season is 24,488. The addition of 1.20 mortalities will increase the mortality relative to the baseline mortality rate by 0.005%.

12.13.115 This level of potential change is considered to be of **negligible** magnitude during the return migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.116 During the migration-free breeding bio-season, less than one lesser black-backed gull is estimated to be subject to mortality. The regional breeding population was calculated as 80,289 (**Table 12-15**) and using the average baseline mortality rate of 0.124 (**Table 12-16**), the natural predicted mortality in the post-breeding migration bio-season is 9,956. The addition of 0.64 mortalities will increase the mortality relative to the baseline mortality rate by 0.006%.

12.13.117 This level of potential change is considered to be of **negligible** magnitude during the migration-free breeding bio-season, as it represents no discernible increase to baseline mortality levels due to the very small number of estimated collisions.

12.13.118 During both the post-breeding migration bio-season and migration-free winter bio-season, zero lesser black-backed gulls are predicted to be subject to collision mortality. This represents no change and therefore those bio-seasons are not assessed further.

12.13.119 The annual total of lesser black-backed gulls subject to mortality due to collision is estimated to be approximately two. Using the largest BDMPS population of 209,007, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.124 (**Table 12-16**), the natural predicted mortality is 25,917. The addition of 1.84 mortalities will increase the mortality relative to the baseline mortality rate by 0.007%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 864,000 across all seasons is 107,136. The addition of 1.84 mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.002%.

12.13.120 Consideration has also been given to the range of uncertainty surrounding collision risk. Considering the minimum and maximum scenarios, the possible total annual range of lesser black-backed gulls subject to mortality due to collision is estimated between zero and six. Using the largest BDMPS population of 209,007, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.124 (**Table 12-16**), the natural predicted mortality is 25,917. The addition of between zero and six mortalities will increase the mortality relative to the baseline mortality rate by 0.001% to 0.023%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 864,000 across all seasons is 107,136. The addition of between zero and six mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.000% to 0.006%.

12.13.121 This level of potential change is considered to be **negligible** on an annual basis at both the BDMPS and bio-geographic scales, as it represents no discernible increase to baseline mortality levels due to the small number of estimated collisions.

Significance of residual effect

12.13.122 Therefore, the magnitude of change resulting from collision risk in each bio-season alone and on an annual basis is considered to be **negligible**. Irrespective of the sensitivity of the receptor, the significance of the residual effect is **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**) and is not considered further in this assessment.

Herring gull

sCRM outputs

12.13.123 The monthly estimated mortality rates are presented in **Table 12-32**, which vary from a minimum of zero individuals in several months to a maximum of approximately 12 individuals in July. On an annual basis, the estimated mortality rate for collision risk from Rampion 2 is under 30 individuals with a range of between nine and 80 individuals using the minimum and maximum sCRM outputs (**Table 12-32**), which is further broken down into relevant bio-seasons in **Table 12-34**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional BDMPS populations and their overall baseline mortality rates as described in Section **12.8.10**, which are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-38 Bio-seasons collision risk estimates for herring gull for Rampion 2

Bio-season (months)	Collisions (min – max)	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
		Population	Baseline Mortality	
Breeding (March – August)	24.13 (7.95 – 63.28)	246,694	42,431	0.057 (0.019 – 0.149)
Non-breeding (September – February)	5.48 (1.15 – 17.17)	466,511	80,240	0.007 (0.001 – 0.021)
Annual (BDMPS)	29.61 (9.10 – 80.45)	466,511	80,240	0.037 (0.011 – 0.100)
Annual (Biogeographic)	29.61 (9.10 – 80.45)	1,098,000	188,856	0.016 (0.005 – 0.043)

Magnitude of change

12.13.124 During the breeding bio-season, approximately 24 herring gulls are estimated to be subject to mortality. The regional population during the breeding bio-season is 246,694 (**Table 12-15**) and using the average baseline mortality rate of 0.172 (**Table 12-16**), the natural predicted mortality in the breeding bio-season is 42,431. The addition of 24.13 mortalities will increase the mortality relative to the baseline mortality rate by 0.057%.

12.13.125 This level of potential change is considered to be of **negligible** magnitude during the breeding bio-season, as it represents only a slight increase to baseline mortality levels due to the small number of estimated collisions.

12.13.126 During the non-breeding bio-season, approximately five herring gulls are estimated to be subject to mortality. The BDMPS for the non-breeding bio-season is defined as 466,511 (**Table 12-15**) and using the average baseline mortality rate of 0.172 (**Table 12-16**), the natural predicted mortality in the non-breeding bio-season is 80,240. The addition of 5.48 mortalities will increase the mortality relative to the baseline mortality rate by 0.007%.

12.13.127 This level of potential change is considered to be of **negligible** magnitude during the non-breeding bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.128 The annual total of herring gulls subject to mortality due to collision is estimated to be approximately 30. Using the largest BDMPS population of 466,511, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.172 (**Table 12-16**), the natural predicted mortality is 80,240. The addition of 29.61 mortalities will increase the mortality relative to the baseline mortality rate by 0.037%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 1,098,000 across all seasons is 188,856. The addition of 29.61 mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.016%.

12.13.129 Consideration has also been given to the range of uncertainty surrounding collision risk. Considering the minimum and maximum scenarios, the possible total annual range of herring gulls subject to mortality due to collision is estimated between nine and 80. Using the largest BDMPS population of 466,511, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.172 (**Table 12-16**), the natural predicted mortality is 80,240. The addition of between nine and 80 mortalities will increase the mortality relative to the baseline mortality rate by 0.011% to 0.100%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 1,098,000 across all seasons is 188,856. The addition of between nine and 80 mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.005% to 0.043%.

12.13.130 This level of potential change is considered to be **negligible** on an annual basis at both the BDMPS and bio-geographic scales, as it represents no discernible increase to baseline mortality levels due to the small number of estimated collisions.

Significance of residual effect

12.13.131 Therefore, the magnitude of change resulting from collision risk in each bio-season alone and on an annual basis is considered to be **negligible**. Irrespective of the sensitivity of the receptor, the significance of the residual effect is **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**) and is not considered further in this assessment.

Great black-backed gull

sCRM Outputs

12.13.132 The monthly estimated mortality rates are presented in **Table 12-32**, which vary from a minimum of zero individuals in several months to a maximum of approximately two individuals in September. On an annual basis, the estimated mortality rate for collision risk from Rampion 2 is four individuals with a range of between one and seven individuals using the minimum and maximum sCRM outputs (**Table 12-32**), which is further broken down into relevant bio-seasons in **Table 12-34**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional BDMPS populations and their overall baseline mortality rates as described in **paragraph 12.8.10**, which are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-39 Bio-seasons collision risk estimates for great black-backed gull for Rampion 2

Bio-season (months)	Collisions (min – max)	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
		Population	Baseline Mortality	
Return Migration (January – April)	1.61 (0.33 – 2.79)	17,742	1,650	0.097 (0.020 – 0.169)
Migration-free Breeding (May – July)	0.00 (0.00 – 0.00)	9,940	924	0
Post-breeding Migration (August – November)	2.41 (0.62 – 4.15)	17,742	1,650	0.146 (0.037 – 0.252)
Migration-free Winter (December)	0.00 (0.00 – 0.00)	17,742	1,650	0
Annual (BDMPS)	4.01 (0.94 – 6.94)	17,742	1,650	0.243 (0.057 – 0.421)
Annual (Biogeographic)	4.01 (0.94 – 6.94)	23,500	2,186	0.184 (0.043 – 0.318)

Magnitude of change

12.13.133 During the return migration bio-season, approximately two great black-backed gulls are estimated to be subject to mortality. The BDMPS for the return migration bio-season is defined as 17,742 (**Table 12-15**) and using the average baseline mortality rate of 0.093 (**Table 12-16**), the natural predicted mortality in the return migration bio-season is 1,650. The addition of 1.61 mortalities will increase the mortality relative to the baseline mortality rate by 0.097%.

12.13.134 This level of potential change is considered to be of **negligible** magnitude during the return migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.135 During the post-breeding migration bio-season, approximately two great black-backed gulls are estimated to be subject to mortality. The BDMPS for the post-breeding migration bio-season is defined as 17,742 (**Table 12-15**) and using the average baseline mortality rate of 0.093 (**Table 12-16**), the natural predicted mortality in the post-breeding migration bio-season is 1,650. The addition of 2.41 mortalities will increase the mortality relative to the baseline mortality rate by 0.146%.

12.13.136 This level of potential change is considered to be of **negligible** magnitude during the post-breeding migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.137 During both the migration-free breeding bio-season and migration-free winter bio-season, zero great black-backed gulls are predicted to be subject to collision mortality. This represents no change and therefore those bio-seasons are not assessed further.

12.13.138 The annual total of great black-backed gulls subject to mortality due to collision is estimated to be approximately four. Using the largest BDMPS population of 17,742 as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.093 (**Table 12-16**), the natural predicted mortality is 1,650. The addition of 4.01 mortalities will increase the mortality relative to the baseline mortality rate by 0.243%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 23,500 across all seasons is 2,186. The addition of 4.01 mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.184%.

12.13.139 Consideration has also been given to the range of uncertainty surrounding collision risk. Considering the minimum and maximum scenarios, the possible total annual range of great black-backed gulls subject to mortality due to collision is estimated between one and seven. Using the largest BDMPS population of 17,742 as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.093 (**Table 12-16**), the natural predicted mortality is 1,650. The addition of between one and seven mortalities will increase the mortality relative to the baseline mortality rate by 0.057% to 0.421%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 23,500 across all seasons is 2,186. The addition of between one and seven mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.043% to 0.318%.

12.13.140 This level of potential change is considered to be **negligible** on an annual basis at both the BDMPS and bio-geographic scales, as it represents no discernible increase to baseline mortality levels due to the small number of estimated collisions.

Significance of residual effect

12.13.141 Therefore, the magnitude of change resulting from collision risk in each bio-season alone and on an annual basis is considered to be **negligible**. Irrespective of the sensitivity of the receptor, the significance of the residual effect is **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**) and is not considered further in this assessment.

'Commic' tern

sCRM outputs

12.13.142 The monthly estimated mortality rates are presented in **Table 12-32**, which vary from a minimum of zero individuals in most months to a maximum of less than one individual in September. On an annual basis, the estimated mortality rate for collision risk from Rampion 2 is under a single individual with a range of between zero and four individuals using the minimum and maximum sCRM outputs (**Table 12-32**), which is further broken down into relevant bio-seasons in **Table 12-34**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional BDMPS populations and their overall baseline mortality rates as described in **paragraph 12.8.10**, which are based on age specific demographic rates and age class proportions as presented in **Table 12-16**.

Table 12-40 Bio-seasons collision risk estimates for 'commic' tern for Rampion 2

Bio-season (months)	Collisions (min – max)	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
		Population	Baseline Mortality	
Return Migration (April – May)	0.13 (0.00 – 1.10)	308,841	67,018	0.000 (0.000 – 0.002)
Migration-free Breeding (June)	0.00 (0.00 – 0.00)	118,315	24,674	0
Post-breeding Migration (July - September)	0.48 (0.07 – 2.90)	308,841	67,018	0.001 (0.000 – 0.004)
Annual (BDMPS)	0.61 (0.07 – 4.00)	308,841	67,018	0.001 (0.000 – 0.006)

Bio-season (months)	Collisions (min – max)	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
		Population	Baseline Mortality	
Annual (Biogeographic)	0.61 (0.07 – 4.00)	1,108,000	240,436	0.000 (0.000 – 0.002)

Magnitude of change

12.13.143 During the return migration bio-season, less than one 'commic' tern is estimated to be subject to mortality. The BDMPS population size for the return migration bio-season is calculated as 308,841, being the sum of the common tern and Arctic tern populations (**Table 12-15**). Using an average baseline mortality rate of 0.217 (using the lower average mortality rate from common and Arctic terns as a precautionary assumption; **Table 12-16**), the natural predicted mortality in the return migration bio-season is 67,018. The addition of 0.13 mortalities will increase the mortality relative to the baseline mortality rate by 0.000%.

12.13.144 This level of potential change is considered to be of **negligible** magnitude during the post-breeding migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.145 During the migration-free breeding bio-season, zero 'commic' terns are predicted to be subject to collision mortality. This represents no change and therefore that bio-season is not assessed further.

