Muir Mhòr Offshore Wind Farm

Habitats Regulations Appraisal:

Report to Inform Appropriate Assessment

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Glossary

Term	Definition
Array Area	The area in which the generation infrastructure (including Wind Turbine Generators and associated foundations and inter-array cables), Offshore Electrical Platform(s), and an interconnector cable will be located.
Baseline	The status of the environment at the time of assessment without the development in place.
Design Envelope	A description of the range of possible elements that make up the Proposed Development's design options under construction, as set out in detail in the project description. This envelope is used to define the Proposed Development for Environmental Impact Assessment (EIA) and RIAA purposes when the exact engineering parameters are not yet known. This is often referred to as the "Rochdale Envelope" approach.
Developer	Muir Mhòr Offshore Wind Farm Limited
Floating Foundations	The floating structures on which the Wind Turbine Generators are installed.
Foundation anchors	The structures which anchor the Floating Foundations to the seabed, connected to the foundation mooring.
Foundation mooring	The mooring structures which connect the Floating Foundations to the anchors.
Habitat Regulations	The Conservation (Natural Habitats, &c.) Regulations 1994, Conservation of Offshore Marine Habitats and Species Regulations 2017 and the Conservation of Habitats and Species Regulations 2017 are collectively referred to as the Habitat Regulations.
Inter-array cables	Cables which link the Wind Turbines Generators to each other and the Offshore Electrical Platform(s).
Interconnector cable	Cable which links the Offshore Electrical Platform(s) to one another, allowing for power to be transferred between the platforms.
Intertidal	The intertidal zone, sometimes referred to as the littoral zone, is the area where the marine and terrestrial environments meet between the tide's highest and lowest points. Intertidal ecology encompasses the substrate found in that zone, as well as the flora and fauna there.
Landfall	The area between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS) where the offshore export cables are brought onshore.
Offshore Electrical Platform (OEP)	Offshore platform consisting of High Voltage Alternating Current (HVAC) equipment, details depending on the final electrical set up of the Project.
Offshore Export Cable Corridor (ECC)	The area within which the offshore export cables will be installed.
Offshore export cables	The subsea electricity cable circuits running from the Offshore Electrical Platform(s) to the landfall which will transmit the electricity generated by the offshore wind farm to the onshore export cables for transmission onwards to the onshore substation and the national electrical transmission system along with auxiliary cables such as fibre optic cables.
Offshore transmission infrastructure	The proposed transmission infrastructure comprising: Offshore Electrical Platform(s) and associated foundations and substructures; the offshore export cables; and the landfall area up to Mean High Water Springs (MHWS).

Term	Definition
Primary study area	The Array Area, ECC, intertidal area seawards of MHWS, and the underwater noise zone of influence for fish and shellfish ecology.
Project	Muir Mhòr Offshore Wind Farm – comprises the wind farm and all associated offshore and onshore components.
Proposed Development	The offshore Muir Mhòr Offshore Wind Farm project elements to which this Offshore EIA Report relates.
Receptor	A distinct part of the environment on which impacts could occur and can be the subject of specific assessments. Examples of receptors include species (or groups) of animals or plants, people (often categorised further such as 'residential' or those using areas for amenity or recreation), watercourses *etc*.
Subtidal	The region of shallow waters which are below the level of low tide.
Transboundary Impacts	Transboundary impacts arise when impacts from the development within one European Economic Area (EEA) state affects the environment of another EEA state(s).
Wet storage	Wet storage in floating offshore wind development involves assembling and storing turbine components, such as the floating platform and tower, in a submerged state on the water's surface before deployment.
Wind Turbine Generator (WTG)	The wind turbines that generate electricity consisting of tubular towers and blades attached to a nacelle housing mechanical and electrical generating equipment.
Worst case design scenario	A 'worst case' design scenario from then design envelope that would lead to the greatest impact for receptors or receptor groups.

Acronyms

Term	Definition
AA	Appropriate Assessment
AC	Alternating Current
ADDs	Acoustic Deterrent Device
AEoSI	Adverse Effect on Site Integrity
AHCV	Anchor Handling Construction Vessel
AHT	Anchor Handling Tug
BAP	Biodiversity Action Plan
BEIS	Department of Business, Energy and Industrial Strategy
BERR	Department of Business, Enterprise and Regulatory Reform
BSL	Benthic Solutions Ltd
CaP	Cable Plan
CBRA	Cable Burial Risk Assessment
Cefas	Centre for Environmental, Fisheries and Aquaculture Science
CES	Coastal East Scotland
CGR	Counterfactual of Growth Rate
CIEEM	The Chartered Institute of Ecology and Environmental Management
CJEU	The Court of Justice of the European Union
CLV	Cable Lay Vessel
CMS	Construction Method Statement
CO	Conservation Objectives
CoP	Construction Programme
CPS	Counterfactual of Population Size
CRM	Collision Risk Modelling
CSIP	The UK Cetacean Strandings Investigation Programme
CSV	Construction Support Vessel
DC	Direct Current
DECC	Departments of Energy and Climate Change
DEFRA	Department of Environment, Food and Rural Affairs
DP	Decommissioning Programme
DSLP	Development Specification and Layout Plan
EC	European Commission
ECC	Export Cable Corridor
ECJ	European Court of Justice
ECOMMAS	East Coast Marine Mammal Acoustic Study
eDNA	Environmental DNA
EDR	Effect Deterrence Range
EEA	European Economic Area
EEC	European Economic Community
EIA	Environmental Impact Assessment

Term	Definition
EIAR	Environmental Impact Assessment Report
EMEC	European Marine Energy Centre
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EPS	European Protected Species
EU	European Union
FCS	Favourable Conservation Status
FFPV	Flexible Fallpipe Vessel
FHG	Functional Hearing Groups
FPSO	Floating Production, Storage and Offloading
FWPM	Freshwater Pearl Mussel
GNS	Greater North Sea
GV	Guard Vessel
GW	Gigawatt
HDD	Horizontal Direction Drilling
HF	High-Frequency
HLV	Heavy Lift Vessel
HRA	Habitats Regulations Appraisal
HTV	Heavy Transfer Vessel
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IAC	Inter-Array Cables
ICES	International Council for the Exploration of the Sea
INTOG	Innovation and Targeted Oil and Gas
IROPI	Imperative Reasons of Overriding Public Interest
ISV	Installation Support Vessel
IUCN	International Union for the Conservation of Nature
JNCC	Joint Nature Conservation Committee
JUV	Jack-Up Vessel
LAT	Lowest Astronomical Tide
LCV	Light Construction Vessel
LF	Low-Frequency
LSE	Likely Significant Effect
MAG	Magnetometer
MBES	Multibeam Echo Sounder
MD-LOT	Marine Directorate – Licensing Operations Team
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MM	Mean max
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation

Term	Definition
MMOb	Marine Mammal Observers
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MPI	Multi-Purpose Interconnector
MU	Management Unit
MW	Megawatt
NMFS	National Marine Fisheries Service
NPL	National Physical Laboratory
NSIP	Nationally Significant Infrastructure Project
NSN	National Site Network
O&M	Operation and Maintenance
OEP	Offshore Electrical Platform
OSPAR	Oslo and Paris Conventions
OWF	Offshore Wind Farm
PAMO	Passive Acoustic Monitoring Operators
PCW	Phocid Carnivores in Water
PEMP	Project Environmental Monitoring Programme
PTS	Permanent Threshold Shift
PVA	Population Viability Analysis
RIAA	Report to Inform Appropriate Assessment
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SEL	Sound Exposure Level
SEPA	Scottish Environmental Protection Agency
SOV	Service Operation Vessels
SPA	Special Protection Area
SPL	Sound Pressure Level
SSC	Suspended Sediment Concentration
SSS	Side Scan Sonar
SW	Southwest
TTS	Temporary Threshold Shift
UHRS	Ultra-High Resolution Seismic
USBL	Ultra Short Baseline
UWN	Underwater Noise
UXO	Unexploded Ordnance
VHF	Very High-Frequency
VMNSP	Vessel Management and Navigational Safety Plan
VMP	Vessel Management Plan
WSP	Wet Storage Plan
WTG	Wind Turbine Generator
ZoI	Zone of Influence

EXECUTIVE SUMMARY

Muir Mhòr Offshore Wind Farm Limited (hereafter referred to as 'the Developer') is proposing to develop the Muir Mhòr Offshore Wind Farm (OWF) (hereafter 'the Project'), situated in the North Sea, east of the Petershead coastline. The Project comprises of both onshore and offshore components. The subject of this Report to Inform Appropriate Assessment (RIAA) is the offshore component of the Project, hereafter referred to as the 'Proposed Development'.

This RIAA has been drafted to provide the Scottish Ministers with the information necessary to undertake a Habitat Regulations Appraisal (HRA) as part of the determination process for the application for the Proposed Development.

The RIAA builds upon and in part has updated the conclusions of the HRA Screening report (Muir Mhòr Offshore Wind Farm Limited, 2023), which determines whether the Proposed Development alone or in-combination with other plans and projects has the potential to result in Likely Significant Effects (LSE) on European sites in relation to their Conservation Objectives. The HRA Screening Report concluded that three receptors groups should be considered in the RIAA; Marine Mammals with one site screened in, Offshore and Intertidal Ornithology with 58 sites screened in, and Migratory Fish with one site screened in. Benthic and Intertidal Habitats, and Coastal Processes were screened out due to no LSE concluded for this receptor group.

This RIAA concludes that there is no potential for Adverse Effect on Site Integrity (AEoSI) on Marine Mammal and Migratory Fish receptors either alone or in-combination with other projects and plans for all designated sites screened in for those receptors. For sites designated for Offshore and Intertidal Ornithology it has been concluded that an AEoSI cannot be ruled out for five designated sites; Buchan Ness to Collieston Coast Special protection Area (SPA), East Caithness Cliffs SPA, Fowlsheugh SPA, Troup, Pennan and Lion's Head SPA and Forth Islands SPA, all with regards to their kittiwake feature. For all other ornithological features of designated sites screened in the assessment concludes that the Proposed Development will not result in an AEoSI.

With consideration of the conclusion of AEoSI, this RIAA concludes that a derogation case is likely to be required.

1. INTRODUCTION

1.1. BACKGROUND TO THE PROPOSED DEVELOPMENT

1.1.1. Muir Mhòr Offshore Wind Farm Limited (hereafter referred to as 'the Developer') is proposing to develop the Muir Mhòr Offshore Wind Farm (OWF) (hereafter 'the Project'). The Project is made up of both offshore and onshore components. The subject of this Report to Inform Appropriate Assessment (RIAA) is the offshore infrastructure of the Project seaward of Mean High-Water Springs (MHWS) which is hereafter referred to as 'the Proposed Development'. The onshore components of the Project are considered through a separate consenting process and are therefore not considered within this assessment.

1.1.2. The Muir Mhòr Array Area covers an area of approximately 200 km² and is located approximately 63 km east of Peterhead on the east coast of Scotland (Figure 1-1). The offshore infrastructure of the Proposed Development includes Wind Turbine Generators (WTGs) and associated floating foundations, the Offshore Electrical Platform(s) (OEP(s)) and associated foundations, the inter-array cables, an interconnector cable, offshore export cables and landfall.

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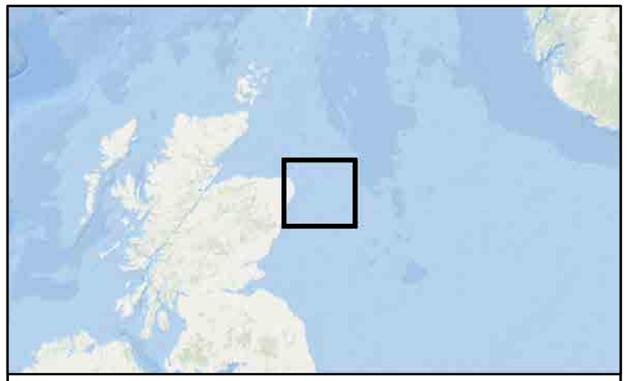

Legend:

- Array Area
- Offshore Export Cable Corridor

Project:	Report:
Muir Mhòr	Report to Inform Appropriate Assessment

The Proposed Development

Figure: 1-1	Drawing No: GoBe-0147		
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Map scale 1:400,000 @ A3

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Co-ordinate system: ETRS 1989 UTM Zone 30N **EPSG:** 25830

MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred. Olsen Seawind & Vattenfall

Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

1.2. PURPOSE OF THE RIAA

RIAA CONTEXT

1.2.1. European Union legislation, as transposed into UK legislation, on the assessment of plans and projects significantly affecting European designated sites, identifies a staged process to the assessment (Section 3.5). Together, these stages are referred to as the Habitats Regulations Assessment (HRA), with this report being of particular relevance to Stage 2 by providing relevant information for the Competent Authority, in this case the Marine Directorate – Licensing Operations Team (MD-LOT), to undertake their 'Appropriate Assessment' (AA).

1.2.2. Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') protects habitats and species of European nature conservation importance. Together with Council Directive 2009/147/EC on the conservation of wild birds (the 'Birds Directive'), the Habitats Directive established a network of internationally important sites, designated for their ecological status: Special Areas of Conservation (SACs), under the Habitats Directive, to promote the protection of flora, fauna and habitats; and Special Protection Areas (SPAs), under the Birds Directive, in order to protect rare, vulnerable and migratory birds. These sites combined form a Europe-wide 'Natura 2000' network of designated sites, which are referred to as "European sites".

1.2.3. The above Directives were transposed into UK legislation through a series of regulations. Terrestrial areas of Scotland and Scottish territorial waters are covered under the Conservation (Natural Habitats, &c.) Regulations 1994. Waters between 12nm and 200nm are covered under The Conservation of Offshore Marine Habitats and Species Regulations 2017. In addition, the Conservation of Habitats and Species Regulations 2017 apply throughout the UK and UK waters to certain applications for consent, including applications for section 36 consent. Collectively, these three sets of regulations are referred to herein as the "Habitats Regulations". For additional context on the legislative context behind this assessment see Section 3.

1.2.4. In this report, and in accordance with EU Exit guidance issued by the Scottish Government, the term “European site” has been retained to refer to the above sites protected in European Member States, Scotland and the rest of the UK (Scottish Government, 2020).

1.2.5. Post EU-Exit, the Habitats Regulations continue to refer to Annexes I and II of the Habitats Directive and Annex I of the Birds Directive and as such, reference is made to the annexes of the Habitats and Birds Directives in this report.

PURPOSE OF THIS DOCUMENT

1.2.6. The RIAA has been prepared to support the HRA of the Proposed Development in the determination of the implications for European sites. The RIAA builds upon the HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) completed in July 2023 and subsequent joint Environmental Impact Assessment (EIA) Scoping and Likely Significant Effect (LSE) Screening advice received in the Muir Mhòr Scoping Opinion (Volume 3, Appendix 5.2 (Offshore Scoping Opinion)) in September 2023. It presents the necessary information for MD-LOT to undertake their HRA Stage 2 AA to consider the likelihood of the Proposed Development affecting the integrity of any European site (Adverse Effect on Site Integrity (AEoSI)). See Section 3.5 for more details on the HRA process.