12.13.146 During the post-breeding migration bio-season, less than one 'commic' tern is estimated to be subject to mortality. The BDMPS population size for the post-breeding migration bio-season is calculated as 308,841, being the sum of the common tern and Arctic tern populations (**Table 12-15**). Using an average baseline mortality rate of 0.217 (using the lower average mortality rate from common and Arctic terns as a precautionary assumption; **Table 12-16**), the natural predicted mortality in the return migration bio-season is 67,018. The addition of 0.48 mortalities will increase the mortality relative to the baseline mortality rate by 0.001%.

12.13.147 This level of potential change is considered to be of **negligible** magnitude during the post-breeding migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.148 The annual total of 'commic' terns subject to mortality due to collision is estimated to be less than one. Using the largest BDMPS population of 308,841, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.217 (**Table 12-16**), the natural predicted mortality is 67,018. The addition of 0.61 mortalities will increase the mortality relative to the baseline mortality rate by 0.001%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 1,108,000 across all seasons is 240,436. The addition of 0.61

mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.000%.

12.13.149 Consideration has also been given to the range of uncertainty surrounding collision risk. Considering the minimum and maximum scenarios, the possible total annual range of 'commic' terns subject to mortality due to collision is estimated between zero and four. Using the largest BDMPS population of 308,841, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.217 (**Table 12-16**), the natural predicted mortality is 67,018. The addition of between zero and four mortalities will increase the mortality relative to the baseline mortality rate by 0.000% to 0.006%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 1,108,000 across all seasons is 240,436. The addition of between zero and four mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.000% to 0.002%.

12.13.150 This level of potential change is considered to be **negligible** on an annual basis at both the BDMPS and bio-geographic scales, as it represents no discernible increase to baseline mortality levels due to the small number of estimated collisions.

Significance of residual effect

12.13.151 Therefore, the magnitude of change resulting from collision risk in each bio-season alone and on an annual basis is considered to be **negligible**. Irrespective of the sensitivity of the receptor, the significance of the residual effect is **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**) and is not considered further in this assessment.

Sandwich tern

sCRM outputs

12.13.152 The monthly estimated mortality rates are presented in **Table 12-32**, which vary from a minimum of zero individuals in most months to a maximum of less than one individual in August. On an annual basis, the estimated mortality rate for collision risk from Rampion 2 is under a single individual with a range of between zero and five individuals using the minimum and maximum sCRM outputs (**Table 12-32**), which is further broken down into relevant bio-seasons in **Table 12-34**. The magnitude of change is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional BDMPS populations and their overall baseline mortality rates as described in **paragraph 12.8.10**, which are based on age specific demographic rates and age class proportions as presented in **Table 12-16.**

Table 12-41 Bio-seasons collision risk estimates for Sandwich tern for Rampion 2

Bio-season (months)	Collisions (min – max)	Regional baseline populations and baseline mortality rates (individuals per annum)		Increase in baseline mortality (%)
		Population	Baseline Mortality	
Return Migration (March – May)	0.16 (0.00 – 1.33)	38,051	9,322	0.002 (0.000 – 0.014)
Migration-free Breeding (June)	0.00 (0.00 – 0.00)	15,239	3,734	0
Post-breeding Migration (July - September)	0.68 (0.14 – 3.61)	38,051	9,322	0.007 (0.002 – 0.039)
Annual (BDMPS)	0.84 (0.14 – 4.94)	38,051	9,322	0.009 (0.002 – 0.053)
Annual (Biogeographic)	0.84 (0.14 – 4.94)	148,000	36,260	0.002 (0.000 – 0.014)

Magnitude of change

12.13.153 During the return migration bio-season, less than one Sandwich tern is estimated to be subject to mortality. The BDMPS for the post-breeding migration bio-season is defined as 38,051 (**Table 12-15**) and using the average baseline mortality rate of 0.245 (**Table 12-16**), the natural predicted mortality in the post-breeding migration bio-season is 9,322. The addition of 0.16 mortalities will increase the mortality relative to the baseline mortality rate by 0.002%.

12.13.154 This level of potential change is considered to be of **negligible** magnitude during the post-breeding migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.155 During the migration-free breeding bio-season, zero Sandwich terns are predicted to be subject to collision mortality. This represents no change and therefore that bio-seasons are not assessed further.

12.13.156 During the post-breeding migration bio-season, less than one Sandwich tern is estimated to be subject to mortality. The BDMPS for the post-breeding migration bio-season is defined as 38,051 (Furness, 2015) and using the average baseline mortality rate of 0.245 (**Table 12-16**), the natural predicted mortality in the post-breeding migration bio-season is 9,322. The addition of 0.68 mortalities will increase the mortality relative to the baseline mortality rate by 0.007%.

12.13.157 This level of potential change is considered to be of **negligible** magnitude during the post-breeding migration bio-season, as it represents no discernible increase to baseline mortality levels due to a very small number of estimated collisions.

12.13.158 The annual total of Sandwich terns subject to mortality due to collision is estimated to be less than one. Using the largest BDMPS population of 38,051 as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.245 (**Table 12-16**), the natural predicted mortality is 9,322. The addition of 0.84 mortalities will increase the mortality relative to the baseline mortality rate by 0.009%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 148,000 across all seasons is 36,260. The addition of 0.84 mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.002%.

12.13.159 Consideration has also been given to the range of uncertainty surrounding collision risk. Considering the minimum and maximum scenarios, the possible total annual range of Sandwich terns subject to mortality due to collision is estimated between zero and five. Using the largest BDMPS population of 38,051 as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.245 (**Table 12-16**), the natural predicted mortality is 9,322. The addition of between zero and five mortalities will increase the mortality relative to the baseline mortality rate by 0.002% to 0.053%. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 148,000 across all seasons is 36,260. The addition of between zero and five mortalities will increase the mortality relative to the biogeographic baseline mortality rate by 0.000% to 0.014%.

12.13.160 This level of potential change is considered to be **negligible** on an annual basis at both the BDMPS and bio-geographic scales, as it represents no discernible increase to baseline mortality levels due to the small number of estimated collisions.

Significance of residual effect

12.13.161 Therefore, the magnitude of change resulting from collision risk in each bio-season alone and on an annual basis is considered to be **negligible**. Irrespective of the sensitivity of the receptor, the significance of the residual effect is **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**) and is not considered further in this assessment.

Collision risk: migratory seabirds and non-seabirds

12.13.162 Migrant seabirds and non-seabirds flying through the array area during the operational phase are at risk of collision with WTG rotors and associated infrastructure. The result of such collisions may be fatal to the bird concerned. Migratory birds may not be reliably detected using aerial digital surveys or any other existing generally applied survey method. 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.

12.13.163 For this PEIR stage, no bespoke modelling has been taken place, and instead an assessment has been made on the basis of existing data and literature, particularly the assessments applied and agreed for Rampion 1 ES.

12.13.164 As part of the Rampion 1 DCO Examination, APEM carried out Migropath modelling of migratory non-seabirds (APEM, 2013). Migropath is a modelling tool to estimate the number of birds passing through an OWF, based on the work carried out by the BTO as part of the SOSS-05 project (Wright *et al.*, 2012). The results from this modelling were then fed into the Band (2011) CRM to inform potential collision mortality (Percival, 2013). The annual total migrant estimate and subsequent collision mortality at a range of possible avoidance rates is given in **Table 12-42**.

Table 12-42 Summary of migration modelling and CRM results as determined for Rampion 1.

Species	Annual migrant passage estimate	Annual Collisions		
		98% Avoidance	99% Avoidance	99.5% Avoidance
Dark-bellied Brent Goose	148	0.22	0.11	0.05
Common scoter	1,243	0.025	0.013	0.006
Marsh harrier	57	0.14	0.07	0.003
Ringed plover (breeding)	818	1.37	0.69	0.34
Ringed plover (non-breeding)	1,420	2.39	1.19	0.60
Grey plover	1,647	3.02	1.51	0.75
Dunlin (breeding and passage population)	96	0.16	0.08	0.004
Dunlin (wintering population)	0	0	0	0
Bar-tailed godwit	770	0.49	0.25	0.12
Redshank (breeding)	214	0.41	0.21	0.10
Redshank (non-breeding)	666	1.29	0.64	0.32
Common tern	1,580	0.35	0.17	0.09
Arctic tern	739	0.16	0.08	0.04

12.13.165 Following this, it was concluded that there was no adverse significant effect from Rampion 1 to migratory seabirds or non-seabirds. Given that Rampion 2 is immediately adjacent to Rampion 1, and the maximum number of WTGs for Rampion 2 is lower than the MDS number of WTGs presented for Rampion 1 during that project's DCO application, it can be assumed that the impact of Rampion 2 will be no higher and potentially lower than estimated for Rampion 1.

12.13.166 On this basis a significant effect to migratory seabirds and non-seabirds from Rampion 2 appears to be highly unlikely. Nonetheless, the ES that will follow this PEIR will include quantitative modelling to assess the impact of Rampion 2 on migratory seabirds and non-seabirds.

Barrier effect: Array area

Overview

12.13.167 In the operational phase of Rampion 2, the presence of WTGs 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.

12.13.168 This could affect seabirds migrating along the English Channel (east-west movement), non-seabirds migrating across the English Channel (north-south movement) and breeding seabirds on foraging trips.

Migrating seabirds

12.13.169 For seabirds migrating along the English Channel, the Rampion 2 array area is roughly parallel with the typical flight direction, with a frontal area of 12km compared to the entire width of the channel of approximately 130km. Of this, the existing Rampion 1 project already occupies approximately 7km. The number of additional migrating seabirds encountering Rampion 2 will therefore be a small proportion of the total number of migrating seabirds. Furthermore, the change in route will require a maximum deviation of 6km, which is a negligible distance for migratory seabirds and the increase in energy demand is minor and will be insignificant compared to unsuitable wind conditions or changes in prey density (Masden *et al.*, 2010). The magnitude of change will therefore be, at most, **negligible** and so, regardless of the sensitivity of the receptor involved, the effect is assessed as **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**).

Migrating non-seabirds

12.13.170 For birds migrating across the English Channel (i.e. between England and France), Rampion 2 may create a barrier effect. Unlike seabirds, most non-seabirds are unable to rest or forage at sea and are therefore required to complete the crossing in a single flight. With a frontal area of 40km, the maximum deviation required will be 20km. A direct flight line across the English Channel at that point will be approximately 128km. This will therefore represent an increase in flight distance of 15.6%. This is a relatively small increase, and unlikely to be significant compared to the effect of unfavourable winds or cold weather. For example, an 11mph headwind ("gentle breeze" on the Beaufort scale) would represent a 50% increase in effective flight distance for a bird with a flight speed of 10m/s.

12.13.171 The English Channel is approximately 560km long, and therefore only a small proportion of birds crossing the Channel are likely to encounter Rampion 2 at all. If birds were distributed evenly, approximately 7% might be expected to encounter Rampion 2. Birds that are most sensitive to energy constraints are more likely to cross at the narrowest point (the straits of Dover), which will avoid Rampion 2 entirely.

12.13.172 However, it should be noted that most migratory non-seabirds fly at heights well above the maximum WTG blade height (Alerstam, 1990) and therefore are likely to fly over the offshore wind farm, rather than around it.

12.13.173 The magnitude of change will therefore be, at most, **negligible** and so, regardless of the sensitivity of the receptor involved, the effect is assessed as **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**).

Breeding seabirds

12.13.174 Ecological theory suggests that birds, while they are breeding, will take the shortest (energetically most efficient) route to and from known areas that provide good foraging resources. Any deviation from this route may lead to 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.

12.13.175 Of the species identified as breeding within the region surrounding Rampion 2 (see **Appendix 12.1, Volume 4**), only kittiwakes breeding on the south coast of Sussex at Splash Point, Seaford, have been identified as vulnerable to this impact.

12.13.176 Following a review of the available foraging area for kittiwake at Splash Point, any barrier effect will only be of consequence to a small proportion of the total available foraging area from this site. The total at-sea area within a mean-max foraging range of 156.1km (Woodward *et al.*, 2019) is approximately 37,285km^2. Of this, approximately 6,550km^2 (17.6%) at the outer reach of their foraging range will require some deviation as a result of Rampion 2. The maximum deviation required will be to a point immediately south of Rampion 2, to which the shortest route in the absence of Rampion 2 will be approximately 38km, and the shortest route avoiding both will be 44km, an increase of 15.8%. Further away from the colony, the proportional deviation declines. Even at the maximum deviation of 15.8%, the effect is minor and will be insignificant compared to unsuitable wind conditions or changes in prey density (Masden *et al.* 2010).