1.2.7. The scope of this document covers all relevant European sites and relevant qualifying interest features where potential LSEs have been identified from impacts arising from the Proposed Development. This includes both ‘offshore’ European sites and features (seaward of MHWS) and ‘onshore’ European sites (landward of Mean Low Water Springs (MLWS)).

1.3. PROJECT LITERATURE

1.3.1. This RIAA follows a suite of documents prepared alongside the Proposed Development's Environmental Impact Assessment Report (EIAR) to be issued as part of the consent application. Key documents issued as part of the EIAR and in support of the statutory consultation process include technical reports (both for site-specific surveys but also modelling and desk-based studies), with many of these being the key source documents for the information presented herein. For ease of reference, and to minimise repetition, the main sources of project literature (including relevant EIAR chapters, technical reports and management plans) for the current report are as follows:

- Within the EIAR:
  - Volume 1: Introductory Chapters
    - Chapter 1: Introduction;
    - Chapter 2: Legislation and Policy Context;
    - Chapter 3: Project Description; and
    - Chapter 5: Consultation.
  - Volume 2: Offshore Environmental Impact Assessment Report
    - Chapter 9: Benthic, Subtidal and Intertidal Ecology;
    - Chapter 10: Fish and Shellfish Ecology;
    - Chapter 11: Offshore and Intertidal Ornithology; and
    - Chapter 12: Marine Mammals.
  - Volume 3: Offshore Technical Appendices
    - Appendix 3.1: Subsea Noise Technical Report;
    - Appendix 9.1 Benthic, Subtidal and Intertidal Ecology Technical Report;
    - Appendix 9.2: Marine Protected Area Assessment Report;
    - Appendix 10.1: Fish and Shellfish Technical Report;
    - Appendix 11.1: Ornithology Baseline Technical Report;
    - Appendix 11.2: Ornithology Collision Risk Modelling Technical Report;
    - Appendix 11.3: Ornithology Displacement Technical Report;
    - Appendix 11.4: Offshore and Intertidal Ornithology Apportionment Report;
    - Appendix 11.5: Offshore and Intertidal Ornithology Population Viability Analysis Report;
    - Appendix 11.6: Ornithology Density and Abundance Technical Report; and
    - Appendix 12.1: Marine Mammal Baseline Technical Assessment Report.
  - Volume 4: Supporting Documentation
    - Appendix 2: Outline Environmental Management Plan;
    - Appendix 3: Outline Marine Mammal Mitigation Protocol; and
    - Appendix 9: Offshore Planning Statement.
- Standalone documents:
  - HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023)

2. STRUCTURE OF THE RIAA

2.1.1. This document is set out in several sections as summarised below:

- Section 1: Executive Summary. Summary of the Proposed Development and conclusions of the RIAA;
- Section 2: Introduction. Providing a background to the Proposed Development, including the purpose of the Proposed Development and where additional project literature (including baseline reports and EIA) can be found;
- Section 3: Structure of the RIAA. Providing an overview of the structure of the document and section headings;
- Section 4: Legislation Policy and Guidance. Summarising the relevant legislation, policy and guidance documents that have been used to inform this RIAA;
- Section 5: Consultation. Summarising the consultation undertaken, with whom, when, the issues raised, how and where these have been addressed, including the need for transboundary consultation;
- Section 6: Proposed Development Overview. Drawing on the information presented in relevant chapters of the EIAR, providing the worst case design scenario for each receptor group including temporal and spatial aspects;
- Section 7: Mitigation. Presenting the project mitigation relevant to the assessments presented within the RIAA;
- Section 8: Stage 1 HRA Screening. Summarising the conclusions on screening;
- Section 9: Assessment of Adverse Effect Alone. Determination of whether the Proposed Development alone will result in an adverse effect;
- Section 10: Assessment of Adverse Effect In-Combination. Determination of whether the Proposed Development in-combination with other plans and projects will result in an adverse effect;
- Section 11: Conclusion of the Assessment. Summarising the conclusions on adverse effect, alone and/or in-combination; and
- Section 12: References.

2.1.2. This document has been drafted by GoBe Consultants Limited on behalf of the Developer, with ornithological sections drafted by HiDef Environmental Consultancy.

3. LEGISLATION, POLICY AND GUIDANCE

3.1. HABITATS DIRECTIVE AND UK HABITATS REGULATIONS

3.1.1. Under the Habitats Directive, Bird Directive and Habitat Regulations, the network of sites considered relevant to this RIAA includes SACs and SPAs (as detailed above). SACs are designated for the conservation of Annex I habitats (including priority types which are in danger of disappearance) and Annex II species (other than birds). SPAs are designated for the conservation of Annex I birds and other regularly occurring migratory birds and their habitats. The annexed habitats and species for which each site is designated correspond to the qualifying interest features of the sites. From these features, the Conservation Objectives of the site are derived.

3.1.2. While the UK is no longer an EU Member State, the Habitats Directive as implemented by the Habitats Regulations continues to provide the legislative backdrop for HRA in the UK. The HRA process implemented under the Habitats Regulations continues to apply (subject to minor changes effected by the regulations providing for the UK's exit from the EU) and HRA judgments handed down by The Court of Justice of the European Union (CJEU) prior to 31st December 2020 until disapplied by subsequent domestic judgments or legislation.

3.1.3. The objective of the Habitats Regulations is to conserve, at a favourable conservation status (FCS), those habitats and species listed in Annexes I and II of the Habitats Directive and Annex I of the Wild Birds Directive.

3.1.4. In addition to sites formally defined as European sites in the Habitats Regulations, Scottish Planning Policy (Scottish Government, 2020) acknowledges that Ramsar sites are afforded the same protection where they are also designated as a European site. As a matter of Scottish planning policy, the Scottish Government also states that authorities should afford the same level of protection to proposed SACs and SPAs (i.e. sites which have been approved by Scottish Ministers for formal consultation, but which have not yet been designated) as they do to sites which have been designated (Scottish Government, 2020).

3.1.5. Under the Habitats Regulations, before granting approval (i.e. planning permissions, licenses and consents) for a development likely to have a significant effect on an SAC or SPA/Ramsar site, an AA must be made by the competent authority, of the proposed plan or project's potential for adverse effects on integrity of the site in view of that site's Conservation Objectives.

3.2. NATIONAL SITE NETWORK

3.2.1. The National Site Network comprises of European sites in the UK that already existed (i.e. were established under the Habitats or Birds Directives) on 31st December 2020 (or proposed to the European Commission (EC) before that date) and any new sites designated under the Habitats Regulations under an amended designation process.

3.2.2. The regulations providing for EU Exit also establish management objectives for the National Site Network (NSN). These are called the network objectives. The objectives in relation to the NSN are to:

- i) maintain or restore certain habitats and species listed in the Habitats Directive to FCS; and
- ii) contribute to ensuring the survival and reproduction of certain species of wild bird in their area of distribution and to maintaining their populations at levels which correspond

to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements.

3.3. ENERGY ACT 2023

3.3.1. Part 13 Chapter 1 (Sections 290 to 295) of the Energy Act 2023 which received royal assent and became law in October 2023, provides legislation to enable the implementation of strategic compensation to be delivered by public authorities, and marine recovery funds which may fund this strategic compensation. The Energy Act 2023 builds on the commitments in the British Energy Security Strategy to invest in homegrown energy and maintain the diversity and resilience of the United Kingdom's energy supply while working towards net zero by 2050. This has set out an increased ambition for up to 50 gigawatts (GW) of offshore wind, including up to 5GW of floating wind, by 2030.

3.3.2. The statutory provisions enable the potential for altering the requirements of assessment and how compensation is approached and/ or funded, with potential for consideration of both European sites and Marine protection areas. The Developer will monitor the implementation of these provisions and consider if any are suitable or applicable to the Proposed Development.

3.4. GUIDANCE DOCUMENTS

3.4.1. Following the UK's departure from the EU, reference to European Commission (EC) guidance on the interpretation of HRA concepts continues to apply. Scottish Government (December 2020) EU Exit: The Habitats Regulations in Scotland (Marine Scotland, 2020) states that in the longer term, guidance may be updated and/or new guidance may be produced, for example to replace guidance by the European Commission and reflect any changes as required through the British Energy Security Strategy and other relevant Scottish and UK policies. However, in the shorter-term existing guidance continues to apply and should still be used.

3.4.2. Accordingly, this RIAA is undertaken in accordance with the following guidance documents:

- Scottish Natural Heritage (January 2015) (Published 2019) Habitats Regulations Appraisal of Plans - Guidance for plan-making bodies in Scotland - Jan 2015;
- Scottish Natural Heritage (2019) SNH Guidance Note: The handling of mitigation in Habitats Regulations Appraisal – the People Over Wind CJEU judgement;
- Scottish Natural Heritage (2016) Habitats Regulations Appraisal (HRA) on the Firth of Forth A Guide for developers and regulators;
- Scottish Government (2013) HRA Advice Sheet 1 - Aligning Development Planning procedures with Habitats Regulations Appraisal requirements (Version 1 - July 2012);
- Scottish Government (2018). Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications. October 2018;
- Scottish Natural Heritage (2014). Natura Casework Guidance: How to consider plans and projects affecting Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). February 2014;
- European Commission (EC) (2021) Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC. European Commission Notice Brussels C (2021) 6913 final;
- EC (2020) Guidance document on wind energy developments and EU nature legislation. European Commission Notice Brussels C (2020) 7730 final;

- EC (2018) Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC';
- EC (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EE. Clarification on the Concepts of: Alternative Solutions, Imperative Reasons of Overriding Public Interest, Compensatory Measures, Overall Coherence, Opinion of the Commission;
- EC (2006) Nature and Biodiversity Cases Ruling of the European Court of Justice; and
- The Habitats Regulations Assessment Handbook (Tyldesley and Chapman, 2021).

Reference has further been made to the following publications in Scotland and England that seek to explain the changes made to the Habitats Regulations to make them operable from 1st January 2021:

- Scottish Government (December 2020) EU Exit: The Habitats Regulations in Scotland (Marine Scotland, 2020); and
- Department for Environment, Food and Rural Affairs (DEFRA) (January 2021) Policy Paper - Changes to the Habitats Regulations 2017.

3.4.3. The Statutory Nature Conservation Bodies (SNCBs) have produced conservation advice for European sites under their statutory remit. This conservation advice provides information on sites and features and guidance on how to achieve FCS. Conservation advice is discussed further in Section 8 and 1 of this RIAA.

3.5. THE HRA PROCESS

3.5.1. The Habitats Regulations require that whenever a project that is not directly connected to, or necessary for the management of a European site, is likely to have a significant effect on the site (directly, indirectly, alone and/or in-combination with other plans or projects), then an AA must be undertaken by the Competent Authority. The AA must be carried out before consent or authorisation can be given for the Proposed Development.

3.5.2. In Scotland, the HRA process is generally recognised as a progressive, three-stage process built around the wording of Articles 6(3) and 6(4) of the Habitats Directive, with the outcome at each stage defining the requirement for and scope of the next.

3.5.3. Article 6(3) of the Habitats Directive requires that:

"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and *subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned* and *if appropriate, after having obtained the opinion of the general public".*

3.5.4. This provides the first two stages of the HRA process:

- **Stage 1 - Screening:** Screening for potential LSE (alone and/or in-combination with other projects or plans); and
- **Stage 2 - Appropriate Assessment:** Assessment of implications of identified potential LSEs on the conservation objectives of a European site to ascertain if the proposal will adversely affect the integrity of the site.

3.5.5. Article 6(4) subsequently states:

"If, in spite of a negative assessment of the implications for the site and *in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.".*

3.5.6. This provides Stage 3 of the process:

Stage 3 - Assessment of Alternative Solutions/ Imperative Reasons of Overriding Public Interest (IROPI): Where it cannot be ascertained that the proposal will not adversely affect the integrity of a European site, the competent authority must consider alternative solutions. Where it can be demonstrated that there are no alternative solutions to the project, the project may still be carried out if the competent authority is satisfied that the scheme must be carried out for IROPI, and appropriate compensatory measures have been developed.

3.5.7. All three stages of the process are referred to as the HRA to clearly distinguish the whole process from the one step within it referred to as the 'AA'.

3.5.8. This RIAA is concerned with the second stage of the process (i.e. the AA), which seeks to assess and decide whether a plan or project, alone or in combination with other projects or plans, will have an AEoSI of a European site. This RIAA also summarises the conclusions of the HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) and updates made to the screening conclusions since this was published in July 2023, to account for feedback received from stakeholders during consultation.

4. CONSULTATION

4.1.1. Consultation is ongoing for the Proposed Development, with the HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) published on the 21st June 2023 and feedback received from MD-LOT in September 28th, 2023 (see EIAR Volume 3, Appendix 5.2 (Offshore Scoping Opinion)). Subsequent consultation was undertaken in response to the Scoping Opinion, with various stakeholders commenting in relation to the Offshore EIA Scoping Report (EIAR, Volume 3, Appendix 5.1 (Offshore Scoping Report)) and HRA Screening Report. Comments (actionable) relating to HRA matters were received from:

- NatureScot; and
- Royal Society for the Protection of Birds (RSPB).

4.1.2. Comments received have been taken into consideration and actioned where appropriate and practicable during the development of this RIAA, and summarised in Table 4.1.

4.1.3. Furthermore, this RIAA has been developed alongside the EIAR. Where design, supporting information or stakeholder feedback is common to both assessments, this has been used, as referenced. Consultation has been undertaken with statutory stakeholders throughout the development of the Proposed Development. A summary of the details of all consultation undertaken to date relevant to the RIAA and the HRA process in general, is presented in Table 4.1.