12.13.177 Furthermore, a barrier effect requires foraging birds to avoid the offshore wind farm. Kittiwakes show relatively low avoidance of offshore wind farms, and are often seen flying within offshore wind farms, perching on offshore structures and even nesting on offshore structures (Garthe & Hüppop, 2004; Vanermen *et al.*, 2015; Skov *et al.*, 2018).

12.13.178 On the basis that there will be no barrier effect to the majority of potential foraging locations, that deviations required as a result of a barrier effect will be relatively small, and that kittiwakes show low avoidance and may therefore be willing to fly through the offshore wind farm anyway, the potential magnitude of change has been assessed as **negligible**. Regardless of the sensitivity of the receptor involved, the effect is assessed as **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**).

Indirect effects: Array area

12.13.179 During the operation phase of Rampion 2 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 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.

12.13.180 However, 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 8** and **Chapter 9**, respectively) then there is no potential for any indirect effects of an adverse significance to occur on offshore and intertidal ornithology receptors.

12.14 Preliminary assessment: Decommissioning phase

Introduction

12.14.1 The impacts of the offshore decommissioning of Rampion 2 have been assessed for offshore and intertidal ornithology receptors. The potential environmental impacts arising from the decommissioning of Rampion 2 are listed in **Table 12-5.** The MDS against which each decommissioning phase impact has been assessed is presented in **Table 12-17**.

Disturbance and displacement: Array

12.14.2 Decommissioning activities within the array area associated with foundations and WTGs may lead to disturbance and displacement of species within the array and different degrees of buffers surrounding it.

12.14.3 The MDS for decommissioning activities within the array area is equal to the MDS for the construction phase within the array area (**Table 12-17**). Therefore, the impacts are likely to be similar.

12.14.4 As all potential effects within the construction phase were deemed to be not significant (see **Section 12.12**), no significant effects are expected within the decommissioning phase.

Disturbance and displacement: Offshore cable corridor

12.14.5 Decommissioning activities within the offshore cable corridor associated with decommissioning the export cable may lead to disturbance and displacement of species within the offshore export cable corridor and different degrees of buffers surrounding it.

12.14.6 The MDS for decommissioning activities within the offshore export cable corridor is equal to the MDS for the construction phase within the offshore export cable corridor (**Table 12-17**). Therefore, the impacts are likely to be similar.

12.14.7 As all potential effects within the construction phase were deemed to be not significant (see **paragraph 12.12.1**), no significant effects are expected for the decommissioning phase either.

Indirect effects: Offshore cable corridor

12.14.8 During the decommissioning phase of Rampion 2 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.

12.14.9 However, 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 8** and **Chapter 9**, respectively) then there is no potential for any indirect effects of an adverse significance to occur on offshore and intertidal ornithology receptors.

12.15 Preliminary assessment: Cumulative effects

Approach

12.15.1 A preliminary cumulative effect assessment (CEA) has been carried out for Rampion 2 which examines the results from the combined impacts of Rampion 2 with other developments on the same single receptor or resource. The overall method followed to identify and assess potential cumulative effects in relation to the offshore environment is set out in **Chapter 5, Section 5.10**.

12.15.2 The offshore screening approach is based on the Planning Inspectorate's Advice Note Seventeen (Planning Inspectorate, 2019b), with relevant components of the RenewableUK (RenewableUK, 2013) accepted guidance, which includes aspects specific to the marine elements of an offshore wind farm, addressing the need to consider mobile wide-ranging species (foraging species, migratory routes etc).

12.15.3 For offshore and intertidal ornithology, a Zone of Influence (ZOI) has been applied for the CEA to ensure direct and indirect cumulative effects can be appropriately identified and assessed. The ZOI has been defined as the area within the mean-max foraging range (Woodward *et al.*, 2019) of each receptor during the breeding bio-season, and within the BDMPS region as defined by Furness (2015) outside the breeding bio-season.

12.15.4 A short list of other developments that may interact with the Rampion 2 ZOIs during their construction, operation or decommissioning is presented in **Appendix 5.4: Cumulative effects assessment shortlisted developments, Volume 4** and on Figure 5.4.1, Volume 4. This short list has been generated applying criteria set out in Chapter 5 and has been collated up to the finalisation of the PEIR through desk study, consultation and engagement.

12.15.5 Only those developments in the short list that fall within the offshore and intertidal ornithology ZOI have the potential to result in cumulative effects with Rampion 2. All developments falling outside the offshore and intertidal ornithology ZOI are excluded from this assessment. Furthermore, the following types of other development have the potential to result in cumulative effects on offshore and intertidal ornithology.

- Other developments that could result in loss or change (permanent and/ or temporary) to habitats through displacement and disturbance which could potentially also be affected by Rampion 2.
- Other offshore wind farm developments that could lead to a risk of collision with WTG blades during the operational phase, where the operational phase overlaps with the operational phase of Rampion 2.

12.15.6 In assessing the potential cumulative impacts for Rampion 2, it is important to bear in mind that some developments, predominantly those 'proposed' or identified in development plans, may not actually be taken forward, or fully built out as described within their MDS. There is therefore a need to build in some consideration of certainty (or uncertainty) with respect to the potential impacts which might arise from such proposals. For example, those other developments under construction are likely to contribute to cumulative impacts (providing effect or spatial pathways exist), whereas those proposals not yet approved are less likely to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors.

12.15.7 With this in mind, all other developments and plans considered alongside Rampion 2 have been allocated into 'tiers' and 'sub-tiers' reflecting their current stage within the planning and development process. This allows the CEA to present several future development scenarios, each with a differing potential for being ultimately built out. This approach also allows appropriate weight to be given to each scenario (tier) when considering the potential cumulative impact. The proposed tier structure is intended to ensure that there is a clear understanding of the level of confidence in the cumulative assessments provided in this report. An explanation of each tier is included in **Table 12-43**.

Table 12-43 Description of tiers of other developments considered for CEA (adapted from PINS Advice Note 17)

Tier	Sub-Tier	Description of stage of development of project
Tier 1	Tier 1a	Project in operation
	Tier 1b	Project under construction
	Tier 1c	Permitted applications, whether under the Planning Act 2008 or other regimes, but not yet implemented

Tier	Sub-Tier	Description of stage of development of project
	Tier 1d	Submitted applications, whether under the Planning Act 2008 or other regimes, but not yet determined
Tier 2	N/A	Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has been submitted
Tier 3	Tier 3a	Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has not been submitted
	Tier 3b	Identified in the relevant Development Plan (and emerging Development Plans with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited
	Tier 3c	Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward

12.15.8 On the basis of the above, the following specific other developments presented in **Table 12-44** contained within the short list in **Appendix 5.4, Volume 4** are scoped into this CEA. The cumulative project table within this PEIR chapter will be updated in the ES once a holistic approach across chapters is agreed and feedback from stakeholder received.

Table 12-44 Other offshore wind farm developments considered for CEA

Project	Status	Tier
Barrow	Operational	1a
Beatrice	Operational	1a
Beatrice Demonstrator	Operational	1a
Blyth Demonstration Site	Operational	1a
Burbo Bank	Operational	1a
Burbo Bank Extension	Operational	1a
Dudgeon	Operational	1a
East Anglia One	Operational	1a
European Offshore Wind Development Centre	Operational	1a
Forthwind Demonstration Project (Methil)	Operational	1a
Galloper	Operational	1a
Greater Gabbard	Operational	1a
Gunfleet Sands	Operational	1a

Project	Status	Tier
Gwynt y Mor	Operational	1a
Hornsea Project One	Operational	1a
Humber Gateway	Operational	1a
Hywind Scotland (Hywind 2)	Operational	1a
Kentish Flats	Operational	1a
Kentish Flats Extension	Operational	1a
Kincardine	Operational	1a
Lincs, Lynn & Inner Dowsing	Operational	1a
London Array	Operational	1a
North Hoyle	Operational	1a
Ormonde	Operational	1a
Race Bank	Operational	1a
Rampion	Operational	1a/1c
Rhyl Flats	Operational	1a
Robin Rigg	Operational	1a
Scroby Sands	Operational	1a
Sheringham Shoal	Operational	1a
Teesside	Operational	1a
Thanet	Operational	1a
Walney Phase 1	Operational	1a
Walney Phase 2	Operational	1a
Walney Extension	Operational	1a
West of Duddon Sands	Operational	1a
Westermost Rough	Operational	1a
Hornsea Project Two	Under Construction	1b
Moray East	Under Construction	1b
Neart na Gaoithe	Under construction	1b
Seagreen (formerly Seagreen A and Seagreen B)	Under construction	1b
Triton Knoll	Under construction	1b
Dogger Bank A	Consented– construction expected 2022-2023	1c
Dogger Bank B	Consented– construction expected 2022-2024	1c

Project	Status	Tier
Dogger Bank C (formerly Dogger Bank Teesside A)	Consented - construction expected 2023-2026	1c
East Anglia Three	Consented - construction expected 2023-2026	1c
Hornsea Three	Consented – construction expected 2024-2030	1c
Inch Cape	Consented	1c
Moray West	Consented – construction expected 2022-2025	1c
Norfolk Vanguard	Consented*	1c
Sofia (formerly Dogger Bank Teesside B)	Consented - construction expected 2021-2026	1c
East Anglia One North	Application under examination	1d
East Anglia Two	Application under examination	1d
Hornsea Four	Application under examination	1d
Norfolk Boreas	Application under examination	1d
Awel y Mor	In Planning	2
Sheringham Shoal and Dudgeon Extension Projects	In planning	2
Five Estuaries (Galloper Extension)	In planning	3b
North Falls (Greater Gabbard Extension)	In planning	3b

* Norfolk Vanguard's consent was overturned in February 2021 following a judicial review and therefore requires to be redetermined.

12.15.9 The cumulative MDS described in **Table 12-45** has been selected as having the potential to result in the greatest cumulative effect on an identified receptor group. The cumulative impacts presented and assessed in this section have been selected from the details provided in the **Chapter 4** as well as the information available on other developments and plans in order to inform a cumulative MDS. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the project design envelope compared to that assessed here, be taken forward in the final design scheme.

Table 12-45 Cumulative maximum design scenario for offshore and intertidal ornithology

Project phase and activity/impact	Scenario	Justification
Cumulative effect of displacement on guillemot, razorbill and gannet (operational phase)	Maximum design scenario for Rampion 2 plus the cumulative full development of the following projects within the UK Relevant ZOI: Tier 1: - Operational offshore wind farms in the relevant ZOI; - Offshore wind farms under construction in the relevant ZOI; - Permitted offshore wind farm projects not yet implemented; and - Offshore wind farm projects with submitted applications not yet determined. Tier 2: - Two Tier 2 projects identified, with quantitative data available from PEIRs on developer's website (not yet available via PINS). Tier 3: - No Tier 3 projects identified, as quantitative data not available on displacement of seabirds at this stage.	Maximum potential for interactive effects from maintenance activities associated with and the operational effects of the offshore wind farm(s) considered within the relevant ZOI. This region was chosen as seabirds associated with Rampion 2 are expected to come from or move to other areas within the ZOI, that are also subject to interaction with other developments within this region.
Cumulative effect of collision risk on gannet, kittiwake, herring gull, lesser black-backed gull and great black-backed gull (operational phase)	Maximum design scenario for Rampion 2 plus the cumulative full development of the following projects within the relevant ZOI: Tier 1: - Operational offshore wind farms in the relevant ZOI; - Offshore wind farms under construction in the relevant ZOI;	Maximum potential for interactive effects from maintenance activities associated with and the operational effects of the OWF(s) considered within the relevant ZOI. This region was chosen as seabirds associated with Rampion 2 are expected to come

Project phase and activity/impact	Scenario	Justification
	- Permitted offshore wind farm projects not yet implemented; and - Offshore wind farm projects with submitted applications not yet determined. Tier 2: - Two Tier 2 projects identified, with quantitative data available from PEIRs on developer's website (not yet available via PINS). Tier 3: - No Tier 3 projects identified, as quantitative data not available on displacement of seabirds at this stage.	from or move to other areas within the ZOI, that are also subject to interaction with other developments within this region.

Cumulative effects assessment

Introduction

12.15.10 A description of the significance of cumulative effects upon offshore and intertidal ornithology arising from each identified impact is given below. The CEA has been based on information available in ESs and it is noted that the maximum assessment assumptions quoted within ESs are often refined during the determination period and in the post-consent phase. Where formal project refinements have been applied for and granted for any offshore wind farms the outcomes of their revised assessments were incorporated wherever possible. The assessment presented here is therefore considered to be conservative, with the level of impacts expected to be reduced compared to those presented here.

Comparison with Rampion 1

12.15.11 Throughout this CEA, Rampion 1, being immediately adjacent to Rampion 2, is an obvious reference point. In several instances, the impacts from Rampion 1 are considerably higher than those predicted for Rampion 2. To avoid repetition, a brief exploration of potential reasons for this are provided here. Furthermore, it is likely that the impacts from Rampion 1 are overstated based on the as-built design being smaller than the assessed and consented design.

12.15.12 Guidance on assessment methodology, particularly collision risk modelling, has evolved since the Rampion 1 ES. The collision risk model has evolved through revisions to the Excel-based models (Band, 2011; Band, 2012) and the subsequent development into the sCRM shiny app (Donovan, 2018). The guidance and evidence-base surrounding key parameters such as flight heights and avoidance rates have also evolved (Cook et al., 2012; Cook et al., 2014; Johnston et al., 2014; JNCC et al., 2014).

12.15.13 The Rampion 1 assessment was based on a "Rochdale Envelope" approach, which covered a larger area than that which has since been developed and included significantly more WTGs than that which has subsequently been developed into the operational Rampion 1 OWF. The consented Rampion 1 assessment boundary used covered an area of 138km^2 whereas the Rampion 1 array area as built is 72km^2. The Rampion 1 assessment considered a maximum number of 175 WTGs, but a total of 116 WTGs have been installed. Furthermore, the area not developed out for Rampion 1 extends into the proposed Rampion 2 array area, so should consent be granted to the latter then Rampion 1 would therefore not be able to build out to its consented capacity.

Operational phase CEA – Potential impact from cumulative displacement

Overview

12.15.14 There is potential for cumulative displacement as a result of operational and maintenance activities associated with Rampion 2 and other developments (**Table 12-44**). The only other developments identified for this CEA are those defined as being within Tier 1 (sub-tiers 1a to 1d) and Tier 2, as described in **Table 12-43**.

12.15.15 The presence of WTGs has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea where offshore wind farms are located. This in effect represents indirect habitat loss, which will potentially reduce the area available to those seabirds to forage, loaf and / or moult that currently occur within and around offshore wind farms and may be susceptible to displacement from such developments. Displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals. Cumulative displacement therefore has the potential to lead to effects on a wider scale, which in this case is defined as the wider non-breeding BDMPS populations of gannet and auk species (adults and immature) within the UK North Sea and English Channel from Furness (2015).

12.15.16 Seabird species vary in their response to the presence of operational infrastructure associated with offshore wind farms, such as WTGs and shipping activity related to maintenance activities. Garthe and Hüppop (2004) developed a scoring system for such disturbance factors, whilst Furness and Wade (2012) developed a similar system with disturbance ratings to define the sensitivity of seabirds to disturbance and displacement.

12.15.17 Following the screening process an assessment of cumulative displacement has been carried out for three seabird species of interest identified as potentially at risk and of interest for this CEA. The three species are gannet, guillemot and razorbill.

Gannet

12.15.18 As determined in **paragraph 12.12.42**, gannets show a low level of sensitivity to maintenance activities from ship and helicopter traffic as well as to operational WTGs (Garthe and Hüppop, 2004; Furness and Wade, 2012; Krijgsveld *et al*., 2011; Royal HaskoningDHV, 2013; APEM, 2014). For the purpose of this assessment the level of displacement considered across all bio seasons is between 60-80%.

12.15.19 A mortality rate of 1% was selected for this assessment based on expert judgement supported by additional evidence that suggests that gannet have a large mean max (315km) and maximum (709km) foraging range (Woodward *et al.*, 2019) and feed on a variety of different prey items that provide sufficient alternative foraging opportunities despite the potential loss of habitat within the Rampion 2 array area.

12.15.20 For other developments, the data on seasonal population estimates have been collated where available. The subsequent bio-season and annual abundance estimates for gannet associated with each of the projects identified in **Table 12-44** are presented in **Table 12-46**. As it is difficult to split these project's data collated between the array area and 2km buffer a standardised approach has been taken for estimating displacement at the cumulative level. This approach considers gannet displacement within the array area plus 2km buffers for all projects, despite the Applicant's preferred approach considering that gannet displacement should only be assessed from within the array area only.

Table 12-46 Gannet cumulative bio-season and total abundance estimates from all Tier 1 & 2 projects

Project	Migration-free Breeding	Post-breeding migration	Return Migration	Annual Total	Tier
Beatrice	-	0	0	0	1a
Blyth Demonstration Site	-	-	-	-	1a
Dudgeon	-	25	11	36	1a
East Anglia One	-	3,638	76	3,714	1a
European Offshore Wind Development Centre (EOWDC)	-	5	0	5	1a
Galloper	-	907	276	1,183	1a
Greater Gabbard	-	69	105	174	1a
Gunfleet Sands	-	12	9	21	1a
Hornsea Project One	-	694	250	944	1a
Humber Gateway	-	-	-	-	1a
Hywind 2 Demonstration	-	0	4	4	1a
Kentish Flats	-	-	-	-	1a
Kentish Flats Extension	-	13	0	13	1a
Kincardine	-	0	0	0	1a
Lincs	-	-	-	-	1a
London Array	-	-	-	-	1a
Lynn and Inner Dowsing	-	-	-	-	1a
Methil	-	0	0	0	1a
Race Bank	-	32	29	61	1a
Rampion	0	590	0	590	1a
Scroby Sands	-	-	-	-	1a
Sheringham Shoal	-	31	2	33	1a
Teesside	-	0	0	0	1a
Thanet	-	-	-	-	1a

Project	Migration-free Breeding	Post-breeding migration	Return Migration	Annual Total	Tier
Westermost Rough	-	-	-	-	1a
Hornsea Project Two	-	1,140	124	1,264	1b
Moray East	-	292	27	319	1b
Neart na Gaoithe	-	552	281	833	1b
Triton Knoll	-	15	24	39	1b
Seagreen Alpha	-	296	138	434	1b
Seagreen Bravo	-	368	194	562	1b
Dogger Bank A	-	916	176	1,092	1c
Dogger Bank B	-	1,132	218	1,350	1c
Dogger Bank C	-	379	226	605	1c
East Anglia Three	-	1,269	524	1,793	1c
Hornsea Three	-	1,494	1,099	2,593	1c
Inch Cape	-	703	212	915	1c
Moray West	-	439	144	583	1c
Norfolk Vanguard	-	2,453	437	2,890	1c
Sofia	-	508	238	746	1c
East Anglia ONE North	-	468	44	512	1d
East Anglia TWO	-	891	192	1,083	1d
Hornsea Four	-	1,199	659	1,858	1d
Norfolk Boreas	-	1,723	526	2,249	1d
All projects excluding Rampion 2	**0**	**22,253**	**6,245**	**28,498**	
Rampion 2	**162**	**224**	**90**	**476**	
All Projects including Rampion 2	**162**	**22,477**	**6,335**	**28,974**	

12.15.21 The magnitude of change is estimated by calculating the increase in mortality relative to the baseline mortality when compared against the largest UK North Sea and English Channel BDMPS population and then separately against the biogeographic population. The largest gannet BDMPS for the UK North Sea and English Channel is 456,298 (adults and immatures), whilst the wider bio-geographic population is 1,180,000 individuals (adults and immatures). Using the average mortality rate of 0.188, based on age specific demographic rates and age class proportions given in **Table 12-16**, the background mortality for these population scales are 85,784 and 221,840 individuals per annum, respectively.

12.15.22 The cumulative total of gannets at risk of displacement from all OWF projects is calculated to be 28,974 (**Table 12-46**). When applying the evidence led 60-80% displacement rate and a 1% mortality rate to estimate a cumulative total, between 174 and 232 individuals may be lost to the UK North Sea and English Channel BDMPS population and the wider biogeographic population. A full displacement matrix is given in **Table 12.47**.

12.15.23 The potential cumulative loss of 232 gannets will represent an increase of 0.27% relative to the baseline mortality rate at the BDMPS scale. At the biogeographic scale this additional mortality will increase the mortality relative to the baseline mortality by 0.10%.

12.15.24 At the both the BDMPS and the biogeographic scale, this level of potential change is considered to be of **negligible** magnitude on an annual cumulative basis, as it represents well under a 1% increase in mortality relative to the baseline mortality conditions. Therefore, irrespective of the sensitivity of the receptor, the effect is **Not Significant** at the BDMPS or biogeographic scales as defined in the assessment of significance matrix (**Table 12-22**) and is therefore not considered further in this assessment.

Table 12.47 Gannet annual cumulative displacement matrix

Displacement (%)	Mortality Rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	3	6	9	12	14	29	58	87	116	145	174	203	232	261	290
10	0	29	58	87	116	145	290	579	869	1,159	1,449	1,738	2,028	2,318	2,608	2,897
20	0	58	116	174	232	290	579	1,159	1,738	2,318	2,897	3,477	4,056	4,636	5,215	5,795
30	0	87	174	261	348	435	869	1,738	2,608	3,477	4,346	5,215	6,085	6,954	7,823	8,692
40	0	116	232	348	464	579	1,159	2,318	3,477	4,636	5,795	6,954	8,113	9,272	10,431	11,590
50	0	145	290	435	579	724	1,449	2,897	4,346	5,795	7,244	8,692	10,141	11,590	13,038	14,487
60	0	174	348	522	695	869	1,738	3,477	5,215	6,954	8,692	10,431	12,169	13,908	15,646	17,384
70	0	203	406	608	811	1,014	2,028	4,056	6,085	8,113	10,141	12,169	14,197	16,225	18,254	20,282
80	0	232	464	695	927	1,159	2,318	4,636	6,954	9,272	11,590	13,908	16,225	18,543	20,861	23,179
90	0	261	522	782	1,043	1,304	2,608	5,215	7,823	10,431	13,038	15,646	18,254	20,861	23,469	26,077
100	0	290	579	869	1,159	1,449	2,897	5,795	8,692	11,590	14,487	17,384	20,282	23,179	26,077	28,974

Guillemot

12.15.25 As determined in **paragraph 12.12.42**, guillemots show a medium level of sensitivity to maintenance activities from ship and helicopter traffic as well as to operational WTGs (Garthe and Hüppop, 2004; Furness and Wade, 2012; Langston, 2010; Bradbury *et al*., 2014).

12.15.26 As each individual offshore wind farm assessment considers the peak mean for each bio-season when these values are added together at a cumulative level, a highly unlikely total number of birds is estimated within these array areas and 2km buffers. The total abundance in **Table 12-48** represents almost 25% of the entire North Sea and English Channel BDMPS population, whilst the area covered by the combined array areas and 2km buffers of all offshore wind farms within this cumulative displacement assessment will be well under 5% of the area. Therefore, by adding together seasonal mean peaks in this manner the overall assessment for cumulative displacement is considered to be highly precautionary.

12.15.27 It is also highly likely that guillemot and other auk species are displaced and / or habituate at different levels from areas within and outside active array areas. However, as it is difficult to split the data collated between the array area and 2km buffer for the majority of the other developments within this CEA a standardised approach has been taken for estimating displacement. Accounting for this difficulty in separating data from array areas and the 2km buffers surrounding them for other developments considered in this CEA, a precautionary displacement rate of 50%, as described in **paragraph 12.13.26**, has been applied across both the array areas and 2km buffer for all projects.

12.15.28 Due to limitations in the data for other offshore wind farms, seasonal population estimates have been collated for two separate bio-seasons covering the entire annual cycle, one for breeding and one for non-breeding. For some projects, data are also not available for their array area plus 2km buffer, so in these instances these data have been scaled up or down based on data from the project area alone. The subsequent bio-season and annual abundance estimates for guillemot associated with each of the projects identified in **Table 12-44** are presented in **Table 12-48**.

Table 12-48 Guillemot cumulative bio-season and total abundance estimates from all Tier 1 & 2 projects' array areas and 2km buffers.