Table 4.1 Consultation undertaken in relation the RIAA and HRA process

Date & Document	Consultee	Topic	Comment received	How and where the comment is considered within the RIAA.
11/08/2024, EIA Scoping Report	NatureScot	Wet Storage	Wet storage could represent a significant impact. Consideration of the potential impacts on all receptors needs to be addressed with the EIA Report and HRA. We would welcome further discussion on this as and when further details are available.	The Proposed Development's scoping opinion referred to inclusion of assessment of Wet Storage within the EIAR. Following discussion with NatureScot on 24th October 2024, and MD-LOT on the 31st October 2024, it was confirmed that as the Developer is not applying for the consent and/or licensing of wet storage facilities for the Proposed Development, the EIAR is not required to include Wet Storage assessment. A Wet Storage Plan (WSP) will be developed to provide details on requirements (if applicable) for assembled WTGs and cabling
11/08/2024, EIA Scoping Report	NatureScot	Ornithology	The installation/decommissioning of cables could disturb or displace birds using the marine extension. Consideration should be given to the timing of the works and a vessel management plan, to minimise impacts on the SPA qualifying species. We advise avoiding works within the 2 km SPA extension during the main breeding season. There is also potential for disturbance of seabirds nesting on the cliffs as the works approach the coastline. Consideration should be given to selecting a cable route and landfall that avoid the most sensitive areas of the nesting colonies within the SPA, and not carrying out works close to the coast during the main breeding season.	Final route selection for the ECC has been undertaken cognisant of this consultation feedback, and the Developer has committed to the production of a Cable Plan (C-02) and Vessel Management Plan (C-10); Table 6-1.
11/08/2024, EIA Scoping Report	NatureScot	Ornithology & Wet Storage	Wet storage has been scoped in for the operational phase as follows: 'disturbance and/or displacement from WTGs and associated vessels and maintenance activities including wet storage activities'. We consider that a similar impact pathway exists during the construction and decommissioning phases in relation to disturbance and	The Proposed Development's scoping opinion referred to inclusion of assessment of Wet Storage within the EIAR. Following discussion with NatureScot on 24th October 2024, and MD-LOT on the 31st October 2024, it

Date & Document	Consultee	Topic	Comment received	How and where the comment is considered within the RIAA.
			therefore wet storage activities should be scoped in for these phases as well.	was confirmed that as the Developer is not applying for the consent and/or licensing of wet storage facilities for the Proposed Development, the EIAR is not required to include Wet Storage assessment. A Wet Storage Plan (WSP) will be developed to provide details on requirements (if applicable) for assembled WTGs and cabling
11/08/2024, EIA Scoping Report	NatureScot	Ornithology – Density modelling	We note that availability bias is not included in the density modelling section. We would expect that species-specific correction factors should be applied to the number of each auk species recorded on the sea's surface. We accept factors derived from Thaxter *et al*. (2010) for guillemot and razorbill, from Spencer (2012) for puffin and using Barlow *et al*. (1988).	Availability bias has been included in the density calculations – see the Offshore and Intertidal Ornithology Density and Abundance Report (Volume 3, Appendix 11.6).
11/08/2024, EIA Scoping Report	NatureScot	Ornithology - SeabORD	Please note that the SeabORD model can only be used in the chick rearing period for puffin, guillemot, razorbill and kittiwake. For these species the matrix approach will still be needed in the non-breeding season.	SeabORD has been used to determine impacts arising from distributional responses during the breeding season for these species, and the matrix approach was used during the non-breeding season (Offshore and Intertidal Ornithology Distributional Responses Report (Volume 3, Appendix 11.3)).
11/08/2024, EIA Scoping Report	NatureScot	Ornithology – Population Viability Analysis (PVA)	We clarify that the requirement for PVA should be triggered where a change in baseline adult annual survival rate/mortality rate exceeds 0.02 percentage points and not as a 0.02% change. This small change in terminology is significant in the correct application of our guidance. Further information in relation to this can be found in our Guidance Note 11 (NatureScot, 2023). We are pleased to see that both the Counterfactual of Growth Rate (CGR) and the Counterfactual of Population Size (CPS) will be	This advice has been used to inform the species for which PVA is used and reported on in the offshore ornithology Offshore and Intertidal Ornithology Population Viability Analysis Report (Volume 3, Appendix 11.5)**.**

Date & Document	Consultee	Topic	Comment received	How and where the comment is considered within the RIAA.
			used in assessments.	
11/08/2024, EIA Scoping Report	NatureScot	Ornithology – Collision Risk Modelling (CRM)	We note the intention to use the stochastic collision risk model (sCRM) developed by Marsden, E. 2015. We recommend using the 2022 update to the sCRM tool shiny app (Caneco, 2022)[1]. We advise that we can accept the proposal to only use Option 2. We will be updating our guidance shortly to reflect this change in our advice. However, we do expect deterministic outputs for each collision risk species as well as stochastic outputs. Please note that we are currently reviewing our avoidance rate guidance in light of the Ozsanlav-Harris *et al*. (2023) review.	All comments taken into account to inform the approach used for CRM, as reported in the Offshore and Intertidal Ornithology CRM Report (Volume 3, Appendix 11.2)." To confirm, CRM was undertaken using Option 2 and deterministic outputs were provided as well as the stochastic outputs.
11/08/2024, EIA Scoping Report	NatureScot	Ornithology – Macro-avoidance and CRM	For both species we currently advise that these impacts should be considered as additive. We are aware of ongoing work looking at how gannet behave with respect to macro avoidance and the means of quantifying this, but this research is not currently published. Until such a point as the research is published and reviewed, we advise that collision and displacement are considered as additive for gannet.	Species mortality has been treated as additive for kittiwake and for gannet, and no adjustment for gannet macro-avoidance has been made as set out in the Offshore and Intertidal Ornithology Population Viability Analysis Report (Volume 3, Appendix 11.5).
11/08/2024, EIA Scoping Report	NatureScot	Ornithology – Potential effects considered	Table 5.4 of the HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) details the potential effects considered for offshore and intertidal ornithology. We advise that the potential effect of 'disturbance and displacement' during the operation and maintenance phase should include the presence of operating wind turbines.	Seabird distributional responses during O&M are understood to primarily relate to the operational WTGs, as assessed for the Project alone and in-combination (Section 8.3 and Section 9.3 respectively).
11/08/2024, EIA Scoping Report	NatureScot	Ornithology - LSE	The approach undertaken in the HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) seems appropriate for LSE screening. However, no conclusions on LSE should be made until the second year of survey	Noted. The final LSE screening is presented as Table 7.2 in this RIAA, updated in accordance with the consultation feedback, as set out in

[1] sCRM tool shiny app: https://dmpstats.shinyapps.io/sCRM/

Date & Document	Consultee	Topic	Comment received	How and where the comment is considered within the RIAA.
			data is included. This is so that a full picture of how birds are interacting with the array footprint is fully understood.	Section 7.1 under Offshore and Intertidal Ornithology.
11/08/2024, HRA Stage 1 LSE Screening Report	NatureScot	Ornithology – Potential for LSE	**Seabird breeding colony sites** The list of sites included in Table 5.6 is largely correct, but there are some additional seabird breeding colony sites/features that should be included at this stage. These are: • Mousa SPA – European storm petrel feature 13 NatureScot is the operating name of Scottish Natural Heritage • Ramna Stacks and Grunei SPA – Leach's storm petrel feature. Although this species was not recorded in the year 1 surveys, we advise that features should not be excluded on the basis of incomplete survey data. • St Abb's Head to Fast Castle SPA Please note that there may be species which are components of the Seabird Assemblage feature for some sites, but not listed as individual features, which should be considered. Natural England should be consulted on the inclusion of sites / features they manage e.g. • Farne Islands SPA • Coquet Island SPA	The HRA screening was updated following this consultation feedback, as set out in Section 7.1 and Table 7.2, and these SPAs with their relevant qualifying interests are now included for assessment.
11/08/2024, HRA Stage 1 LSE Screening Report	NatureScot	Ornithology – Potential for LSE	**Migratory waterbird sites** Not all relevant SPAs (and Ramsar sites) with migratory waterbird qualifying features seem to have been included in the table, for example Ythan Estuary, Sands of Forvie and Meikle Loch SPA / Ythan Estuary and Meikle Loch Ramsar site. It is important to consider all qualifying waterbird features which may fly through the area of the Proposed Development during migration. Relevant sites may be estuarine or inland sites. We recommend that relevant migratory waterbird sites are included together in	The HRA screening was updated following this consultation feedback, as set out in Section 7.1 and Table 7.2, and further waterbird SPAs included for assessment.

Date & Document	Consultee	Topic	Comment received	How and where the comment is considered within the RIAA.
			a separate section of Table 5.6.	
11/08/2024, HRA Stage 1 LSE Screening Report	NatureScot	Ornithology – Potential for LSE	**Barrier effects** Barrier effects should be included more consistently in the operation and maintenance potential effects in Table 5.6.	Barrier effects are addressed as part of seabird distributional responses in the Project alone and in-combination assessment sections (Section 8.3 and Section 9.3 respectively).
11/08/2024, HRA Stage 1 LSE Screening Report	NatureScot	Ornithology – Potential for LSE	**Buchan Ness to Collieston Coast SPA** One of the landfall areas of search lies within this SPA, creating potential for disturbance of seabirds on their nests, as works approach cliff nesting habitat on or near the coast. Birds such as fulmar, which are not sensitive to disturbance from vessel activity at sea, are nonetheless sensitive to disturbance on their nests, especially during chick rearing. It will be important to consider this aspect of disturbance in assessments of impacts.	Final route selection for the ECC has been undertaken cognisant of this consultation feedback, and now avoids the SPA. Potential disturbance impacts during construction are addressed in Section 8.3, and the Developer has committed to the production of a Cable Plan (C-02) and Vessel Management Plan (C-10); Table 6-1.
11/08/2024, HRA Stage 1 LSE Screening Report	NatureScot	Ornithology – Potential for LSE	**European storm petrel, Leach's storm petrel and Manx shearwater features** With respect to these nocturnal species, impacts of lighting should be considered. They may be attracted to and/or disorientated by artificial light sources. As well as turbine lighting, these include lighting on servicing or construction vessels, especially if construction will be a 24/7 operation. Such effects could impact assessment of collision and/or displacement. We recommend considering findings from the Marine Directorate commissioned review (Marine Directorate, 2022) to inform the assessment of the risk of collision and displacement in petrels and shearwaters from offshore wind developments in Scotland.	Potential impacts from artificial lighting have been assessed across all phases of development; Construction and Decommissioning and O&M in Section 8.3, referencing the Marine Directorate review (Deakin *et al*., 2022).
11/08/2024, HRA Stage 1 LSE Screening Report	NatureScot	Ornithology – Potential for LSE	**Fair Isle SPA** One row in table 5.6 has a list of species for Fair Isle SPA for which the conclusion is no connectivity in relation to the foraging ranges for these species. The list includes	Table 7.2 provides the final list of SPAs and their qualifying interests included for assessment, reflecting the consultation feedback received. This

Date & Document	Consultee	Topic	Comment received	How and where the comment is considered within the RIAA.
			puffin which has a foraging range of 265 km, so it should not be included here. Puffin is assessed correctly for Fair Isle further on in the table.	includes puffin at Fair Isle SPA.
11/08/2024, EIA Scoping Report & HRA Stage 1 LSE Screening Report	NatureScot	Marine Mammals – Unexploded Ordnance (UXO) Clearance	It is noted that underwater noise modelling is proposed for unexploded ordnance (UXO) clearance. As highlighted above, the joint interim position statement on UXO should be taken into consideration. Our preference is to see the use of deflagration as a removal technique and there is currently a deflagration campaign ongoing in Scottish waters. However, in the absence of the outcomes of this campaign, we advise that currently, both high order and low order clearance should be modelled to ensure the WCS is assessed.	Noted, the WCS has been assessed within this RIAA.
11/08/2024, HRA Stage 1 LSE Screening Report	NatureScot	Marine Mammals – LSE	As noted in the HRA Stage 1 LSE Screening Report, bottlenose dolphins from the Moray Firth SAC are known to regularly transit the east coast of Scotland. Therefore, we agree with the conclusion in table 7.1 that the Moray Firth SAC should be screened in as having potential for LSE (alone or in-combination) for bottlenose dolphin. This is due to the location of the export cable corridor and the potential for underwater noise from piling activities and UXO clearance reaching the coastal area. We also agree that all other marine mammal SACs can be screened out as having no potential for LSE (alone or in-combination).	Noted, this approach to screening has been carried forward and addressed in Section 7.1.
11/08/2024, HRA Stage 1 LSE Screening Report	NatureScot	Migratory Fish	We note that for diadromous fish species there is limited knowledge of distribution and behaviour of these species in the marine environment. For example, the precise migration routes of adult or juvenile Atlantic salmon or direction taken by migrating adult European eels is not fully known. Published information indicates that European smelt and River lamprey are primarily, though probably not exclusively, associated with estuarine environments. Shad might also prefer estuarine environments. Furthermore, for some species, like seals, we have a reasonable understanding of connectivity to	Although it is noted that NatureScot have recommended that all migratory fish features be screened out of the RIAA and HRA process as a whole, the Developer has concluded there is nonetheless potential for LSE on the basis of the potential effects of the Proposed Development. Due to this, we have taken the precautionary approach of applying a 100 km Zone of Influence (ZoI) from the Proposed Development,

Date & Document	Consultee	Topic	Comment received	How and where the comment is considered within the RIAA.
			individual SACs. We also have population estimates for nearly all seal SAC populations in the standard data forms – part of the citation package. For diadromous fish species we do not have population data for any salmon or lamprey SAC on the data forms. This inability to understand connectivity to and within individual rivers to the development area, currently prohibits an informed assessment of the impact on individual site integrity. This is a necessary step within HRA assessment process. The recently updated ScotMER evidence map (Marine Directorate, 2024) process for diadromous fish confirms the evidence gaps, particularly with respect to spatial and temporal distribution as well as uncertainty around migration routes and connectivity to protected sites. The ScotMER process is an important vehicle for helping to address these evidence gaps and uncertainties. We specifically welcome the ScotMER project 'Diadromous Fish in the Context of Offshore Wind – Review of Current Knowledge & Future Research'. This research may change conclusions on how diadromous fish are treated in both EIA and HRA going forward. We have concluded that, based on evidence currently available to us, it is not possible for us to carry out an assessment of diadromous fish to the level required under HRA. We therefore advise that diadromous fish species should be assessed through EIA only and not through HRA. We advise that offshore wind developers should be contributing to ScotMER research as well as other initiatives such as the Wild Salmon Strategy Implementation Plan[2] and any other strategies that are developed for diadromous fish interests.	which has significantly reduced the number of sites being considered since screening. This is clarified in Sections 7.1.3 and 7.1.4.
11/08/2024, HRA	NatureScot	Marine and	We recommend that the study area extends at least one	The maximum tidal excursion recorded

[2] https://www.gov.scot/publications/wild-salmon-strategy-implementation-plan-2023-2028/

Date & Document	Consultee	Topic	Comment received	How and where the comment is considered within the RIAA.
Stage 1 LSE Screening Report		Coastal Processes	tidal excursion out with the Array Area and export cable corridor, rather than the arbitrary distance of 20 km which is currently proposed (HRA Screening Report 4.2, 5.2, 6.2, (Muir Mhòr Offshore Wind Farm Limited, 2023)).	is 15 km (Volume 2, Chapter 7 Marine and Coastal Processes) and therefore this has no material impact on the conclusions of the HRA Screening Report nor RIAA.
17/08/2024, HRA Stage 1 LSE Screening Report	RSPB	Ornithology – Screening for LSE	Due to constraints as to when Digital Arial Surveys (DAS) can be undertaken, RSPB Scotland are doubtful that the surveys will reflect the density of birds with crepuscular and nocturnal flight tendencies. This should be acknowledged and accounted for.	This limitation is acknowledged in "Data Limitations and Assumptions" in Section 11.5 of EIA Chapter 11: Offshore and Intertidal Ornithology (found in Volume 2), and further discussed in the Offshore and Intertidal Ornithology Baseline Report (Volume 3, Appendix 11.1).
17/08/2024, HRA Stage 1 LSE Screening Report	RSPB	Ornithology	**Bio-seasons for Kittiwake and Gannet** The RSPB has outstanding issues with the manner in which the bio-seasons definitions from Furness (2015)[3] have been defined for gannet and kittiwake. This is because by using the "migration-free" seasonal definition as opposed to full breeding season the early and later months of the season are effectively excluded. For example, the kittiwake breeding season is defined as May to July, when evidence from colony monitoring shows that birds are present from April at least to August. In the latter part of the season all birds will have fledged but individual birds will still be present with both young and adult birds coming back to the cliff. These are still SPA birds, and those most likely to be affected by impacts from the development.	NatureScot advice was followed when determining seasonal definitions for gannet and kittiwake, which addresses this RSPB concern and takes into account that these seabirds can be present at their SPA breeding colonies until later in the year.
17/08/2024, HRA Stage 1 LSE	RSPB	Ornithology	**Foraging ranges for Common Guillemot and Razorbill** We welcome using foraging ranges as published in	This RSPB advice corresponds to that given in NatureScot guidance (2023a) and was taken on board for the LSE