Project	Breeding Season	Non-breeding Season	Annual Total	Tier
Beatrice	-	2,755	2,755	1a
Blyth Demonstration Site	-	1,321	1,321	1a
Dudgeon	-	542	542	1a
East Anglia One	-	640	640	1a
EOWDC	-	225	225	1a
Galloper	-	593	593	1a

Project	Breeding Season	Non-breeding Season	Annual Total	Tier
Greater Gabbard	-	548	548	1a
Gunfleet Sands	-	363	363	1a
Hornsea Project One	-	8,097	8,097	1a
Humber Gateway	-	138	138	1a
Hywind 2 Demonstration	-	2,136	2,136	1a
Kentish Flats Extension	-	4	4	1a
Kentish Flats	-	3	3	1a
Lincs, Lynn & Inner Dowsing	-	814	814	1a
Kincardine	-	0	0	1a
London Array	-	377	377	1a
Methil	-	0	0	1a
Race Bank	-	708	708	1a
Rampion	10,887	15,536	26,423	1a
Scroby Sands	-	-	-	1a
Sheringham Shoal	-	715	715	1a
Teesside	-	901	901	1a
Thanet	-	124	124	1a
Westermost Rough	-	486	486	1a
Hornsea Project Two	-	13,164	13,164	1b
Moray East	-	547	547	1b
Neart na Gaoithe	-	3,761	3,761	1b
Triton Knoll	-	746	746	1b
Dogger Bank A	-	6,142	6,142	1c
Dogger Bank B	-	10,621	10,621	1c
Dogger Bank C	-	2,268	2,268	1c
East Anglia Three	-	2,859	2,859	1c
Hornsea Three	-	19,174	19,174	1c
Inch Cape	-	3,177	3,177	1c
Moray West	-	38,174	38,174	1c
Seagreen Alpha	-	4,688	4,688	1c
Norfolk Vanguard	-	4,776	4,776	1c

Project	Breeding Season	Non-breeding Season	Annual Total	Tier
Seagreen Bravo	-	4,112	4,112	1c
Sofia	-	3,701	3,701	1c
East Anglia ONE North	-	1,888	1,888	1d
East Anglia TWO	-	1,675	1,675	1d
Hornsea Four	-	69,555	69,555	1d
Norfolk Boreas	-	13,777	13,777	1d
All Projects Totals (excluding Rampion 2)	**10,887**	**241,831**	**252,718**	
Rampion 2	**185**	**13,219**	**13,404**	
All Projects Totals (including Rampion 2)	**11,072**	**255,050**	**266,122**	

12.15.29 The magnitude of change is estimated by calculating the increase in mortality relative to the baseline mortality when compared against the largest UK North Sea and English Channel BDMPS population and then separately against the biogeographic population. The largest guillemot BDMPS for the UK North Sea and English Channel is 1,617,306 (adults and immatures), whilst the wider bio-geographic population is 4,125,000 individuals (adults and immatures). Using the average mortality rate of 0.143, based on age specific demographic rates and age class proportions given in **Table 12-16**, the background mortality for these population scales are 231,275 and 589,875 individuals per annum, respectively.

12.15.30 The cumulative total of guillemots at risk of displacement from all offshore wind farm projects is calculated to be 266,122 (**Table 12-48**). When applying the evidence led 50% displacement rate and a 1% mortality rate to cumulative total, 1,331 individuals may be lost to the UK North Sea and English Channel BDMPS population and the wider biogeographic population. A complete displacement matrix is presented in **Table 12-49**.

12.15.31 The potential cumulative loss of 1,331 guillemots will represent an increase of 0.58% relative to the baseline mortality rate at the BDMPS scale. At the biogeographic scale this will represent an increase of 0.23% in mortality relative to baseline mortality.

12.15.32 At the both the BDMPS and the biogeographic scale, this level of potential change is considered to be of **negligible** magnitude on an annual cumulative basis, as it represents under a 1% increase in mortality relative to the baseline mortality conditions. Therefore, irrespective of the sensitivity of the receptor, the significance of the effect is **Not Significant** at the BDMPS or biogeographic scales as defined in the assessment of significance matrix (**Table 12-22**) and is therefore not considered further in this assessment.

Table 12-49 Guillemot annual cumulative displacement matrix.

Displacement (%)	Mortality Rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	27	53	80	106	133	266	532	798	1,064	1,331	1,597	1,863	2,129	2,395	2,661
10	0	266	532	798	1,064	1,331	2,661	5,322	7,984	10,645	13,306	15,967	18,629	21,290	23,951	26,612
20	0	532	1,064	1,597	2,129	2,661	5,322	10,645	15,967	21,290	26,612	31,935	37,257	42,580	47,902	53,224
30	0	798	1,597	2,395	3,193	3,992	7,984	15,967	23,951	31,935	39,918	47,902	55,886	63,869	71,853	79,837
40	0	1,064	2,129	3,193	4,258	5,322	10,645	21,290	31,935	42,580	53,224	63,869	74,514	85,159	95,804	106,449
50	0	1,331	2,661	3,992	5,322	6,653	13,306	26,612	39,918	53,224	66,531	79,837	93,143	106,449	119,755	133,061
60	0	1,597	3,193	4,790	6,387	7,984	15,967	31,935	47,902	63,869	79,837	95,804	111,771	127,739	143,706	159,673
70	0	1,863	3,726	5,589	7,451	9,314	18,629	37,257	55,886	74,514	93,143	111,771	130,400	149,028	167,657	186,285
80	0	2,129	4,258	6,387	8,516	10,645	21,290	42,580	63,869	85,159	106,449	127,739	149,028	170,318	191,608	212,898
90	0	2,395	4,790	7,185	9,580	11,975	23,951	47,902	71,853	95,804	119,755	143,706	167,657	191,608	215,559	239,510
100	0	2,661	5,322	7,984	10,645	13,306	26,612	53,224	79,837	106,449	133,061	159,673	186,285	212,898	239,510	266,122

Razorbill

12.15.33 As determined in **paragraph 12.12.42**, razorbills show a medium level of sensitivity to maintenance activities from ship and helicopter traffic as well as to operational WTGs (Garthe and Hüppop, 2004; Furness and Wade, 2012; Langston, 2010; Bradbury *et al*., 2014).

12.15.34 As each individual offshore wind farm assessment considers the peak mean for each bio-season when these values are added together at a cumulative level, a highly unlikely total number of birds is estimated within these array areas and 2km buffers. The total abundance in **Table 12-50** represents almost 20% of the entire North Sea and English Channel BDMPS population, whilst the area covered by the combined array areas and 2km buffers of all offshore wind farms within this cumulative displacement assessment will be well under 5% of the area. Therefore, by adding together seasonal mean peaks in this manner the overall assessment for cumulative displacement is considered to be highly precautionary.

12.15.35 It is also highly likely that razorbills and other auk species are displaced and / or habituate at different levels from areas within and outside active array areas. However, as it is difficult to split the data collated between the array area and 2km buffer for the majority of the other developments within this CEA a standardised approach has been taken for estimating displacement. Accounting for this difficulty in separating data from array areas and the 2km buffers surrounding them for other developments considered in this CEA, a precautionary displacement rate of 50%, as described in **paragraph 12.13.26**, has been applied across both the array areas and 2km buffer for all projects.

12.15.36 Seasonal population estimates have been collated for four separate bio-seasons covering the entire annual cycle. For some projects, data are also not available for their array area plus 2km buffer, so in these instances these data have been scaled up or down based on data from the project area alone. The subsequent bio-season and annual abundance estimates for razorbill associated with each of the projects identified in **Table 12-44** are presented in **Table 12-50**.

Table 12-50 Razorbill cumulative bio-season and total abundance estimates from all Tier 1 & 2 projects' array areas and 2km buffers.

Project	Migration-free breeding	Post-breeding migration	Migration-free winter	Return migration	Annual total	Tier
Beatrice	-	833	555	833	2,221	1a
Blyth Demonstration Site	-	91	61	91	243	1a
Dudgeon	-	346	745	346	1,437	1a
East Anglia One	-	26	155	336	517	1a
EOWDC	-	64	7	26	97	1a

Project	Migration-free breeding	Post-breeding migration	Migration-free winter	Return migration	Annual total	Tier
Galloper	-	43	106	394	543	1a
Greater Gabbard	-	0	387	84	471	1a
Gunfleet Sands	-	0	30	0	30	1a
Hornsea Project One	-	4,812	1,518	1,803	8,133	1a
Humber Gateway	-	20	13	20	53	1a
Hywind 2 Demonstration	-	719	10	-	729	1a
Kentish Flats Extension	-	-	-	-	-	1a
Kentish Flats I	-	-	-	-	-	1a
Kincardine	-	0	0	0	0	1a
Lincs, Lynn & Inner Dowsing	-	34	22	34	90	1a
London Array	-	20	14	20	54	1a
Methil	-	0	0	0	0	1a
Race Bank	-	42	28	42	112	1a
Rampion	630	66	1,244	3,327	5,267	1a
Scroby Sands	-	-	-	-	-	1a
Sheringham Shoal	-	1,343	211	30	1,584	1a
Teesside	-	61	2	20	83	1a
Thanet	-	0	14	21	35	1a
Westermost Rough	-	121	152	91	364	1a
Hornsea Project Two	-	4,221	720	1,668	6,609	1b
Moray East	-	1,103	30	168	1,301	1b
Neart na Gaoithe	-	5,492	508	-	6,000	1b
Triton Knoll	-	254	855	117	1,226	1b
Dogger Bank A	-	1,576	1,728	4,149	7,453	1c

Project	Migration-free breeding	Post-breeding migration	Migration-free winter	Return migration	Annual total	Tier
Dogger Bank B	-	2,097	2,143	5,119	9,359	1c
Dogger Bank C	-	310	959	1,919	3,188	1c
East Anglia Three	-	1,122	1,499	1,524	4,145	1c
Hornsea Three	-	2,020	5,024	1,754	8,798	1c
Inch Cape	-	2,870	651	-	3,521	1c
Moray West	-	3,544	184	3,585	7,313	1c
Norfolk Vanguard	-	866	839	924	2,629	1c
Seagreen Alpha	-	0	1,103	0	1,103	1c
Seagreen Bravo	-	0	1,272	0	1,272	1c
Sofia	-	592	1,426	2,953	4,971	1c
East Anglia ONE North	-	85	54	207	346	1d
East Anglia TWO	-	44	136	230	410	1d
Hornsea Four	-	5,960	685	1,361	8,006	1d
Norfolk Boreas	-	263	1,065	345	1,673	1d
Total Excluding Rampion 2	**630**	**41,060**	**26,155**	**33,541**	**101,386**	
Rampion 2	**44**	**19**	**22**	**2,164**	**2,249**	
Total Including Rampion 2	**674**	**41,079**	**26,177**	**35,705**	**103,635**	

12.15.37 The magnitude of change is estimated by calculating the increase in mortality relative to the baseline mortality when compared against the largest UK North Sea and English Channel BDMPS population and then separately against the biogeographic population. The largest razorbill BDMPS for the UK North Sea and English Channel is 591,874 (adults and immatures), whilst the wider bio-geographic population is 1,707,000 individuals (adults and immatures). Using the average mortality rate of 0.193, based on age specific demographic rates and age class proportions given in **Table 12-16**, the background mortality for these population scales are 114,232 and 329,451 individuals per annum, respectively.

12.15.38 The cumulative total of razorbills at risk of displacement from all OWF projects is calculated to be 103,635 (**Table 12-50**). When applying the evidence led 50% displacement rate and a 1% mortality rate to cumulative total, 518 individuals may be lost to the UK North Sea and English Channel BDMPS population and the wider biogeographic population. A complete displacement matrix is presented in **Table 12-51**.

12.15.39 The potential cumulative loss of 518 razorbills will represent an increase in mortality of 0.45% relative to the baseline mortality rate at the BDMPS scale. At the biogeographic scale this will represent an increase in mortality of 0.16% relative to the baseline mortality.

12.15.40 At the both the BDMPS and the biogeographic scale, this level of potential change is considered to be of **negligible** magnitude on an annual cumulative basis, as it represents under a 1% increase to the baseline mortality conditions. Therefore, irrespective of the sensitivity of the receptor, the significance of the effect is **Not Significant** at the biogeographic scale as defined in the assessment of significance matrix (**Table 12-22**) and is therefore not considered further in this assessment.

wood.