[3] Furness, R.W. (2015) Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Reports, Number 16

Date & Document	Consultee	Topic	Comment received	How and where the comment is considered within the RIAA.
Screening Report			Woodward *et al*. (2019) to derive connectivity with SPA colonies. We also recommend that site specific data are examined and where the maximum foraging range from the colony exceeds the generic value, that the site-specific value is used. The exceptions to this are for common guillemot and razorbill. Tracking on Fair Isle showed foraging for both common guillemot and razorbill distances are greater than those of all other colonies. This may relate to poor prey availability during the study. However, trends for seabirds in the Northern Isles indicate this may be becoming a more frequent occurrence. For all designated sites south of the Pentland Firth (i.e. excluding the Northern Isles), we advise use of mean max (MM) plus one standard deviation (SD) discounting Fair Isle values. For clarity, North Caithness Cliffs SPA is considered to lie south of the Pentland Firth.	screening, the outputs of which are presented in Table 7.2.
17/08/2024, HRA Stage 1 LSE Screening Report	RSPB	Ornithology	**Gannet** Whilst the RSPB agree with the majority of the NatureScot advised Avoidance Rates including the use of a 99.2% avoidance rate for non-breeding gannets, in our opinion, a 98% avoidance rate is more appropriate for breeding gannets. This is because the figures used for the calculation of avoidance rates advocated by the SNCBs are largely derived from the non-breeding season for gannet. During the breeding season, gannets are constrained to act as central placed foragers meaning they return to the colony after feeding in order to maintain territories, incubate eggs and provide for chicks. Once chicks have fledged adult gannets remain at sea and no longer visit the colony. Differences in behaviour between the breeding and non-breeding season are likely to result in changes in avoidance behaviour. This seasonally defined change in reactive behaviour will also be reflected in the distributional changes occurring due to the	NatureScot guidance is followed for the impact assessment in relation to CRM (for gannet this will mean using an avoidance rate of 0.993 (±0.0003) for the option 2 stochastic model); however the Offshore and Intertidal Ornithology CRM report (Volume 3, Appendix 11.2) also provides collision estimates for a range of avoidance rates including 98% for gannet in the breeding season.

Date & Document	Consultee	Topic	Comment received	How and where the comment is considered within the RIAA.
			presence of turbines. As such, alongside the 70% displacement rate recommended by NatureScot for the assessment of gannet, we recommend the presentation of 60% displacement rate during the breeding season	
17/08/2024, HRA Stage 1 LSE Screening Report	RSPB	Ornithology	**Prey species** Sandeels are a key food source for a number of seabirds including Black-Legged Kittiwakes, Razorbill, and Puffin. The suitability of this area of sea for sandeels may increases the likelihood that birds will be in the area and therefore increases the potential for impact through collision with the turbines or displacement from the foraging area. It should also be recognised that sandeels are themselves a Priority Marine Features (PMFs) in Scotland due to their ecosystem importance[4], and are vulnerable to impacts from development. Placing a windfarm or cabling on top of a key sandeel spawning and nursery ground could have wider implications for recruitment into the sandeel subpopulation with secondary impacts to seabirds and other sandeel-dependent species. The proposed offshore export cable corridor overlaps with the Turbot Bank Marine Protected Area (MPA). This located in an area of sandy sediment and includes part of the shelf bank and mound feature known as Turbot Bank. This an important site for sandeels, particularly Raitt's sandeel (a UK BAP species) and has been identified as having potential to act as a source of young sandeels for maintaining and restocking surrounding areas. The Proposed Development array boundary is just 30 meters from this designated feature and has also been identified as high intensity spawning grounds (See Figure 9.3 of the EIA Scoping Report) and nursery grounds (See Figure 9.8 of the EIA Scoping	Consideration of impacts to sandeel populations and their designation as a PMF, and as a qualifying feature of the Turbot Bank Nature Conservation MPA (NC MPA), is presented in Section 8.2. Additionally, impacts on this MPA are assessed in Volume 3, Appendix 9.2 (Marine Protected Area Assessment Report).

[4] Case Study: Sandeels in Scottish waters | Scotland's Marine Assessment 2020

Date & Document	Consultee	Topic	Comment received	How and where the comment is considered within the RIAA.
			Report) for sandeel. In accordance with the mitigation hierarchy, we suggest impacts to the Turbot Bank MPA are avoided. We note that paragraph 9.3.10 of the EIA scoping report references the sandeel survey carried out by Beatrice OWF which concluded there was no evidence to suggest that construction of the windfarm had negative impacts on the local sandeel population. This study is useful but is only a single study site and reports just one year's findings post construction. Furthermore, it also does not report the age profile of sandeels. A diverse age profile is crucial to maintain the sandeel and dependant predator populations. It also did not report on the distribution of the sandeels, in particular in relation to their availability to predators such as seabirds which the presence of turbines is likely to change[5]. Subsequent follow up monitoring is necessary to establish whether these results indicate a long-term trend or reflect good winter sandeel survival in 2019-20. We caution against overreliance on this study. The cumulative impacts of windfarms on sandeels, and the secondary impact to seabirds, should be included within the environment statement.	

[5] Trifonova, N. I., Scott, B. E., De Dominicis, M., Waggitt, J. J., & Wolf, J. (2021). Bayesian network modelling provides spatial and temporal understanding of ecosystem dynamics within shallow shelf seas. Ecological Indicators, 129, 107997.

5. PROPOSED DEVELOPMENT OVERVIEW

5.1. LOCATION

5.1.1. The Proposed Development will be located in the North Sea, with the Array Area situated approximately 63 km due east of the Peterhead coastline, detailed in Figure 1-1. As described in the EIAR (Volume 1, Chapter 1 Introduction), the Proposed Development was successfully awarded an Option Agreement granting exclusive rights to develop an OWF within the area proposed. The operational lifetime of the Proposed Development is approximately 35 years.

5.1.2. A baseline geophysical survey was undertaken across the Array Area in 2023, providing geophysical and bathymetric data (EIAR Volume 3, Appendix 9.1 (Offshore Environmental Baseline Survey Reports)).

5.1.3. Across the Array Area the water depths are between 62.0 m and 97.7 m below Lowest Astronomical Tide (LAT). A maximum seabed depth is recorded in the north-eastern corner of the Array Area and the shallowest area is observed in the south-eastern corner of the Array Area. The average seabed depth across the Array Area is 79.9 m below LAT.

5.1.4. The offshore Export Cable Corridor (ECC) has an average water depth of 88.4 m below LAT. A maximum water depth of 118.8 m below LAT is recorded at the Buchan Deep.

5.1.5. Further details of the bathymetry and a description of the seabed composition at the Array Area are presented within EIAR Volume 2, Chapter 7 (Marine and Coastal Processes).

5.2. PROPOSED DEVELOPMENT OVERVIEW

5.2.1. The Proposed Development is split into three distinct areas, which are depicted in Figure 5-1 below and detailed below:

- **Array Area (200 km^2):** This is the offshore energy generation site, where the following key infrastructure is located:
  - Up to 67 WTGs;
  - Up to 67 WTG floating foundations, including their anchors & mooring lines;
  - Up to 250 km of Inter-Array Cables (IAC), which connect the individual WTGs to each other and then to the OEP(s);
  - Up to two OEP(s), where the IAC transition to the export cables; and
  - A single interconnector cable connecting the OEP(s).
- **Offshore ECC (167 km^2):** This is the offshore area containing the export cables which connect the Array Area to the grid connection point on the Scottish mainland.
  - The Offshore ECC includes all the export cabling seaward of MHWS to the limit of the Array Area.
  - There are up to three export cables, each up to 90 km in length.
- **Intertidal Area:** This is the area between MHWS and MLWS where the export cable transitions towards landfall and the onshore infrastructure.
  - The offshore export cables will cross the intertidal area via trenchless techniques such as Horizontal Directional Drilling (HDD).

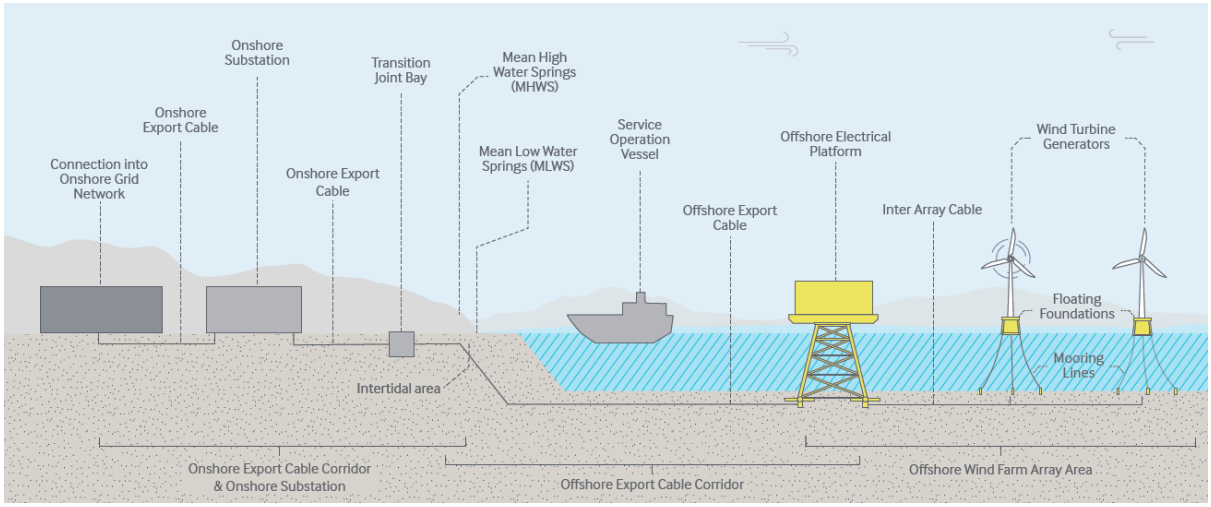


Figure 5-1 Indicative Project Overview[6]

5.3. PROJECT PROGRAMME

5.3.1. An outline of the Project programme for construction of the Proposed Development is provided below. The indicative commencement and completion dates, together with estimated durations of key construction activities, have been used to inform the assessment of construction impacts of the Proposed Development.

5.3.2. Due to the scale of the Proposed Development, it will be built out over a period up to 4 years including site preparation works and snagging activities following installation of the wind turbines prior to final commissioning. The majority of activities will occur over various campaigns targeted at specific areas of the Proposed Development. Most activities will have a maximum duration of three years or less. Although construction activities will typically occur sequentially there are expected to be periods where certain construction activities occur concurrently. For example, anchors and mooring pre-lay and inter-array cables installation.

5.3.3. Indicative outline construction programme includes the following:

- Commencement of offshore construction (site preparation and landfall activities) expected 2030
- Completion of construction (including snagging) expected 2033
- Key construction activity and estimated durations:
  - Site preparation activities: will occur for the first two years of the construction phase but will not be continuous
  - OEP(s) installation: up to one year across one installation campaign
  - Anchors and mooring pre-lay: up to three years across one installation campaign
  - IACs installation: up to three years across three installation campaigns
  - Offshore export cables installation: up to one year
  - WTG and floating substructure installation – up to two years across two installation campaigns
  - Completion and snagging – up to two years across one campaigns period.

[6] Consent is not sought in the Offshore Section 36 Consent Application for the Onshore Export Cable Corridor & Onshore Substation.

6. COMMITMENTS

6.1.1. As part of the project design process the developer has commitments to enable the implementation of standard mitigation and/or guidance. Designed-in avoidance measures have been included to reduce the potential for impacts on environmental receptors. These measures are considered inherently part of the design of the Proposed Development and have therefore been considered in the assessment (i.e., the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry practice for this type of development.

6.2. MARINE MAMMAL COMMITMENTS

6.2.1. As part of the project design process, several designed-in avoidance measures have been included to reduce the potential for impacts on environmental receptors. These measures are considered inherently part of the design of the Proposed Development and have therefore been considered in the assessment (i.e., the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry practice for this type of development. The embedded commitments relevant to marine mammals are presented in the EIAR and in Table 6.1 below. Volume 3, Appendix 6.1 (Commitments Register) provides additional information on how these commitments are secured.

Table 6.1 Embedded commitment measures of relevance to marine mammal receptors

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-04	The infrastructure will be designed in such a way to minimise the impacts and will be within the key parameters set out in the EIA Project Description and EIAR.	Primary	Development Specification and Layout Plan (DSLP)
C-05	Development of a Construction Method Statement (CMS). This will detail the construction procedures (including piling), good working practices for constructing the works, and how the construction-related mitigation steps are to be delivered.	Tertiary	CMS
C-06	Development of and adherence to a Construction Programme (CoP). This will detail the timeline and duration of the primary construction and commissioning activities.	Tertiary	CoP
C-08	Development of and adherence to an Environmental Management Plan (EMP). This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	Tertiary	EMP
C-09	Development of and adherence to a Decommissioning Programme (DP). The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-10	Development of and adherence to a Vessel Management Plan (VMP) (forming part of the Vessel Management and Navigational Safety Plan (VMNSP)). The VMP will confirm the types and numbers of vessels that will be engaged on the Proposed Development and consider vessel coordination including indicative transit	Tertiary	VMP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
	route planning.		
C-14	Development of and adherence to a Piling Strategy (PS) (applicable where piling is undertaken). The PS will detail the method of pile installation and associated noise levels. It will describe any mitigation measures to be put in place (e.g., soft starts and ramp ups, use of Acoustic Deterrent Devices) during piling to manage the effects of underwater noise on sensitive receptors.	Tertiary	PS
C-15	Development of and adherence to Marine Mammal Mitigation Protocol (MMMP). This will identify appropriate mitigation measures during offshore activities that are likely to produce underwater noise and vibration levels capable of potentially causing injury or disturbance to marine mammals. This will be developed alongside the Piling Strategy and referred to in European Protected Species (EPS) licence applications.	Tertiary	MMMP
C-31	UXO hazards will be avoided where practicable and appropriate. If avoidance is not possible, decision making will relate to removal, with detonation considered if avoidance or removal is not possible. If detonation is required, and where practicable and appropriate, low-order deflagration will be the preferred method. Licensing of UXO clearance works will be subject to a standalone Marine Licence (and EPS licence) application. These applications will provide details of measures to minimising impacts on marine mammals where appropriate.	Tertiary	UXO MMMP
C-35	Adherence by vessels to guidelines laid out in the Scottish Marine Wildlife Watching Code	Tertiary	VMP
C-37	Development of and adherence to an Entanglement Management Plan to reduce the potential entanglement risk to marine life.	Tertiary	Entanglement Management Plan
C-38	Development of and adherence to a Project Environmental Monitoring Programme (PEMP), which will set out commitments to environmental monitoring in pre-, during and post-construction phases.	Tertiary	PEMP
C-40	Development of and adherence to a Wet Storage Plan (WSP) to provide details on requirements (if applicable) for assembled WTGs and cabling.	Tertiary	WSP

6.3. OFFSHORE AND INTERTIDAL ORNITHOLOGY COMMITMENTS

6.3.1. The embedded commitments relevant to Offshore and Intertidal Ornithology are presented in the Table 6.2. EIAR Volume 3, Appendix 6.1 (Commitments Register) provides additional information on how these commitments are secured.