Table 12-51 Razorbill annual cumulative displacement matrix

Displacement (%)	Mortality Rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	10	21	31	41	52	104	207	311	415	518	622	725	829	933	1,036
10	0	104	207	311	415	518	1,036	2,073	3,109	4,145	5,182	6,218	7,254	8,291	9,327	10,364
20	0	207	415	622	829	1,036	2,073	4,145	6,218	8,291	10,364	12,436	14,509	16,582	18,654	20,727
30	0	311	622	933	1,244	1,555	3,109	6,218	9,327	12,436	15,545	18,654	21,763	24,872	27,981	31,091
40	0	415	829	1,244	1,658	2,073	4,145	8,291	12,436	16,582	20,727	24,872	29,018	33,163	37,309	41,454
50	0	518	1,036	1,555	2,073	2,591	5,182	10,364	15,545	20,727	25,909	31,091	36,272	41,454	46,636	51,818
60	0	622	1,244	1,865	2,487	3,109	6,218	12,436	18,654	24,872	31,091	37,309	43,527	49,745	55,963	62,181
70	0	725	1,451	2,176	2,902	3,627	7,254	14,509	21,763	29,018	36,272	43,527	50,781	58,036	65,290	72,545
80	0	829	1,658	2,487	3,316	4,145	8,291	16,582	24,872	33,163	41,454	49,745	58,036	66,326	74,617	82,908
90	0	933	1,865	2,798	3,731	4,664	9,327	18,654	27,981	37,309	46,636	55,963	65,290	74,617	83,944	93,272
100	0	1,036	2,073	3,109	4,145	5,182	10,364	20,727	31,091	41,454	51,818	62,181	72,545	82,908	93,272	103,635

Operational phase CEA: Potential impact from collision risk

Overview

12.15.41 There is potential for cumulative collision risk to birds as a result of operational activities associated with Rampion 2 and other developments (**Table 12-44**). The risk to birds is through potential collision with WTGs and associated infrastructure from offshore wind farms, resulting in injury or fatality. This may occur when birds fly through the offshore wind farms whilst foraging for food, commuting between breeding sites and foraging areas, or during migration. The only projects identified for this CEA are those defined as being within Tier 1 (sub-tiers 1a to 1d) and Tier 2, as described in **Table 12-43**. The approach taken to assessing cumulative collision risk is a quantitative one, drawing upon the published information produced by the respective project developers. Such published, quantitative information on predicted collisions is not available at an early stage in the development of a project e.g. a project in Tier 3. The result is that the cumulative collision risk assessment addresses projects in Tiers 1 and 2 but not Tier 3 or below.

12.15.42 CRM has been carried out for Rampion 2 (**paragraph 12.13.55**) for nine seabird species of interest identified as potentially at risk and of interest for impact assessment. Following a screening process for potential cumulative effects, those species predicted to have very low risk from Rampion 2 alone (deemed to be of no material contribution cumulatively) were screened out of further assessment. Seabird species considered to be of more than a material contribution to potential cumulative effects from collision risk were screened in, which were; gannet, kittiwake, great black-backed gull, herring gull and lesser black-backed gull. The cumulative totals of collision risk from other developments have been amended and collated in order to be most representative of Band Option 1 (or 2 where that was presented) and standardised in accordance to the avoidance rates most appropriate to each species, as described in **paragraph 12.13.55** and in more detail within **Appendix 12.3, Volume 4**.

Gannet

12.15.43 During the non-breeding season, the BDMPS is defined as the UK North Sea and English Channel. During the breeding season, the only other project within the defined ZOI is Rampion 1. **Table 12-52** shows the collision totals from all Tier 1 developments within the season-specific ZOI.

Table 12-52 Gannet cumulative bio-season and total collision mortality estimates from all Tier 1 and Tier 2 projects.

Project	Migration-free breeding	Post-breeding migration	Return Migration	Total
Beatrice	-	48.8	9.5	58.3
Blyth Demonstration Site	-	2.1	2.8	4.9
Dudgeon	-	38.9	19.1	58

Project	Migration-free breeding	Post-breeding migration	Return Migration	Total
East Anglia One	-	131	6.3	137.3
EOWDC	-	5.1	0.1	5.2
Galloper	-	30.9	12.6	43.5
Greater Gabbard	-	8.8	4.8	13.6
Gunfleet Sands	-	-	-	-
Hornsea Project One	-	32	22.5	54.5
Humber Gateway	-	1.1	1.5	2.6
Hywind 2 Demonstration	-	0.8	0.8	1.6
Kentish Flats	-	0.8	1.1	1.9
Kentish Flats Extension	-	-	-	-
Kincardine	-	0	0	0
Lincs, Lynn & Inner Dowsing	-	1.4	1.9	3.3
London Array	-	1.4	1.8	3.2
Methil	-	0	0	0
Race Bank	-	11.7	4.1	15.8
Rampion	36.2	63.5	2.1	101.8
Scroby Sands	-	-	-	-
Sheringham Shoal	-	3.5	0	3.5
Teesside	-	1.7	0	1.7
Thanet	-	0	0	0
Westermost Rough	-	0.1	0.2	0.3
Hornsea Project Two	-	14	6	20
Moray East	-	35.4	8.9	44.3
Neart na Gaoithe	-	47	23	70
Seagreen Alpha & Bravo	-	49.3	65.8	115.1
Triton Knoll	-	64.1	30.1	94.2
Dogger Bank A & B	-	83.5	54.4	137.9
Dogger Bank C & Sofia	-	10.1	10.8	20.9
East Anglia Three	-	28.4	8.2	36.6
Hornsea Three	-	12	11	23
Inch Cape	-	29.2	5.2	34.4

Project	Migration-free breeding	Post-breeding migration	Return Migration	Total
Moray West	-	2	1	3
Norfolk Vanguard	-	18.6	5.3	23.9
East Anglia ONE North	-	11.3	3	14.3
East Anglia TWO	-	24.2	4.7	28.9
Hornsea Four	-	9.9	8.1	18.0
Norfolk Boreas	-	12.7	3.9	16.6
Total excluding Rampion 2	**36.2**	**835.3**	**340.6**	**1,212.1**
Rampion 2	9.73	4.02	1.39	15.13
Total including Rampion 2	**45.9**	**839.3**	**342.0**	**1,227.2**

Magnitude of change

12.15.44 During the return migration bio-season, a total of 342 gannets may be subject to mortality. The BDMPS for the return migration bio-season is defined as 248,385 (Furness, 2015) and using the average baseline mortality rate of 0.187 (**Table 12-16**), the natural predicted mortality in the return migration bio-season is 46,696. The addition of between 342 mortalities will represent an increase in mortality relative to the baseline mortality rate of 0.73%.

12.15.45 This level of potential change is considered to be of **low** magnitude during the return migration bio-season, as it represents only a slight increase to baseline mortality levels due to the small number of estimated collisions.

12.15.46 During the migration-free breeding bio-season, 46 gannets may be subject to mortality. During the migration-free breeding bio-season, the total regional baseline population of breeding adults and immature birds is predicted to be 128,528 gannets (**Table 12-15**). When the average baseline mortality rate of 0.188 (**Table 12-16**) is applied, the natural predicted mortality in the migration-free breeding bio-season is 24,163. The addition of 46 mortalities will represent a 0.19% increase in mortality relative to the baseline mortality rate.

12.15.47 This level of potential change is considered to be of **negligible** magnitude during the return migration bio-season, as it represents only a slight increase to baseline mortality levels due to the small number of estimated collisions.

12.15.48 During the post-breeding migration bio-season, 839 gannets may be subject to mortality. The BDMPS for the post-breeding migration bio-season is defined as 456,298 (Furness, 2015) and using the average baseline mortality rate of 0.188 (**Table 12-16**), the natural predicted mortality in the post-breeding migration bio-season is 85,784. The addition of 839 mortalities will represent a 0.98% increase in mortality relative to the baseline mortality rate.

12.15.49 This level of potential change is considered to be of **low** magnitude during the return migration bio-season, as it represents only a slight increase to baseline mortality levels due to the small number of estimated collisions.

12.15.50 The annual total of gannets subject to mortality due to collision is estimated 1,227. Using the largest BDMPS population of 456,298, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.188 (**Table 12-16**), the natural predicted mortality is 85,784. The addition of 1,227 mortalities will represent an increase in mortality of 1.43% relative to the baseline mortality rate. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 1,180,000 across all seasons is 221,840. The addition of between 1,227 mortalities will represent an increase in mortality of 0.55% relative to the biogeographic baseline mortality rate.

12.15.51 This level of potential change is considered to be **medium** on an annual basis at both the BDMPS and bio-geographic scales, as it exceeds a 1% increase in mortality relative to baseline mortality level, which is the commonly used threshold for more detailed consideration.

12.15.52 Therefore, the magnitude of change resulting from collision risk in each bio-season alone is **minor** or **negligible**, but on an annual basis the magnitude of change is considered to be **moderate**.

Sensitivity of receptor

12.15.53 Whilst the majority of the gannets within the BDMPS are likely to be from designated sites (including UK SPAs), there is no strong connection to any one UK SPA. Gannets are a far-ranging species, and therefore it is likely that any impacts will be distributed across a number of breeding colonies within and outside of UK SPAs. However, gannets are amber listed in the UK and restricted to a small number of breeding colonies. To reflect that, this species is afforded a conservation value level of high. With respect to vulnerability to collision it is considered to be medium (**Table 12-31**). Given a medium conservation value and medium vulnerability, this leads to an overall sensitivity of this receptor to collision risk of **high**.

Significance of the residual effect

12.15.54 The magnitude of cumulative collision risk from operational offshore wind farms within the UK North Sea and Channel is defined as being a **moderate** adverse change on an annual basis and the sensitivity of the species is considered to be **high**. The overall UK population of gannets has been increasing since at least 1986 (JNCC, 2020). Therefore, the predicted level of impact is not considered to be of any significant consequence to the overall BDMPS population. Based on the matrix approach, the overall effect from cumulative collision risk to gannet from Rampion 2 and all other UK offshore wind farms in the UK North Sea and Channel is assessed as **moderate**, which is **Potentially Significant**.

12.15.55 However, previous offshore wind farms in UK waters including East Anglia One, Hornsea Project One, Hornsea Project Two, Hornsea Project Three, Hornsea Four and Norfolk Vanguard have carried out CEA for gannets, including Population

Viability Analysis (PVA), for impacts of a similar magnitude and concluded that any effects are likely to be, at worst, minor adverse. It is unlikely that an assessment for Rampion 2 will be more significant. The contribution of Rampion 2 is also minimal, contributing an estimated 15 collision mortalities annually to a cumulative total of 1,202.

12.15.56 The majority of UK gannet colonies have experienced positive growth rates since records began, with the total UK population increasing by 41% in the period 2000 to 2018 (JNCC, 2020). The colony at Bempton Cliffs, which is likely to have the strongest connectivity with Rampion 2, has experienced an average annual growth rate of 9.9% between 2003 and 2017 (JNCC, 2020), a period in which numerous offshore windfarms became operational. Furthermore, there is evidence of density-dependence in gannets (Horwsill & Robinson, 2015) which suggests colony growth rates are limited by population size, possibly due to competition for nesting sites or for food. This suggests that even with a slight increase in mortality relative to counterfactual baseline mortality, the UK population is likely to continue to experience strong growth. Therefore, on this basis, it is assessed that a more reasonable conclusion of the significance of the effect on a cumulative scale is **minor** adverse, which is **Not Significant** in EIA terms.

12.15.57 Nonetheless, in order to provide a full and robust underpinning of this conclusion, a more detailed assessment including PVA will be presented in the ES that follows this PEIR. Baseline data and further information on other developments will continue to be collected prior to the finalisation of the ES and iteratively fed into the assessment.

Kittiwake

12.15.58 During the non-breeding season, the BDMPS is defined as the UK Western Waters and Channel (Furness, 2015). During the breeding season, the only other project within the defined ZOI is Rampion 1. **Table 12-53** shows the collision totals from all Tier 1 and Tier 2 developments within the season-specific ZOI.

Table 12-53 Kittiwake cumulative bio-season and total collision mortality estimates from all Tier 1 and Tier 2 projects.