Table 6.2 Embedded commitment measures of relevance to offshore and intertidal ornithology

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-02	Development of and adherence to a Cable Plan (CaP). The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and any post-installation monitoring.	Tertiary	CaP
C-04	The infrastructure will be designed in such a way to minimise the impacts and will be within the key parameters set out in the EIA Project Description and EIAR.	**Primary**	DSLP
C-05	Development of a CMS. This will detail the construction procedures (including piling), good working practices for constructing the works, and how the construction-related mitigation steps are to be delivered.	Tertiary	CMS
C-08	Development of and adherence to an EMP. This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	Tertiary	EMP
C-09	Development of and adherence to a Decommissioning Programme. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-10	Development of and adherence to a VMP. The VMP will confirm the anticipated types and numbers of vessels that will be engaged on the Proposed Development and consider vessel coordination including indicative transit route planning.	Tertiary	VMP
C-14	Development of and adherence to a Piling Strategy (PS; applicable where piling is undertaken). The PS will detail the method of pile installation and associated noise levels. It will describe any mitigation measures to be put in	Tertiary	PS

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
	place (e.g., soft starts and ramp ups, use of Acoustic Deterrent Devices) during piling to manage the effects of underwater noise on sensitive receptors.		
C-33	Minimum blade clearance of 30 m above MSL	Primary	DSLP CMS
C-35	Adherence by vessels to guidelines laid out in the Scottish Marine Wildlife Watching Code	Tertiary	VMP
C-36	Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm appropriate lighting and marking mitigation whilst ensuring compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.	Tertiary	LMP
C-37	Development of and adherence to an Entanglement Management Plan to reduce the potential entanglement risk to marine life.	Tertiary	Entanglement Management Plan

6.4. MIGRATORY FISH COMMITMENTS

6.4.1. The embedded commitments relevant to Fish and Shellfish Ecology are presented in Table 6.3 below. EIAR Volume 3, Appendix 6.1 (Commitments Register) provides additional information on how these commitments are secured.

Table 6.3 Embedded commitment measures of relevance to Fish and Shellfish receptors

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-01	Scour protection or other appropriate mitigation to be employed around seabed infrastructure where there is the potential risk for significant scour to develop.	Tertiary	The Cable Plan (CaP) CMS
C-02	Development of and adherence to a CaP. The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and any post-installation monitoring.	Tertiary	CaP
C-04	The infrastructure will be designed in such a way to minimise the impacts and will be within the key parameters set out in the EIA Project Description and EIAR.	Primary	DSLP
C-05	Development of a CMS. This will detail the construction procedures (including piling), good working practices for constructing the works, and how the construction-related mitigation steps are to be delivered.	Tertiary	CMS

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-06	Development of and adherence to a Construction Programme (CoP). This will detail the timeline and duration of the primary construction and commissioning activities.	Tertiary	CoP
C-08	Development of and adherence to an EMP. This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	Tertiary	EMP
C-09	Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-14	Development of and adherence to a PS (applicable where piling is undertaken). The PS will detail the method of pile installation and associated noise levels. It will describe any mitigation measures to be put in place (e.g., soft starts and ramp ups, use of Acoustic Deterrent Devices (ADDs)) during piling to manage the impacts of underwater noise (UWN) on sensitive receptors.	Tertiary	PS
C-15	Development of and adherence to MMMP. This will identify appropriate mitigation measures during offshore activities that are likely to produce UWN and vibration levels capable of potentially causing injury or disturbance to marine mammals. This will be developed alongside the PS and referred to in EPS license applications. Measured implemented within the MMMP will also mitigate impacts on fish within the ZoI.	Tertiary	MMMP
C-29	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the Cable Burial Risk Assessment (CBRA) and detailed within the CaP. In areas where CBRA deems burial not feasible, suitable implementation and monitoring of cable protection will be employed.	Primary	CBRA CaP
C-31	UXO hazards will be avoided where practicable and appropriate. If avoidance is not possible, decision making will relate to removal, with detonation considered if avoidance or removal is not possible. If detonation is required, and where practicable and appropriate, low-order deflagration will be the preferred method. Licensing of UXO clearance works will be subject to a standalone Marine Licence application. These applications will provide details of measures to minimising impacts on marine mammals where appropriate.	Tertiary	Licensing of UXO clearance works will be subject to a standalone Marine Licence.
C-37	Development of and adherence to an Entanglement Management Plan to reduce the potential entanglement risk to marine life.	Tertiary	Entanglement Management Plan
C-38	Development of and adherence to a PEMP, which will set out commitments to environmental monitoring in pre-, during and post-construction phases.	Tertiary	PEMP
C-39	The Turbot Bank NC MPA will not be crossed by the Offshore ECC.	Primary	Development Specification and Layout Plan

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
			(DSLP) CaP
C-40	Development of and adherence to a WSP to provide details on requirements (if applicable) for assembled WTGs and cabling.	Tertiary	WSP

7. STAGE 1: HRA SCREENING

7.1. SCREENING UNDERTAKEN FOR THE PROPOSED DEVELOPMENT ALONE

7.1.1. As noted in Section 3.5 above, the first stage of the HRA process is Screening, this being the process followed to identify the potential for LSE from the Proposed Development, alone and or in-combination, on European sites. Screening for the Proposed Development alone was initially undertaken alongside the EIA Scoping process, with the draft Screening Report issued in July 2023 for consultation.

7.1.2. The HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) included details on all consultation carried out during the Screening process. The Screening information for the Proposed Development alone is summarised in Table 7.2 below, where it presents the features screened in for potential LSE from the Proposed Development alone on a site-by-site basis. For information on sites/features/effects screened out from potential LSE please refer to the HRA Screening Report. The HRA Screening Report also included screening for potential LSE for benthic subtidal and intertidal ecology, which confirmed that no potential for LSE alone or in-combination had been identified.

7.1.3. With regards to migratory fish, the approach to the screening within the RIAA has been updated to be based on the UWN effects on diadromous fish ZoI associated with the Proposed Development. This is 120 km to the relevant estuary mouth associated with a designated site from the array area. This is considered a precautionary screening range on the basis of the consultation response from NatureScot, in which they have advised that diadromous fish be screened out of the HRA due to the uncertainty around pathways for effect (Table 4.1). The original screening range considered all designated sites with migratory fish receptors present within Scottish Territorial waters with an additional 100km range to consider transboundary sites.

7.1.4. Due to this change in the screening range from the HRA screening report, the number of sites screened in for effects on migratory fish has been significantly reduced. The sites originally screened in that are now screened out are not included within Table 7.2, please refer to the HRA Screening Report for clarity on which sites are no longer considered. There is now only one designated site screened in for potential effects on migratory fish features: the River Dee SAC.

7.1.5. With regards to marine mammals, bottlenose dolphins from the Moray Firth SAC are known to regularly transit the east coast of Scotland. Therefore, Moray Firth SAC is screened in as having potential for LSE for bottlenose dolphin. This is due to the location of the export cable corridor and the potential for underwater noise from piling activities and UXO clearance reaching the coastal area.

7.1.6. With regards to Offshore and Intertidal Ornithology, the following updates have been made to the HRA Screening since submission of the initial HRA Screening Report (Muir Mhòr, 2023). This takes account of the consultation feedback, particularly from NatureScot as the statutory conservation adviser, as well as the Royal Society for the Protection of Birds (RSPB) Scotland, with both these stakeholder responses incorporated within the Muir Mhòr Offshore Wind Farm Offshore Muir Mhòr Scoping Opinion (Volume 3, Appendix 5.2) issued in September 2023.

7.1.7. For all relevant detail on the stakeholder consultation carried out, please see Section 4 of this RIAA, as well as Table 12-2 in the Environmental Impact Assessment Report: Volume 2, Chapter 11: Offshore and Intertidal Ornithology.

7.1.8. As a result of this stakeholder feedback on the HRA Screening Report, the following sites have been added to the Stage 1 SPA long list:

- St Abb's Head to Fast Castle SPA (kittiwake, *Rissa tridactyla*)
- Mousa SPA (European storm petrel, *Hydrobates pelagicus*)
- Ramna Stacks and Grunei SPA (Leach's petrel, *Hydrobates leucorhous*)
- Farne Islands SPA (puffin, *Fratercula arctica*; kittiwake)
- Coquet Island SPA (puffin)
- Outer Firth of Forth and St Andrews Bay Complex mSPA (marine SPA)
- Ythan Estuary and Meikle Loch SPA / Ramsar (waterbirds)

7.1.9. Additionally, gannet (*Morus bassanus*) and Manx shearwater (*Puffinus puffinus*) have now been screened in for potential impacts from artificial lighting and from entanglement during wind farm Operation and Maintenance.

7.1.10. For all relevant species where artificial lighting is identified as an impact pathway during Operation and Maintenance, this has now been extended as relevant to consider for Construction and Decommissioning phases also.

7.1.11. The following pathways to impact have been screened out of the offshore and intertidal ornithology assessment, with the associated justifications given in Table 7.1. Accidental pollution is retained for consideration in line with the HRA Screening Report (Muir Mhòr, 2023) and consultation feedback.

Table 7.1 Impacts scoped out of the offshore and intertidal ornithology assessment

Impact Scoped Out	Justification
Construction	
Collision with WTGs	Whilst WTGs will be present once installed during the construction phase, the risk of collision with WTGs is greatest with turbine blades whilst they are in motion. Therefore, collision with WTGs has been scoped out during construction since they will not be operational.
Entanglement	The potential for entanglement to occur with WTG mooring lines is scoped out during the construction phase as marine debris will not have had time to build-up, thus there is no route to this impact.
Operation and Maintenance	
Direct distributional responses with regards to Manx shearwater, Leach's petrel and European storm petrel.	These species have a low/very-low sensitivity to this impact (see Table 11-23 of Volume 2, Chapter 11 of the EIAR), and based on NatureScot (2023e) guidance, have therefore been screened out.
Decommissioning	
Collision with WTGs	Whilst WTGs will be present until removed during the decommissioning phase, the risk of collision with WTGs is greatest with turbine blades whilst they are in motion. Therefore, collision with WTGs is scoped out since they will no longer be operational.
Entanglement	The potential for entanglement is scoped out during the decommissioning phase as they will only be present during this phase for a limited duration before the WTGs and the mooring lines are removed.

7.1.12. Table 7.2 presents the SPAs screened into HRA under Stage 1. There are three types of SPA where likely significant effect (LSE) has been identified for ornithological interests:

- SPA breeding seabird colonies;
- Marine SPAs; and
- Waterbird SPAs / Ramsar sites.

7.1.13. Figure 7-1 presents the overview of these SPAs, with Figure 7-2 ‘zoomed in’ to the Proposed Development location and closest SPAs.

Table 7.2 Sites and features screened in for the assessment of the Proposed Development alone

Designated Site	Distance to the Proposed Development (km)		Feature(s) screened in	Potential for LSE identified		
	Array	Offshore ECC		Construction	O&M	Decommissioning
Marine Mammal Ecology						
Moray Firth SAC	158.5	102	Bottlenose dolphin (*Tursiops truncatus*)	• Injury and disturbance from underwater noise • Collision risk and disturbance from vessels • Changes in water quality • Indirect impacts on prey species	• Injury and disturbance from underwater noise • Collision risk and disturbance from vessels • Changes in water quality • Indirect impacts on prey species • Entanglement • Barrier effects	• Injury and disturbance from underwater noise • Collision risk and disturbance from vessels • Changes in water quality • Indirect impacts on prey species
Offshore and Intertidal Ornithology – SPA breeding seabird colonies						
Buchan Ness to Collieston Coast SPA	61.26	5.86	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Shag	• Direct distributional responses (ECC only) • Changes to prey (ECC only) • Accidental pollution • (ECC only)	• Direct distributional responses • (ECC only) • Changes to prey (ECC only) • Accidental pollution (ECC only)	• Direct distributional responses • (ECC only) • Changes to prey (ECC only) • Accidental pollution (ECC only)
			Guillemot	• Direct distributional responses • Changes to prey • Accidental pollution	• Direct distributional responses • Entanglement • Changes to prey • Accidental pollution	• Direct distributional responses • Changes to prey • Accidental pollution
			Herring gull	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Troup, Pennan and Lion's Heads SPA	90.95	33.27	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Guillemot, razorbill	• Direct distributional responses • Changes to prey • Accidental pollution	• Direct distributional responses • Entanglement • Changes to prey • Accidental pollution	• Direct distributional responses • Changes to prey • Accidental pollution
			Herring gull	• Changes to prey (ECC only) • Accidental pollution (ECC only)	• Changes to prey (ECC only) • Accidental pollution (ECC only)	• Changes to prey (ECC only) • Accidental pollution (ECC only)
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Fowlsheugh SPA	102.00	70.12	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution

Designated Site	Distance to the Proposed Development (km)		Feature(s) screened in	Potential for LSE identified		
	Array	Offshore ECC		Construction	O&M	Decommissioning
			Guillemot	• Changes to prey (ECC only) • Accidental pollution (ECC only) • Direct distributional responses (ECC only)	• Changes to prey (ECC only) • Accidental pollution (ECC only) • Direct distributional responses (ECC only)	• Changes to prey (ECC only) • Accidental pollution (ECC only) • Direct distributional responses (ECC only)
			Razorbill	• Direct distributional responses • Changes to prey • Accidental pollution	• Direct distributional responses • Entanglement • Changes to prey • Accidental pollution	• Direct distributional responses • Changes to prey • Accidental pollution
			Herring gull	• Changes to prey (ECC only) • Accidental pollution (ECC only)	• Changes to prey (ECC only) • Accidental pollution (ECC only)	• Changes to prey (ECC only) • Accidental pollution (ECC only)
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
East Caithness Cliffs SPA	170.43	121.95	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Forth Islands SPA	171.62	158.28	Gannet	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Lesser black-backed gull	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Puffin	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
North Caithness Cliffs SPA	182.09	137.80	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Puffin	• Direct distributional responses • Artificial lighting • Changes to prey	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution

Designated Site	Distance to the Proposed Development (km)		Feature(s) screened in	Potential for LSE identified		
	Array	Offshore ECC		Construction	O&M	Decommissioning
				• Accidental pollution	• Accidental pollution	
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Copinsay SPA	191.19	156.87	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
St Abb's Head to Fast Castle SPA	193.63	184.49	Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Farne Islands SPA	200.21	202.36	Puffin	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution •
Auskerry SPA	203.07	171.43	European storm petrel	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
Hoy SPA	206.08	163.38	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Great skua	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Puffin	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution
Calf of Eday SPA	224.82	197.05	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision	• Changes to prey • Accidental pollution

Designated Site	Distance to the Proposed Development (km)		Feature(s) screened in	Potential for LSE identified		
	Array	Offshore ECC		Construction	O&M	Decommissioning
					• Changes to prey • Accidental pollution	
Rousay SPA	228.35	199.4	Fulmar	• Accidental pollution • Changes to prey	• Accidental pollution • Changes to prey	• Accidental pollution • Changes to prey
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Fair Isle SPA	228.60	216.94	Fulmar	• Changes to prey • Accidental pollution	• Accidental pollution • Changes to prey	• Changes to prey • Accidental pollution
			Gannet	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Great skua	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Puffin	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution
Coquet Island SPA	232.24	236.32	Puffin	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution
West Westray SPA	238.26	205.21	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Marwick Head SPA	240.89	218.63	Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Sumburgh Head SPA	263.36	256.83	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey	• Direct distributional responses	• Changes to prey

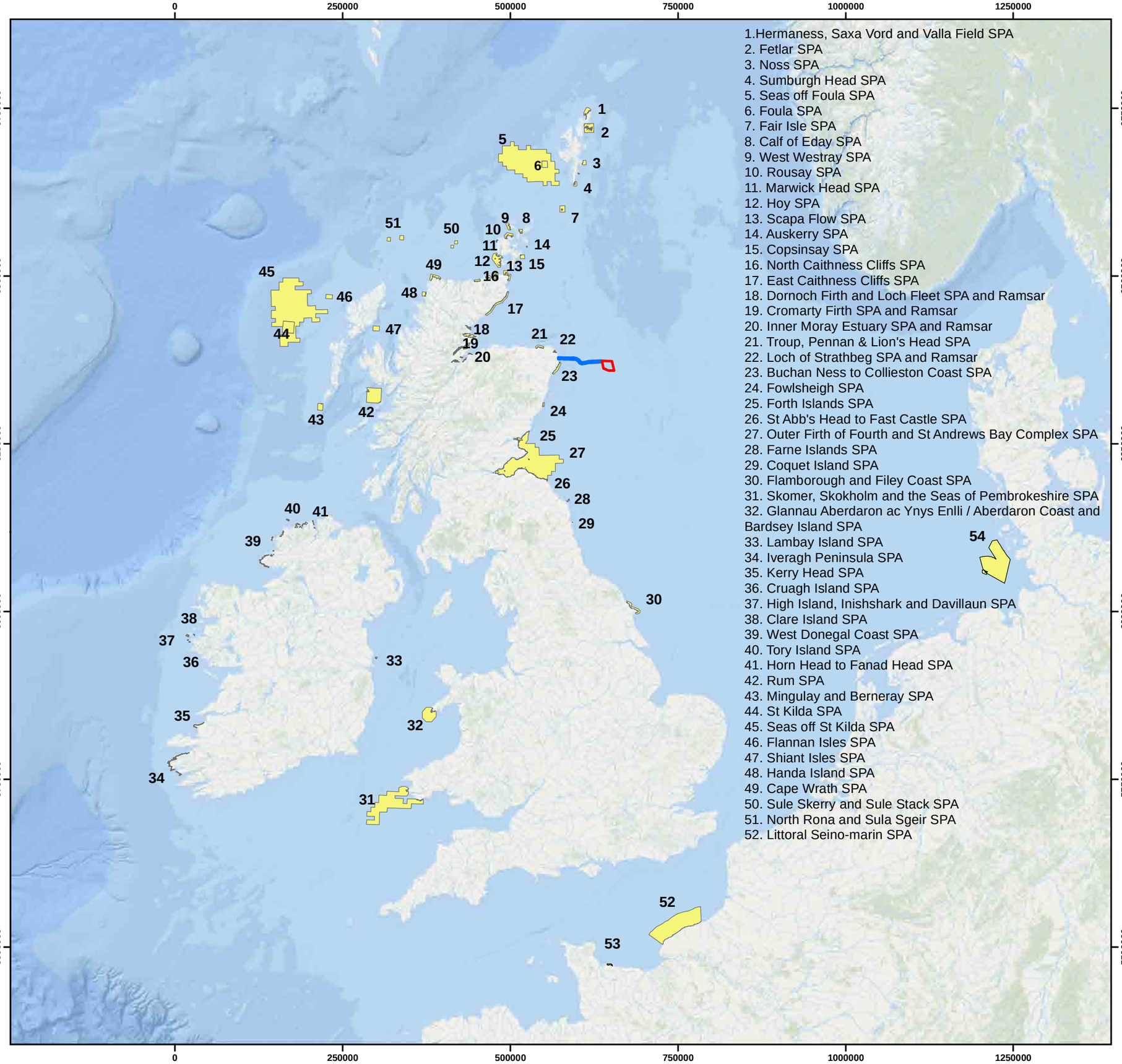
Designated Site	Distance to the Proposed Development (km)		Feature(s) screened in	Potential for LSE identified		
	Array	Offshore ECC		Construction	O&M	Decommissioning
				• Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Accidental pollution
Sule Skerry and Sule Stack SPA	278.45	235.83	Gannet	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Leach's petrel	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
			European storm petrel	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
Mousa SPA	280.22	274.18	European Storm Petrel	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
Cape Wrath SPA	292.92	256.93	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Noss SPA	293.20	288.34	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Gannet	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Great skua	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Foula SPA	299.73	284.00	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Great skua	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey	• Changes to prey • Accidental pollution

Designated Site	Distance to the Proposed Development (km)		Feature(s) screened in	Potential for LSE identified		
	Array	Offshore ECC		Construction	O&M	Decommissioning
					• Accidental pollution	
			Leach's petrel	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
Handa SPA	332.96	294.33	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Great skua	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Fetlar SPA	340.81	337.69	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Great skua	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Flamborough and Filey Coast SPA	344.10	357.35	Gannet	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Ramna Stacks and Grunei SPA	355.00	313.00	Leach's petrel	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
North Rona and Sula Sgeir SPA	355.10	313.44	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Gannet	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Leach's petrel, European storm petrel	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
Hermaness, Saxa Vord and Valla Field SPA	374.56	374.88	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Gannet	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Great skua	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Shiant Isles SPA	412.69	374.24	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Flannan Isles SPA	456.68	424.72	Fulmar	• Changes to prey	• Changes to prey	• Changes to prey

Designated Site	Distance to the Proposed Development (km)		Feature(s) screened in	Potential for LSE identified		
	Array	Offshore ECC		Construction	O&M	Decommissioning
				• Accidental pollution	• Accidental pollution	• Accidental pollution
			Leach's petrel	• Artificial lighting • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
Rum SPA	516.06	482.99	Manx shearwater	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Entanglement • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
St Kilda SPA	526.02	484.56	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Gannet	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			European storm petrel, Leach's petrel, Manx shearwater	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Entanglement • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
			Great skua	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Mingulay and Berneray SPA	574.60	526.86	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Seevogelschutzgebiet Helgoland SPA	610.66	631.94				
Horn Head to Fanad Head SPA	719.71	695.68				
Tory Island SPA	731.34	695.80				
West Donegal Coast SPA	748.72	760.61				
Littoral seino-marin SPA	828.74	852.11				
Clare Island SPA	940.68	920.25				
Lambay Island SPA	943.23	297.93				
High Island, Inishshark and Davillaun SPA	956.61	935.58				
Falaise du Bessin Occidental SPA	966.33	995.52				
Cruagh Island SPA	967.93	951.19	Manx shearwater	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Entanglement • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
Glannau Aberdaron ac Ynys Enlli / Aberdaron	1014.13	996.58	Manx shearwater	• Artificial lighting • Changes to prey	• Artificial lighting • Entanglement	• Artificial lighting • Changes to prey

Designated Site	Distance to the Proposed Development (km)		Feature(s) screened in	Potential for LSE identified		
	Array	Offshore ECC		Construction	O&M	Decommissioning
Coast and Bardsey Island SPA				• Accidental pollution	• Changes to prey • Accidental pollution	• Accidental pollution
Kerry Head SPA	1092.67	1059.00	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Skomer, Skokholm and the Seas off Pembrokeshire SPA	1092.67	1125.54	Manx shearwater	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Entanglement • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
Iveragh Peninsula SPA	1130.23	1128.00	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Offshore and Intertidal Ornithology – Marine SPAs						
Outer Firth of Forth and St Andrews Bay Complex mSPA	145.50	116.72	Gannet	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Kittiwake	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Manx shearwater	• Artificial lighting • Changes to prey • Accidental pollution	• Artificial lighting • Entanglement • Changes to prey • Accidental pollution	• Artificial lighting • Changes to prey • Accidental pollution
			Puffin	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution	• Direct distributional responses • Artificial lighting • Changes to prey • Accidental pollution
Seas off Foula mSPA	269.33	256.76	Great skua	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Seas off St Kilda mSPA	485.41	445.79	Fulmar	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Gannet	• Changes to prey • Accidental pollution	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			Great skua	• Changes to prey • Accidental pollution	• Collision • Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
			European storm petrel	• Artificial lighting	• Artificial lighting	• Artificial lighting

Designated Site	Distance to the Proposed Development (km)		Feature(s) screened in	Potential for LSE identified		
	Array	Offshore ECC		Construction	O&M	Decommissioning
				• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution	• Changes to prey • Accidental pollution
Offshore and Intertidal Ornithology – Waterbird SPAs						
Loch of Strathbeg SPA and Ramsar	71.06	6.66	Sandwich tern	• Changes to prey (ECC only) • Accidental pollution (ECC only)	• Changes to prey (ECC only) • Accidental pollution (ECC only)	• Changes to prey (ECC only) • Accidental pollution (ECC only)
			Goldeneye, Greylag goose, Pink-footed goose, Svalbard barnacle, goose, Teal, Whooper swan	• N/A	• Collision	• N/A
Ythan Estuary and Meikle Loch SPA and Ramsar	74.90	23.47	Eider, pink footed goose, redshank	• N/A	• Collision	• N/A
Inner Firth of Forth SPA	168.84	131.58	Bar-tailed godwit, common scoter, cormorant, curlew, dunlin, eider, golden plover, goldeneye, great crested grebe, grey plover, knot, lapwing, long-tailed duck, mallard, oystercatcher, pink-footed goose, red-breasted merganser, red-throated diver, redshank, ringed plover, scaup, shelduck, Slavonian grebe, turnstone, velvet scoter, wigeon	• N/A	• Collision	• N/A
Dornoch Firth and Loch Fleet SPA and Ramsar	187.38	149.33	Bar-tailed godwit, curlew, dunlin, greylag goose, oystercatcher, redshank, scaup, teal	• N/A	• Collision	• N/A
Scapa Flow SPA	193.30	154.09	Black-throated diver, eider, great northern diver, long-tailed duck, red-breasted merganser, red-throated diver, slavonian grebe	• N/A	• Collision	• N/A
Inner Moray Estuary SPA and Ramsar	199.55	147.35	Bar-tailed godwit, cormorant, curlew, goldeneye, goosander, greylag goose, oystercatcher, red-breasted merganser, redshank, scaup, teal	• N/A	• Collision	• N/A
Cromarty Firth SPA and Ramsar	202.42	152.05	Bar-tailed godwit, curlew, dunlin, greylag goose, knot, oystercatcher, pintail, red-breasted merganser, redshank, scaup, whooper swan, wigeon	• N/A	• Collision	• N/A
Migratory Fish						
River Dee SAC	86.89	29.94	• Atlantic salmon (*Salmo salar*) • Freshwater pearl mussel (*Margaritifera margaritifera*)	Underwater noise		



1.Hermaness, Saxa Vord and Valla Field SPA
2. Fetlar SPA
3. Noss SPA
4. Sumburgh Head SPA
5. Seas off Foula SPA
6. Foula SPA
7. Fair Isle SPA
8. Calf of Eday SPA
9. West Westray SPA
10. Rousay SPA
11. Marwick Head SPA
12. Hoy SPA
13. Scapa Flow SPA
14. Auskerry SPA
15. Copsinsay SPA
16. North Caithness Cliffs SPA
17. East Caithness Cliffs SPA
18. Dornoch Firth and Loch Fleet SPA and Ramsar
19. Cromarty Firth SPA and Ramsar
20. Inner Moray Estuary SPA and Ramsar
21. Troup, Pennan & Lion's Head SPA
22. Loch of Strathbeg SPA and Ramsar
23. Buchan Ness to Collieston Coast SPA
24. Fowlsheigh SPA
25. Forth Islands SPA
26. St Abb's Head to Fast Castle SPA
27. Outer Firth of Fourth and St Andrews Bay Complex SPA
28. Farne Islands SPA
29. Coquet Island SPA
30. Flamborough and Filey Coast SPA
31. Skomer, Skokholm and the Seas of Pembrokeshire SPA
32. Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA
33. Lambay Island SPA
34. Iveragh Peninsula SPA
35. Kerry Head SPA
36. Cruagh Island SPA
37. High Island, Inishshark and Davillaun SPA
38. Clare Island SPA
39. West Donegal Coast SPA
40. Tory Island SPA
41. Horn Head to Fanad Head SPA
42. Rum SPA
43. Mingulay and Berneray SPA
44. St Kilda SPA
45. Seas off St Kilda SPA
46. Flannan Isles SPA
47. Shiant Isles SPA
48. Handa Island SPA
49. Cape Wrath SPA
50. Sule Skerry and Sule Stack SPA
51. North Rona and Sula Sgeir SPA
52. Littoral Seino-marin SPA

Legend:

- Array Area
- Offshore Export Cable Corridor
- SPA

Project:	Report:
Muir Mhòr	RIAA

Location of SPAs designated for ornithological receptors that require Appropriate Assessment

Figure:	7-1	Drawing No:	GoBe-0001	
Revision:		Date:	Drawn:	Checked:
01		20/11/24	MCS	CG

Map scale 1:5,658,804 @ A3

0 70 140 km

N

Co-ordinate system: ETRS 1989 UTM Zone 30N **EPSG:** 25830

MUIR MHÒR OFFSHORE WIND FARM

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Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

525000 550000 575000 600000 625000 650000 675000

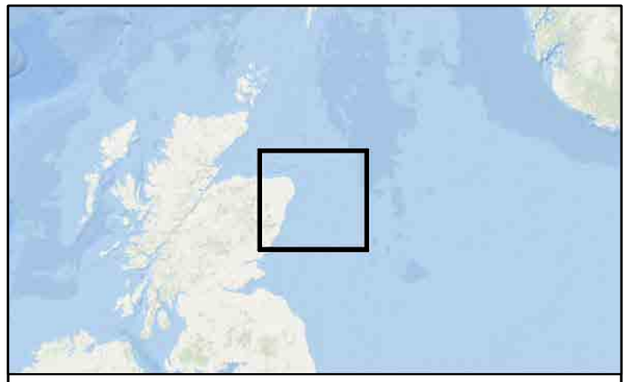
6425000 6400000 6375000 6350000 6325000 6300000

Troup, Pennan
and Lion's Head

Loch of
Strathbeg

Buchan Ness to
Collieston Coast

Fowlsheugh



Legend:

- Array Area
- Offshore Export Cable Corridor
- SPA

Project:	Report:
Muir Mhòr	RIAA

The Array Area, ECC and closeby
SPAs for ornithological receptors

Figure:	Drawing No:
7-2	GoBe-0001

Revision:	Date:	Drawn:	Checked:
01	20/11/24	MCS	CG

Map scale 1:600,000 @ A3

0 7.5 15 km

N

Co-ordinate system: ETRS 1989 UTM Zone 30N **EPSG:** 25830

MUIR MHÒR
OFFSHORE WIND FARM
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7.2. SCREENING UNDERTAKEN FOR THE PROPOSED DEVELOPMENT IN-COMBINATION

7.2.1. The Habitats Regulations include a requirement for the Competent Authority to carry out an AA in respect of the likely significant effects of a plan or project alone and in-combination with other plans or projects, where these are not directly connected with or necessary to the management of the site. Screening for the Proposed Development in-combination was undertaken within the HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023), with updates implemented within this report based on plans and projects screened in in the cumulative assessments of relevant EIAR chapters.