Project	Migration-free Breeding	Post-breeding migration	Return Migration	Annual Total
Barrow	-	-	-	-
Burbo Bank	-	-	-	-
Burbo Bank Extension	-	1.8	5.0	6.8
Gwynt y Mor	-	-	-	-
North Hoyle	-	-	-	-
Ormonde	-	-	-	-
Rampion	67.1	14.7	39.7	121.5
Rhy Flats	-	-	-	-

Project	Migration-free Breeding	Post-breeding migration	Return Migration	Annual Total
Robin Rigg	-	-	-	-
Walney Phase 1	-	-	-	-
Walney Phase 2	-	-	-	-
Walney Extension	-	96.6	48.5	145.1
West of Duddon Sands	-	-	-	-
Total Excluding Rampion 2	**67.1**	**113.1**	**93.1**	**273.4**
Rampion 2	1.7	1.6	7.3	10.6
Total Including Rampion 2	**68.9**	**114.8**	**100.4**	**284.0**

Magnitude of change

12.15.59 The annual total of kittiwakes subject to mortality due to collisions is estimated as 284.0. Using the largest BDMPS population of 911,586, as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.157 (**Table 12-16**), the natural predicted mortality is 143,119. The addition of 284.0 mortalities will represent an increase in mortality of 0.20% relative to the baseline mortality rate. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 5,100,000 across all seasons is 800,700. The addition of 284.0 mortalities will represent an increase in mortality of 0.004% relative to the biogeographic baseline mortality rate.

12.15.60 This level of potential change is considered to be **negligible** on an annual basis at both the BDMPS and bio-geographic scales, as it represents only a slight increase to baseline mortality levels due to the small number of estimated collisions.

Significance of residual effect

12.15.61 Therefore, the magnitude of change resulting from collision risk in each bio-season alone and on an annual basis is considered to be **negligible**. Irrespective of the sensitivity of the receptor, the significance of the residual effect is **Not Significant** as defined in the assessment of significance matrix (**Table 12-22**) and is not considered further in this assessment.

Great black-backed gull

12.15.62 The non-breeding BDMPS for great black-backed gull is defined as the UK South West and Channel (Furness, 2015). In the breeding season, of the developments listed in **Table 12-44**, only Rampion 1 is within the ZOI. For consistency with the data available from other developments, in this assessment two bio-seasons have been considered: breeding (April to August) and non-breeding (September to March) based on Furness (2015).

Table 12-54 Great black-backed gull cumulative bio-season and total collision mortality estimates from all Tier 1 and Tier 2 projects.

Project	Breeding Season	Non-breeding Season	Annual Total
Barrow	-	-	-
Burbo Bank	-	-	-
Burbo Bank Extension	-	-	-
Gwynt y Mor	-	-	-
North Hoyle	-	-	-
Ormonde	-	-	-
Rampion 1	3.2	22.8	26.0
Rhyl Flats	-	-	-
Robin Rigg	-	-	-
Walney Phase 1	-	-	-
Walney Phase 2	-	-	-
Walney Extension	-	27.4	27.4
West of Duddon Sands	-	-	-
Total excluding Rampion 2	3.2	50.1	53.4
Rampion 2	0.9	3.1	4.0
Total including Rampion 2	4.2	53.2	57.4

Magnitude of change

12.15.63 During the breeding bio-season, a total of 4.2 great black-backed gulls are estimated to be subject to mortality. The regional population during the breeding bio-season is defined as 9,940 (Furness, 2015) and using the average baseline mortality rate of 0.093 (**Table 12-16**), the natural predicted mortality in the breeding bio-season is 924. The addition of 4.2 mortalities will represent a 0.45% increase in mortality relative to the baseline mortality rate.

12.15.64 This level of potential change is considered to be of **negligible** magnitude during the return migration bio-season, as it represents only a slight increase to baseline mortality levels due to the small number of collisions.

12.15.65 During the non-breeding bio-season, a total of 53.2 great black-backed gulls are estimated to be subject to mortality. The BDMPS for the non-breeding bio-season is defined as 17,742 (**Table 12-15**) and using the average baseline mortality rate of 0.093 (**Table 12-16**), the natural predicted mortality in the return migration bio-season is 1,650. The addition of 53.2 mortalities will represent a 3.22% increase in mortality relative to the baseline mortality rate.

12.15.66 This level of potential change is considered to be of **medium** magnitude during the return migration bio-season, as it represents a significant increase to baseline mortality levels.

12.15.67 The annual total of great black-backed gulls subject to mortality due to collision is estimated as 57.4. Using the largest BDMPS population of 17,742 as a proxy for the annual BDMPS population, with an average baseline mortality rate of 0.093 (**Table 12-16**), the natural predicted mortality is 1,650. The addition of 57.4 mortalities will be a 3.48% increase in mortality relative to the baseline mortality. When considering the annual potential level of change at the biogeographic scale, the natural predicted mortality for the biogeographic population of 23,500 across all seasons is 2,186. On a biogeographic scale, the addition of 57.4 mortalities will be a 2.63% increase in mortality relative to the baseline mortality.

12.15.68 This level of potential change is considered to be of **medium** magnitude during the return migration bio-season, as it represents a significant increase to baseline mortality levels.

Sensitivity of the receptor

12.15.69 As this species is not connected with a significant number of designated sites within the UK South-west and Channel BDMPS or wider bio-geographic population scales this species is afforded a conservation value level of low to reflect that. With respect to vulnerability to collision, it is considered to be high (**Table 12-31**). Whilst it may be of high vulnerability it is of low conservation value leading to an overall sensitivity of this receptor to collision risk of **medium**.

Significance of the effect

The magnitude of cumulative collision risk from operational offshore wind farms within the UK South-west and Channel is defined as being a **medium** adverse change on an annual basis and the sensitivity of the species considered to be **medium**. However, while the national population trend is declining, the population within the Isles of Scilly SPA has been increasing since 1999 (Heaney & St. Pierre, 2017). Therefore, the predicted level of impact is not considered to be of any significant consequence to the overall BDMPS population. The potential effect from cumulative collision risk to great black-backed gull from Rampion 2 and all other UK OWFs in the UK South-west and Channel is therefore assessed as **moderate**, which is **Potentially Significant** in EIA terms.

12.15.70 There is likely to be a significant amount of precaution in the numbers presented for other wind farms. For Rampion 1 in particular, the collision risk estimate is likely to be much higher than the actual collision risk based on the as-built design. As discussed in **paragraph 12.15.12**, guidance on how to conduct CRM has evolved and so assessments carried out for other OWFs may have also used outdated methodologies and assumptions.

12.15.71 However, the contribution of Rampion 2 is also minimal, contributing an estimated four collision mortalities annually to a cumulative total of 57.4. Baseline data and further information on other developments will continue to be collected prior to the finalisation of the ES and iteratively fed into the assessment. An updated cumulative effects assessment will be reported in the ES.

Lesser black-backed gull

12.15.72 The non-breeding BDMPS for lesser black-backed gull is defined as the UK North Sea and Channel (Furness, 2015). **Table 12-55** summarises the bio-season and annual total collision risk from other developments within that region (**Table 12-44**). These are mostly composed of data from the final agreed cumulative tables submitted at Deadline VIII for Norfolk Boreas (Vattenfall, 2020). The differences to collision risk estimates are due to revisions to Hornsea Three, the removal of Thanet Extension due to consent refusal and the removal of Beatrice Demonstrator as the project will be decommissioned by the time Rampion 2 is predicted to be operational.

Table 12-55 Summary of cumulative bio-season and annual collision mortality estimates for lesser black-backed gull with / without Rampion 2.

Projects	Bio-season estimated collisions		
	Breeding	Non-breeding	Annual
Total excluding Rampion 2	170	371	541
Rampion 2	0.64	1.20	1.84
Total including Rampion 2	**171**	**372**	**543**

12.15.73 The estimated collision risk to lesser black-backed gull from Rampion 2 is an annual total of 1.84 birds (**Table 12-37**), which will increase the cumulative annual total by 0.34%.

12.15.74 In this instance, it is clear that the collision risk from Rampion 2 to the overall cumulative total is of no material contribution. Therefore, it can be concluded that whilst the most precautionary estimates of cumulative collision risk may pose an effect of significance cumulatively, the contribution of Rampion 2 is so small that it will not materially affect the overall cumulative effect. Therefore, the significance of this effect can therefore be considered **Not Significant** on the grounds that its contribution is *de minimis.*

12.16 Transboundary effects

12.16.1 Transboundary effects arise when impacts from a development within one European Economic Area (EEA) states affects the environment of another EEA state(s). A screening of transboundary effects has been carried out and is presented in Appendix B of the Scoping Report (RED, 2020a).

12.16.2 Transboundary impacts upon ornithological receptors (seaward of the MHWS) are possible due to the wide foraging and migratory ranges of typical bird species in the English Channel. 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 Rampion 2 array area, offshore export cable corridor and cable landfall area, based on the results of the desk study and aerial digital survey data presented in **Appendix 12.1, Volume 4** include gannet, kittiwake, guillemot, razorbill and large gulls.

12.16.3 The key direct potential impacts and effects for ornithological receptors are predicted to arise during the operation and maintenance phase as a result of potential collisions (with rotating WTG blades which may result in direct mortality of individuals), disturbance and barrier effects (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).

12.16.4 Protected sites in countries beyond the UK were not considered to have connectivity with Rampion 2 significantly enough to be included in this assessment, though the impacts considered throughout this chapter do consider potential effects on the BDMPS scale and biogeographic scales relevant for each species, that includes birds from outside of the UK.

12.16.5 With regards to the potential for transboundary cumulative impacts, there is some limited potential for collisions and displacement at offshore wind farms outside UK territorial waters. However, the operational offshore wind farms in Belgium, the Netherlands and Germany are comparatively small (collectively, these projects are of a similar size to no more than one to two of the more recent UK OWFs, such as East Anglia ONE). There are no operational offshore wind farms within French territorial waters in the English Channel.

12.16.6 Since the spatial scope for a transboundary assessment would be much larger than that considered for Rampion 2 alone or cumulatively with other UK projects then any assessment of potential impacts and effects would be against larger seabird population sizes accounting for a larger spatial scale. Therefore, it is apparent that the scale of offshore wind farm developments within such a wider context would be relatively much smaller with respect to any potential impacts considered at the UK BSMPS scale. Therefore, the inclusion of non-UK offshore wind farms is considered very unlikely to alter the conclusions of the existing cumulative assessment, and highly likely to reduce estimated impacts at population levels if calculated at larger spatial scales.

12.17 Inter-related effects

12.17.1 The inter-related effects assessment considers likely significant effects from multiple impacts and activities from the construction, operation and decommissioning of Rampion 2 on the same receptor, or group of receptors. These can include:

- Proposed Development lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the project (construction, operational and maintenance, and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three key project stages (e.g. subsea noise effects from piling, operational WTGs, vessels and decommissioning); and

- Receptor led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on offshore and intertidal ornithology, such as collision risk, disturbance and displacement, barrier effect and indirect effects may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects might be short term, temporary or transient effects, or incorporate longer-term effects.

12.17.2 Consideration of the inter-relationships between EIA topics that may lead to environmental effects, is required under Schedule 4 of The Infrastructure EIA Regulations. Guidance on inter-related effects is provided within Section 4.13 of PINS Advice Note Nine: Rochdale Envelope (PINS, 2018), which states that "inter-relationships consider impacts of the proposals on the same receptor. These occur where a number of separate impacts, (e.g. noise and air quality), affect a single receptor such as fauna". The approach to inter-related effects has taken into account this Advice Note, along with all other guidance that exists at present.

12.17.3 The approach to the assessment of inter-related effects considers receptor-led effects; that is effects that interact spatially and/or temporally resulting in interrelated effects upon a single receptor.

12.17.4 The assessment of inter-related effects has also been undertaken with specific reference to the potential for such effects to arise in relation to receptor groups. The term 'receptor group' is used to highlight the fact that the proposed approach to inter-relationships assessment has not, in the main, assessed every individual receptor assessed at the EIA stage, but rather, potentially sensitive groups of receptors.

12.17.5 The broad approach to inter-related effects assessment has followed the following key steps:

- review of effects for individual EIA topic areas;
- review of the assessment carried out for each EIA topic area, to identify "receptor groups" requiring assessment;
- potential inter-related effects on these receptor groups identified via review of the assessment carried out across a range of topics;
- development of lists for all potential receptor-led effects; and
- qualitative assessment on how individual effects may combine to create interrelated effects.

12.17.6 It is important to note that the inter-relationships assessment has only considered effects produced by Rampion 2, and not those from other developments (these will be considered within the CEA in **Section 12.15**). Note that for receptors/impacts scoped out of the EIA process based on the findings of the Impacts Register and the Scoping Report (RED, 2020a), no inter-related assessment has been undertaken.