7.2.2. The following list has been applied to the Proposed Development when identifying plans and projects for consideration in-combination. This approach has been derived from relevant advice, including the UK Planning Inspectorate's "Nationally Significant Infrastructure Projects: Advice on Habitats Regulations Assessments" (2024), which is considered relevant to any major projects. The advice addresses which plans and projects to include, with the addition of relevant projects in operation:

- Projects in operation (that do not form part of the baseline or have an ongoing impact);
- Projects that are under construction;
- Permitted application(s) not yet implemented;
- Submitted application(s) not yet determined;
- All refusals subject to appeal procedures not yet determined;
- Projects on the National Infrastructure Planning's programme of projects; and
- Projects 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 and the degree of uncertainty which may be present.

7.2.3. The HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) identified the broad categories of plans and projects to be considered within this RIAA, and a review of the plans and projects considered within each individual topic chapter for the EIAR has been considered to update the list. The relevant cumulative plan/project screening tables to the receptor groups within the RIAA are presented within the EIAR chapters as follows:

- Table 9-36 from EIAR Volume 2, Chapter 9 (Benthic and Intertidal Ecology);
- Table 10-65 from EIAR Volume 2, Chapter 10 (Fish and Shellfish Ecology);
- Table 11-52 from EIAR Volume 2, Chapter 11 (Offshore and Intertidal Ornithology); and
- Table 12-66 from EIAR Volume 2, Chapter 12 (Marine Mammals).

7.2.4. Further details are provided in Section 1, Assessment of Adverse Effects In-Combination. The specific plans and projects relevant to individual receptors draw on those identified within the individual EIAR chapters, as highlighted above, together with any additional plans or projects relevant to the designated site(s) under consideration. The intention of in-combination screening is to determine, for the plans and projects relevant to each receptor group, which of the designated sites screened in for determination of potential LSE alone may be affected by a spatial and/or temporal overlap of effect from a relevant plan or project.

7.2.5. Furthermore, it is acknowledged that the potential contribution to an in-combination AEoSI by the Proposed Development could stem not only from those effects where potential LSE exists in relation to the Proposed Development alone (as highlighted in Table 7.2 above), but also potentially from an aspect of the Proposed Development that is not significant when considered alone, but that may become more relevant in-combination. As such, where the potential exists for the Proposed Development to contribute to potential LSE in-combination this has been considered, immaterial of whether a potential LSE alone applies or not.

7.2.6. The determination of potential LSE in-combination takes into account the following:

- Level of detail available for project/plans;
- Potential for an effect-pathway-receptor link;
- Potential for a physical interaction; and
- Potential for temporal interaction.

7.2.7. The approach applied to screening in-combination is outlined below.

7.2.8. A tiered approach has been applied to the in-combination assessment to reflect the different levels of uncertainty associated with the Proposed Development design and timeframes for the projects screened into assessment. The allocated 'Tiers' reflect the current stage of the relevant projects within the planning and development process. This allows the in-combination impact assessment to consider several future development scenarios, each with a differing potential for being ultimately built out. Appropriate weight may therefore be given to each scenario (Tier) in the decision-making process when considering the potential in-combination impact associated with the Proposed Development.

7.2.9. The tiering structure applied is in common with that within relevant EIAR chapters, with the approach for marine mammals, offshore and intertidal ornithology and migratory fish presented in Table 7.3, Table 7.4, and Table 7.5 respectively. When regarding addressing impacts on marine mammals and offshore and intertidal ornithology, the tiers used are clearly defined in the tables to ensure that there is an understanding of the level of confidence in the in-combination assessment within the RIAA. It is noted that within Tier 1 there is significant variability in project certainty between a project in planning but not yet submitted, a project under construction and a project in operation, specifically as regards the 'final' scheme design and construction programme (noting that the assessment made here draws on the 'consented' and not 'as built' project design envelope).

7.2.10. Experience from other offshore wind projects over many years indicates that the Proposed Development as assessed on application (in terms of worst case design scenario and the overall construction window) is almost always subject to change and generally concludes a much greater effect in terms of impact/ timeframe than the effects of the Proposed Development at the point of construction - e.g. fewer turbines, more clearly defined (and often shorter) construction window, etc.

Table 7.3 Tiers applied for Marine Mammals

Tier	Description
Tier 1	The whole of the Project (both onshore and offshore elements plus wet storage), combined with plans/projects which have become operational since the baseline characterisation of the Project, operational projects that have an ongoing impact, plus those that are consented and are yet to be constructed or under construction.
Tier 2	All plans/projects assessed under Tier 1, plus those projects that have submitted a Scoping Report or those pending determination following a submitted application
Tier 3	All plans/projects assessed under Tier 2, plus those projects that are not currently in the planning system but are likely to enter the planning system in the near future (e.g., Agreement for Lease (AfL) or projects at feasibility / early design stages) where information is available to inform the in-combination assessment and there is sufficient data confidence

Table 7.4 Tiers applied for Offshore and Intertidal Ornithology

Tier	Description
Tier 1	Plans/projects which are either operational (with an ongoing impact of relevance) or which have become operational since baseline characterisation of the Proposed Development, plus those under construction or that are consented and yet to be constructed. Data is available and can be included in a quantitative assessment, i.e., impact modelling (collision risk / distributional response) and population modelling (i.e., PVA).
Tier 2	Plans/projects at application stage (pending determination) for which data is available and can be included in a quantitative assessment.
Tier 3	Plans/projects have submitted a Scoping Report and are in the planning process, but for which there is limited or no data available to be able to inform a quantitative assessment.

Table 7.5 Tiers applied for Migratory Fish

Tier	Description
Tier 1	The whole of the Project (both onshore and offshore elements plus wet storage), combined with plans/projects which have become operational since the baseline characterisation of the Proposed Development, operational projects that have an ongoing impact, plus those that are consented and are yet to be constructed or under construction.
Tier 2	All plans/projects assessed under Tier 1, plus those projects that have submitted a Scoping Report or those pending determination following a submitted application.
Tier 3	All plans/projects assessed under Tier 2, plus those projects that are not currently in the planning system but are likely to enter the planning system in the near future (e.g., Agreement for Lease (AfL) or projects at feasibility / early design stages) where information is available to inform the cumulative assessment and there is sufficient data confidence.

MARINE MAMMAL ECOLOGY

7.2.11. The HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) identified the designated sites and relevant plans and projects to include for in-combination assessment. On a highly precautionary basis, the screening range used to identify projects was based on the species-specific Management Units (MUs). In agreement with NatureScot (through email correspondence on 23rd May 2024), only Scottish projects were considered in the assessment. For marine mammals, the plans and projects screened into the in-combination assessment are provided in Table 7.6 .

7.2.12. Only some of the projects identified in Table 7.6 were brought forward into the in-combination assessment in Section 9.2 on the basis of effect–receptor pathway, data confidence and the temporal and spatial scales involved.

*Table 7.6 Plans and projects identified for the Marine Mammals in-combination assessment (*represents projects brought forward into in-combination assessment in Section 9.2)*

Development Type	Project
Offshore wind farm (floating)	Arven
Offshore wind farm (floating)	Ayre*
Offshore wind farm (floating)	Bellrock
Offshore wind farm	Berwick Bank*
Offshore wind farm (floating)	Broadshore
Offshore wind farm (floating)	Buchan
Offshore wind farm	Caledonia*
Offshore wind farm (floating)	Cenos
Offshore wind farm (floating)	Culzean
Offshore wind farm	Morven
Offshore wind farm (floating)	Ossian*
Offshore wind farm (floating)	Salamander*
Offshore wind farm (floating)	Scaraben
Offshore wind farm	Spiorad na Mara
Offshore wind farm (floating)	Stromar
Offshore wind farm	West of Orkney*
Offshore wind farm (floating)	Aspen
Offshore wind farm (floating)	Beech
Offshore wind farm	Bowdun
Offshore wind farm (floating)	Havbredey
Offshore wind farm	Machair
Offshore wind farm (floating)	Malin Sea Wind
Offshore wind farm (floating)	Talisk

OFFSHORE AND INTERTIDAL ORNITHOLOGY

7.2.13. The HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) identified the designated sites and relevant plans and projects to include for in-combination assessment. For Offshore and Intertidal Ornithology, the screening process was based on the following season-specific criteria:

- Breeding season: Projects were included if they are within foraging distances of screened-in species' colonies. Colonies that are within foraging distance of the Muir Mhòr Array Area and offshore ECC, will be included with foraging distances being those recommended by NatureScot (2023a).
- Non-breeding season: Projects were included if they are in the relevant species-specific BDMPS area as defined by Furness (2015).

7.2.14. The approach to the in-combination HRA Screening for Offshore and Intertidal Ornithology is set out in Section 6.4 of the Muir Mhòr HRA Screening Report (Muir Mhòr, 2023). This identifies the original long list of development plans and projects to consider in assessment (EIA / HRA), as set out in Table 6.4 of the HRA Screening Report.

7.2.15. Wave and tidal projects are not included in the CEA or in-combination assessment as once the Project is operational the distributional responses are considered to be very low and the spatial scale of the projects are generally small (Long, 2017; Fox 2018; Volume 2, Chapter 11). Further to stakeholder advice, the list of projects considered under in-combination assessment is presented below in Table 7.7.

Table 7.7 Plans and projects identified for the Offshore and Intertidal Ornithology in-combination assessment

Development Type	Project	Status	Tier
OWF	Aberdeen Offshore Wind Farm	Operational	Tier 1
OWF	Beatrice Offshore Wind Farm	Operational	Tier 1
OWF	Blyth Demo Phase 1	Operational	Tier 1
OWF	Blyth Demonstration Site	Construction	Tier 1
OWF	Culzean Pilot Offshore Wind Farm	Consented	Tier 1
OWF	Dogger Bank Offshore Wind Farm – Creyke Beck A	Construction	Tier 1
OWF	Dogger Bank Offshore Wind Farm – Creyke Beck B	Construction	Tier 1
OWF	Dogger Bank Offshore Wind Farm – Teeside B (Sofia)	Construction	Tier 1
OWF	Dogger Bank C Offshore Wind Farm – Teeside A	Construction	Tier 1
OWF	Dudgeon Offshore Wind Farm	Operational	Tier 1
OWF	Dudgeon Extension	Consented	Tier 1
OWF	Forthwind demo Offshore Wind Farm	Consented	Tier 1
OWF	Green Volt Offshore Wind Farm (GV)	Consented	Tier 1

Development Type	Project	Status	Tier
OWF	Hornsea Project One	Operational	Tier 1
OWF	Hornsea Project Two	Operational	Tier 1
OWF	Hornsea Project Three Offshore Wind Farm	Consented	Tier 1
OWF	Hornsea Project Four Offshore Wind Farm	Consented	Tier 1
OWF	Humber Gateway Offshore Wind Farm	Operational	Tier 1
OWF	Hywind Offshore Wind Farm	Operational	Tier 1
OWF	Inch Cape Offshore Wind Farm	Construction	Tier 1
OWF	Inner Dowsing Offshore Wind Farm	Operational	Tier 1
OWF	Kincardine Offshore Wind Farm	Operational	Tier 1
OWF	Lincs Offshore Wind Farm	Operational	Tier 1
OWF	Lynn Offshore Wind Farm	Operational	Tier 1
OWF	Methil Demo Offshore Wind Farm	Operational	Tier 1
OWF	Moray East Offshore Wind Farm	Operational	Tier 1
OWF	Moray West Offshore Wind Farm	Construction	Tier 1
OWF	Neart Na Gaoithe Offshore Wind Farm	Construction	Tier 1
OWF	Norfolk Boreas Offshore Wind Farm	Consented	Tier 1
OWF	Pentland Floating Offshore Wind Farm	Consented	Tier 1
OWF	Race Bank Offshore Wind Farm	Operational	Tier 1
OWF	Sandbank Offshore Wind Farm	Operational	Tier 1
OWF	Seagreen Phase 1 Offshore Wind Farm	Operational	Tier 1
OWF	Sheringham Shoal Offshore Wind Farm	Operational	Tier 1
OWF	Sheringham Shoal Extension	Consented	Tier 1
OWF	Teeside Offshore Wind Farm	Operational	Tier 1
OWF	Triton Knoll Offshore Wind Farm	Operational	Tier 1
OWF	Westermost Rough Offshore Wind Farm	Operational	Tier 1
Tidal project	Bluemull Sound Tidal Array	Operational	Tier 1

Development Type	Project	Status	Tier
Tidal project	Deer Sound Tidal Array	Operational	Tier 1
Tidal project	EMEC BIllia Crooo Wave Energy	Operational	Tier 1
Tidal project	EMEC Fall of Warness Tidal Array	Operational	Tier 1
Wave energy	EMEC Scapa Flow Wave Energy	Operational	Tier 1
Tidal project	EMEC Shapinsay Tidal Array	Operational	Tier 1
Tidal project	Inner Sound Tidal Array	Operational	Tier 1
Tidal project	Ness of Duncasby Tidal Array	On hold	Tier 1
Tidal project	Yell Sound Tidal Array	Operational	Tier 1
OWF	Berwick Bank Offshore Wind Farm (BB)	Application	Tier 2
OWF	Ossian Offshore Wind Farm	Application	Tier 2
OWF	West of Orkney Offshore Wind Farm	Application	Tier 2
OWF	Arven Offshore Wind Farm	Planning	Tier 3
OWF	Ayre Offshore Wind Farm	Planning	Tier 3
OWF	Broadshore Offshore Wind Farm	Planning	Tier 3
OWF	Buchan Offshore Wind Farm	Planning	Tier 3
OWF	Caledonia Offshore Wind Farm	Planning	Tier 3
OWF	Cenos Offshore Wind Farm	Planning	Tier 3
OWF	Dogger Bank South East Offshore Wind Farm	Planning	Tier 3
OWF	Dogger Bank South West Offshore Wind Farm	Planning	Tier 3
OWF	Marram Offshore Wind Farm	Planning	Tier 3
OWF	Morven Offshore Wind Farm	Planning	Tier 3
OWF	Outer Dowsing Offshore Wind Farm	Planning	Tier 3
OWF	Salamander Offshore Wind Farm	Planning	Tier 3
OWF	Spiorad na Mara Offshore Wind Farm	Planning	Tier 3
OWF	Stromar Offshore Wind Farm	Planning	Tier 3
Tidal project	Westray South Tidal Array	Planning	Tier 3

MIGRATORY FISH

7.2.16. The HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) identified the designated sites and relevant plans and projects to include for in-combination assessment (plans or projects which are located within 120 km of the designated site). However, Section 8.3 of the Screening Report concludes no potential for effect alone, and therefore migratory fish are scoped out for in-combination assessment.