12.17.7 The construction, operation and decommissioning phases of the proposed Rampion 2 may cause a range of effects on offshore ornithological interests. The magnitude of these effects has been assessed individually using expert judgement, drawing from a wide science base that includes project-specific surveys and previously acquired knowledge of the bird ecology of the English Channel.

12.17.8 These effects have the potential to form an inter-relationship, directly impact the terrestrial and seabird receptors and have the potential to manifest as sources for impacts upon receptors other than those considered within the context of offshore ornithology.

12.17.9 In terms of how impacts to offshore and intertidal ornithological interests may form inter-relationships with other receptor groups, assessments of significance are provided in the chapters listed in the second column of **Table 12-56** below. In addition, the table shows where other chapters have been used to inform the offshore and intertidal ornithology inter-relationships assessment.

Table 12-56 Chapter topic inter-relationships

Topic and description	Related Chapter	Where addressed in this Chapter
Indirect impacts through effects on habitats and prey during construction (offshore export cable corridor)	Chapter 8 and Chapter 9	**paragraph 12.12.39**
Indirect impacts through effects on habitats and prey during construction (array area)		**paragraph 12.12.41**
Indirect impacts through effects on habitats and prey during operation (array area)		**paragraph 12.13.179**
Indirect impacts through effects on habitats and prey during decommissioning (offshore export cable corridor)		**paragraph 12.14.8**

12.17.10 However, as none of the offshore impacts on birds were assessed individually to have any greater than a minor adverse effect, it is considered highly unlikely that they will inter-relate to form an overall significant effect on offshore and intertidal ornithology receptors.

12.18 Summary of residual effects

12.18.1 **Table 12-57** presents a summary of the preliminary assessment of significant effects, any relevant embedded environmental measures and residual effects on offshore and intertidal ornithology receptors.

Table 12-57 Summary of preliminary assessment of residual effects.

Activity and impact	Receptor and sensitivity or value	Magnitude of change	Embedded environmental measures	Preliminary assessment of residual effect (significance)
		Construction		
Disturbance and displacement: intertidal cable corridor	Sanderling	Negligible	C – 4 Horizontal Directional Drill (HDD) technique will be used at the landfall location. C – 43 The subsea export cable ducts will be drilled underneath the beach using horizontal directional drilling (HDD) techniques.	**Not significant**
	Mediterranean gull	Negligible		**Not significant**
Disturbance and displacement: offshore cable corridor	All receptors	Negligible		**Not significant**
Disturbance and displacement: array area	Gannet	Negligible		**Not significant**
	Guillemot	Negligible		**Not significant**
	Razorbill	Negligible		**Not significant**
Indirect effects: offshore cable corridor	All receptors	Negligible		**Not significant**
Indirect effects: array area	All receptors	Negligible		**Not significant**
		Operation and maintenance		
	Gannet	Negligible		**Not significant**

Activity and impact	Receptor and sensitivity or value	Magnitude of change	Embedded environmental measures	Preliminary assessment of residual effect (significance)
Disturbance and displacement: array area	Guillemot	Negligible		**Not significant**
	Razorbill	Negligible		**Not significant**
Collision risk: array area	Gannet	Negligible	C-89 There will be a minimum blade tip clearance of at least 22m above HAT.	**Not significant**
	Kittiwake	Negligible		**Not significant**
	Common gull	Negligible		**Not significant**
	Little gull	Negligible		**Not significant**
	Lesser black-backed gull	Negligible		**Not significant**
	Herring gull	Negligible		**Not significant**
	Great black-backed gull	Negligible		**Not significant**
	Common tern	Negligible		**Not significant**
	Arctic tern	Negligible		**Not significant**
	Sandwich tern	Negligible		**Not significant**
Indirect effects: array area	All receptors	Negligible		**Not significant**
Decommissioning				
Disturbance and displacement: offshore cable corridor	All receptors	Negligible		**Not significant**
Disturbance and displacement: array area	Gannet	Negligible		**Not significant**
	Guillemot	Negligible		**Not significant**
	Razorbill	Negligible		**Not significant**

Activity and impact	Receptor and sensitivity or value	Magnitude of change	Embedded environmental measures	Preliminary assessment of residual effect (significance)
Indirect effects: offshore cable corridor	All receptors	Negligible		**Not significant**

12.19 Further work to be undertaken for ES

Introduction

12.19.1 Further work that will be undertaken to support the offshore and intertidal ornithology assessment and presented within the ES is set out below.

Baseline

12.19.2 Site-specific surveys of the intertidal and near-shore environment carried out between September 2020 and March 2021 will be analysed to further characterise the intertidal baseline.

12.19.3 An additional nine months of aerial digital survey data of the study area covering the time period July 2020 to March 2021 will be analysed, such that the offshore baseline is characterised by 24 months of survey data.

Assessment

12.19.4 A model-based assessment of the potential collision risk to migratory seabirds and non-seabirds will be carried out using an approach to be agreed upon through the Evidence Plan Process.

12.19.5 PVA will be carried out to inform the CEA for gannet using an approach to be agreed upon through the Evidence Plan Process (EPP).

Consultation and engagement

12.19.6 Further consultation and engagement that will be undertaken to inform the offshore and intertidal ornithology assessment and presented within the ES will be conducted through the EPP and following responses to this PEIR.

12.20 Glossary of terms and abbreviations

Table 12-58 Glossary of terms and abbreviations

Term (acronym)	Definition
AON	Apparently Occupied Nests
Baseline	Refers to existing conditions as represented by latest available survey and other data which is used as a benchmark for making comparisons to assess the impact of development.
Baseline conditions	The environment as it appears (or would appear) immediately prior to the implementation of the Proposed Development together with any known or foreseeable future changes that will take place before completion of the Proposed Development.
BDMPS	Biologically Defined Minimum Population Scale
BEIS	Department for Business, Energy and Industrial Strategy
Bio-season	Biological Season
Biogeographic	Relating to the spatial distribution of living organisms
BoCC	Birds of Conservation Concern
BTO	British Trust for Ornithology
CEA	Cumulative Effects Assessment
CI	Confidence Intervals
Code of Construction Practice (COCP)	The code sets out the standards and procedures to which developers and contractors must adhere to when undertaking construction of major projects. This will assist with managing the environmental impacts and will identify the main responsibilities and requirements of developers and contractors in constructing their projects.
Construction effects	Used to describe both temporary effects that arise during the construction phases as well as permanent existence effects that arise from the physical existence of development (for example new buildings).
CRM	Collision Risk Model
Cumulative effects	Additional changes caused by a Proposed Development in conjunction with other similar developments or as a combined effect of a set of developments.
Cumulative Effects Assessment	Assessment of impacts as a result of the incremental changes caused by other past, present and reasonably foreseeable human activities and natural processes together with the Proposed Development.
DCO Application	An application for consent to undertake a Nationally Significant Infrastructure Project made to the Planning

Term (acronym)	Definition
	Inspectorate who will consider the application and make a recommendation to the Secretary of State, who will decide on whether development consent should be granted for the Proposed Development.
DECC	Department and Energy and Climate Change
Decommissioning	The period during which a development and its associated processes are removed from active operation.
Development Consent Order (DCO)	This is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects, under the Planning Act 2008.
ECC	Export Cable Corridor
EEA	European Economic Area
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed project or development over and above the existing circumstances (or 'baseline').
Environmental measures	Measures which are proposed to prevent, reduce and where possible offset any significant adverse effects (or to avoid, reduce and if possible, remedy identified effects.
Environmental Statement (ES)	The written output presenting the full findings of the Environmental Impact Assessment.
EOWDC	European Offshore Wind Development Centre
ETG	Expert Technical Group
EU	European Union
Evidence Plan Process (EPP)	A voluntary consultation process with specialist stakeholders to agree the approach and the information required to support the EIA and HRA for certain aspects.
ExA	Examining Authority
Future baseline	Refers to the situation in future years without the Proposed Development.
HDD	Horizontal Directional Drill
HRA	Habitats Regulations Assessment
Impact	The changes resulting from an action.
Indirect effects	Effects that result indirectly from the Proposed Development as a consequence of the direct effects, often occurring away from the site, or as a result of a sequence of interrelationships or a complex pathway. They may be separated by distance or in time from the source of the effects.
JNCC	Joint Nature Conservation Committee

Term (acronym)	Definition
LAT	Lowest Astronomical Tide
Likely Significant Effects	It is a requirement of Environmental Impact Assessment Regulations to determine the likely significant effects of the Proposed Development on the environment which should relate to the level of an effect and the type of effect.
Magnitude (of change)	A term that combines judgements about the size and scale of the effect, the extent of the area over which it occurs, whether it is reversible or irreversible and whether it is short term or long term in duration'. Also known as the 'degree' or 'nature' of change.
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
Migropath	Tool to estimate flight pathways of migratory birds.
MLWS	Mean Low Water Springs
MSL	Mean Sea Level
Nationally Significant Infrastructure Project (NSIP)	Nationally Significant Infrastructure Projects are major infrastructure developments in England and Wales which are consented by DCO. These include proposals for renewable energy projects with an installed capacity greater than 100MW.
NEWS	Non-Estuarine Waterbird Survey
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
Offshore part of the PEIR Assessment Boundary	An area that encompasses all planned offshore infrastructure.
ORJIP	Offshore Renewables Joint Industry Programme
OSS	Offshore Substation
OWF	Offshore Wind Farm
Pathway	A potential mechanism by which a source can impact a receptor.
PCH	Potential Collision Height
PEIR Assessment Boundary	The PEIR Assessment Boundary combines the search areas for the offshore and onshore infrastructure associated with the Proposed Development. It is defined as the area within which the Proposed Development and associated infrastructure will be located, including the temporary and permanent construction and operational work areas.

Term (acronym)	Definition
Planning Inspectorate (PINS)	The Planning Inspectorate deals with planning appeals, national infrastructure planning applications, examinations of local plans and other planning-related and specialist casework in England and Wales.
Preliminary Environmental Information Report (PEIR)	The written output of the Environmental Impact Assessment undertaken to date for the Proposed Development. It is developed to support formal consultation and presents the preliminary findings of the assessment to allow an informed view to be developed of the Proposed Development, the assessment approach that has been undertaken, and the preliminary conclusions on the likely significant effects of the Proposed Development and environmental measures proposed.
Proposed Development	The development that is subject to the application for development consent, as described in Chapter 4.
PVA	Population Viability Analysis
Receptor	These are as defined in Regulation 5(2) of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 and include population and human health, biodiversity, land, soil, water, air, climate, material assets, cultural heritage and landscape that may be at risk from exposure to pollutants which could potentially arise as a result of the Proposed Development.
RED	Rampion Extension Development Ltd. (The Applicant)
Draft RIAA	Draft Report to Inform Appropriate Assessment
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
Scoping Opinion	A Scoping Opinion is adopted by the Secretary of State for a Proposed Development.
Scoping Report	A report that presents the findings of an initial stage in the Environmental Impact Assessment process.
sCRM	Stochastic Collision Risk Modelling
SD	Standard Deviation
Secretary of State	The body who makes the decision to grant development consent.
Sensitivity	A term applied to specific receptors, combining judgements of the susceptibility of the receptor to the specific type of change or development proposed and the value associated to that receptor.

Term (acronym)	Definition
Significance	A measure of the importance of the environmental effect, defined by criteria specific to the environmental aspect.
Significant effects	It is a requirement of the EIA Regulations to determine the likely significant effects of the development on the environment which should relate to the level of an effect and the type of effect. Where possible significant effects should be mitigated.
SNCB	Statutory Nature Conservation Body
SNH	Scottish Natural Heritage (now known as NatureScot)
SOS	Sussex Ornithological Society
Source	An aspect of the proposed development that has the potential to cause environmental impacts.
Source-pathway-receptor model	An approach to impact assessment that considers how aspects of the proposed development (sources) may, through plausible mechanisms (pathways) lead to an impact on bird species (receptors).
SPA	Special Protection Area
SSSIs	Sites of Special Scientific Interest
Temporal Scope	The temporal scope covers the time period over which changes to the environment and the resultant effects are predicted to occur and are typically defined as either being temporary or permanent.
UK	United Kingdom
WeBS	Wetland Bird Survey
WTG	Wind Turbine Generator
WWT	Wildfowl & Wetlands Trust
Zone of Influence (ZOI)	The area surrounding the Proposed Development which could result in likely significant effects.

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