8. STAGE 2: ASSESSMENT OF ADVERSE EFFECT ARISING FROM THE PROJECT ALONE

8.1. MARINE MAMMAL ECOLOGY

ASSESSMENT CRITERIA

8.1.1. The approach taken to the assessment of marine mammals is based upon the following:

- The distance between the Array Area, offshore ECC, and the relevant designated sites;
- Sensitivity of the receptors (including consideration of the vulnerability, recoverability, value and importance of the receptors);
- Magnitude of impact (drawing on the spatial extent of any interaction, the likelihood, duration, frequency and reversibility of a potential impact); and
- The effects screened in for LSE.

8.1.2. For the RIAA, the assessment of potential for adverse effect relates to the conclusions of EIAR Volume 2, Chapter 12 (Marine Mammals), but specifically in the context of the designated marine mammal features (or supporting habitats), in light of the relevant conservation objectives, site-based advice and feature condition.

8.1.3. All cetaceans are listed under Annex IV of the Habitats Directive, which means that they are protected wherever they occur within a Member State's territory. In addition, some species of cetacean and pinniped are also listed under Annex II of the Directive which requires that the core areas of their habitat are designated as European Sites. Annex II marine mammal species that occur in Irish and UK waters are bottlenose dolphin (*Tursiops truncatus*), harbour porpoise (*Phocoena phocoena*), grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*).

8.1.4. The screening report screened in the following effects for marine mammals during the construction, operation and maintenance (O&M), and decommissioning phases:

- Injury and disturbance from underwater noise;
- Vessel collision risk and disturbance from vessels;
- Changes in water quality;
- Indirect impacts on prey species;
- Entanglement (O&M only); and
- Barrier effects (O&M only).

8.1.5. The site name, distance to Array Area, marine mammal qualifying feature and the effects screened in for each stage of the Proposed Development are summarised in Section 7.1.

UNDERWATER NOISE

8.1.6. The HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) identified several activities that have the potential to introduce an effect - receptor pathway for underwater noise. Potential impacts on marine mammals from underwater noise are dependent upon;

- The noise source characteristics (frequency (Hz) and amplitude (relating to the change in pressure caused by the sound wave which determines the perceived loudness of a sound)); and
- Attenuation of the noise from the source location and the distance of the sound source from the receptor species.

8.1.7. In addition, species and individual animals display variations in levels of sensitivity at different life stages and in different situations (e.g. presence of young). Proposed Development activities that have the potential to cause an impact through underwater noise include piling of foundations, anchors, UXO clearance, other construction activities, geophysical surveys and operational wind turbines.

8.1.8. The impacts of underwater noise on marine mammals relevant to this assessment can be summarised as:

- Physical/physiological effects (e.g. mortality, non-recoverable injury, Permanent Threshold Shift (PTS) in hearing, Temporary Threshold Shift (TTS) in hearing, recoverable injury); or
- Behavioural responses (e.g. displacement, disturbance).

8.1.9. The biological significance of sound relates to how it interferes with an individual's capacity to undertake normal functional behaviours and activities, as well as their ability to reproduce and survive. Sound can impact communication and/or predator/prey detection, for example, which can result in individual and population level consequences (e.g. alterations in individual fitness, abundance, and diversity) and may affect the overall viability of a species (Popper *et al.* 2014). The greater the amplitude of the sound source and the longer the duration the receptor is exposed to it, the greater the likelihood of biological impacts arising from a behavioural disturbance (Popper *et al*. 2014).

8.1.10. To assess impacts of underwater noise, sound sources are typically divided into two categories, impulsive' and 'non-impulsive', based on attributes of the sound source.

8.1.11. Impulsive sound sources, such as those produced by impact pile driving and UXO detonation, are transient and brief (less than a second), broadband and typically consist of high peak pressure with rapid rise time and decay; and

8.1.12. Non-impulsive sound sources, such as those produced by trenching and vessel movements, can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent. Non-impulsive sound sources do not have high peak sound pressure with rapid rise time typical of impulsive sounds.

8.1.13. As sound travels through water, it experiences sound attenuation (where sound waves lose amplitude and intensity due to energy loss through a medium). This phenomenon affects high frequency sounds to a greater degree than lower frequencies. It is also the reason that a sound with impulsive characteristics at the source may, as a result of propagation effects, lose those characteristics (e.g. rapid pulse rise time and high peak sound pressure) and transition into a non-impulsive sound at some distance from the source (Hastie *et al*., 2016; Matei *et al*., 2024). This distance varies depending on the noise source and the environment over which it travels. Because of propagation, the risk of auditory injury is reduced with increasing distance from the source.

8.1.14. Marine mammal species have different hearing sensitivity thresholds resulting in different species detecting underwater noise at varying frequency bands. These differences in hearing thresholds allow for the assessment of how certain noise sources will be detected, and thus affect the marine mammal species identified in the vicinity of the Proposed Development. Underwater noise can only impact marine mammal hearing if the frequency is within their hearing range. Southall *et al.* (2019[7]) categorised marine mammal Functional Hearing Groups (FHGs) of similar species to reflect the broad differences in hearing capabilities among the taxa.

[7] Southall *et al.* (2019) is an update of Southall *et al.* (2007).

8.1.15. Exposure to loud sounds can lead to a reduction in hearing sensitivity at frequencies, referred to as a shift in hearing threshold. With respect to noise assessments for marine mammals, using the criteria outlined in Southall *et al*. (2019), there are two types of impacts considered, PTS and TTS in hearing.

8.1.16. PTS-onset is defined as a permanent change in the hearing sensitivity of an individual to a specific frequency range, with the change in sensitivity associated with damage to the structures within the ear. PTS in hearing is typically regarded as auditory injury. At a Department of Business, Energy and Industrial Strategy (BEIS)-funded expert elicitation workshop in 2018, experts concluded that the magnitude and frequency band in which PTS occurs is critical to assessing the effect on marine mammal vital rates (Booth *et al.,* 2019).

8.1.17. TTS is a temporary change in the hearing sensitivity of an individual to a specific frequency range. TTS is therefore not regarded as injury given its temporary nature and an individual's ability to recover from the impact (i.e. hearing returns to 'normal' over time). TTS thresholds are not intended to indicate a level of impact but are used to enable the prediction of where PTS might occur; therefore, they should not be used for the basis of any assessment of impact significance.

8.1.18. Noise modelling has been undertaken by Subacoustech Environmental to assess the potential impacts on marine mammals because of noise generating activities from the Proposed Development. A quantitative noise modelling assessment of the impact pile driving has been completed using the INSPIRE underwater noise model (see EIAR Volume 3, Appendix 3.1 (Subsea Noise Technical Report)). The model is a semi-empirical noise propagation model based around a combination of numerical modelling and empirical data. It is designed to calculate the propagation of noise in shallow mixed water.

8.1.19. INSPIRE considers a wide array of input parameters including variations in bathymetry and source frequency. Worst case design scenario assumptions have been selected for:

- Piling hammer blow energies;
- Soft start hammer energy ramp up and strike rate;
- Total duration of piling; and
- Receptor swim speeds.

8.1.20. Two locations have been selected for the assessment of PTS and disturbance from pile driving of anchors: the northeast (NE) location in 97.1 m water depth, and the southwest (SW) location, in 61.8 m water depth. The WCS is based on the installation of 10 piled anchors in one day, with a maximum of 2,400 kJ hammer energy.

8.1.21. One central location has been selected for the assessment of PTS and disturbance from pile driving at the OEP location in 73.9m water depth. The location of the OEP(s) is intended to be central within the Array Area, which helps to minimise electrical losses from the Inter Array Cable system. The WCS is based on the installation of six piles in one day, with a maximum of 3,200 kJ hammer energy.

8.1.22. A standard approach of predictive noise modelling, that meets the requirements set by the National Physical Laboratory (NPL) Good Practice Guide 133 for underwater noise measurement (Robinson *et al*., 2014), have been used to assess the potential impacts on marine mammals as a result of cable laying, trenching, vessel noise and UXO clearance. Refer to EIAR Volume 3, Appendix 3.1 (Subsea Noise Technical Report) for further details on the underwater noise modelling method used.

8.1.23. Noise exposure criteria are typically represented by dual exposure metrics for impulsive noise, including the frequency-weighted sound exposure level (SEL; expressed in decibels (dB) re. $\mu Pa^2{}_s$) and the unweighted sound pressure level (SPL; expressed in units relative to 1 µPa in water; ISO 18405, 2017; Juretzek *et al.,* 2021). SEL is a measure of sound energy over multiple exposures (i.e. accumulated over time) and SPL is a measure of absolute exposure.

Exposure criteria for non-impulsive noise sources are given in frequency weighted SEL (expressed in decibels (dB) re. $\mu Pa^2{}_s$). Underwater noise modelling results are expressed further by SEL_{cum} (SEL cumulative; the frequency weighted sound exposure level where the effect takes into account both the received level and duration of exposure) and SPL_{peak} (the unweighted zero to peak Sound Pressure Level as a measure of characterising the amplitude of a sound).

8.1.24. Where SEL_{cum} thresholds are required for marine mammals, a fleeing animal model has been used. As marine mammals are mobile species, this assumes that a receptor, when exposed to high noise levels will swim away from the noise source. In calculating the received noise levels during the piling event, high frequency cetaceans (i.e., bottlenose dolphin which are the only qualifying feature assessed) were assumed to flee at a swim speed of 1.52m/s once the piling commenced. This is considered a conservative estimate, as bottlenose dolphin are expected to be able to swim much faster under stressed conditions (Gallon *et al.,* 2007; Hastie *et al.,* 2016; Kastelein *et al.,* 2018).

8.1.25. Modelling the SEL_{cum} impact ranges of PTS with a 'fleeing animal' model, as is typically used in noise impact assessments, are subject to uncertainties and the result is a highly precautionary prediction of impact ranges. As a result of these uncertainties on animal movement (responsive movement to the sound source), model parameters (such as swim speed), are generally highly conservative and, when considered across multiple parameters, the resulting predictions are very precautionary and very unlikely to be realised.

8.1.26. The SEL_{cum} PTS-onset ranges represent the range an animal must be at the start of the operation to exactly accrue enough noise exposure over the duration of the acoustic event to meet the exposure threshold. To model this, a starting point close to the source is chosen (1m) and the received noise level for each noise event (e.g. pile strike) while the receptor is fleeing is recorded. These values are aggregated into a SEL_{cum} value over the entire operation, with the faster an animal is fleeing, the greater distance travelled between noise events.

8.1.27. The SEL_{cum} threshold for PTS-onset considers the sound exposure level received by an animal and the duration of exposure, accounting for the accumulated exposure over the duration of an activity within a 24-hour period. Southall *et al.* (2019) recommends the application of SEL_{cum} for the individual activity alone (i.e., not for multiple activities occurring within the same area or over the same time). To inform this impact assessment, sound modelling has considered the SEL_{cum} over a piling event.

8.1.28. All underwater noise modelling has been undertaken without mitigation. However, the effects of using an Acoustic Deterrent Device (ADD) can still be inferred from the results. For example, if a receptor were to flee for 20 minutes from an ADD at a rate of 1.5m/s, it would travel 1.8km before piling begins. If a calculated cumulative impact range was below 1.8km, it can be assumed that the ADD will be effective in eliminating the risk of exceedance of the threshold. The noise from an ADD is of a much lower level than impact piling, and as such its overall effect on the total SEL_{cum} exposure would be minimal.

AUDITORY INJURY

8.1.29. For marine mammals, the main impact associated with the offshore infrastructure will be as a result of underwater noise produced during the construction phase. Auditory injury in relation to construction activities (e.g. pile driving) is likely to occur where the source frequencies overlap the range of peak sensitivity for the receptor species rather than across the whole frequency hearing spectrum (Kastelein *et al.,* 2013).

8.1.30. Southall *et al.* (2019) proposed weighted functions to each FHG. These functions are presented across the entire frequency band of a FHG because the direct mechanical damage to the auditory system is restricted to the audible frequency range of a species.

8.1.31. Impact ranges relating to SEL_{cum} indicate the range in which an animal can experience injury if they remain within the impact range during the period of a construction event. Impact ranges relating to SPL_{peak} indicate the range in which an animal can experience instantaneous injury.

8.1.32. With respect to undertaking a quantitative assessment, the SEL values would be calculated over the duration of a discrete noise exposure event. This would be cumulative over multiple repeated noise exposures occurring in relatively quick succession and would be weighted for the relevant FHG (i.e. High Frequency (HF) for bottlenose dolphin). Therefore, SEL can be calculated for impulsive sound sources (i.e. multiple hammer strikes during installation of anchor piles within a 24-hour period) and for non-impulsive sound sources (i.e. operational noise of vessels). The PTS onset thresholds from impulsive noise used in this assessment are those presented in Southall *et al*. (2019; Table 8.1). In this case, the noise criteria for bottlenose dolphins are presented as they are the only marine mammal qualifying feature assessed.

Table 8.1 Noise exposure criteria from Southall et al., (2019) for the PTS in hearing by the FHG for both impulsive and non-impulsive sound sources

Functional hearing group	Species example	Impulsive		Non-Impulsive
		PTS		PTS
		SEL (weighted) in dB re 1 μPa^2_s	SPL Peak (unweighted) in dB re 1 μ Pa	SEL weighted in dB re 1 μPa^2_s
HF cetaceans	Bottlenose dolphin	185	230	198

8.1.33. Bottlenose dolphins are dependent on sound for communication, foraging, and navigation, and are sensitive to underwater noise. Bottlenose dolphins are classified as HF cetaceans, with a generalised hearing range between 150 Hz and 160 kHz (National Marine Fisheries Service (NMFS), 2018; Southall *et al*., 2019). The thresholds for PTS onset for bottlenose dolphin (HF cetacean) are presented in Table 8.1.

8.1.34. With respect to UXO clearance, most of the acoustic energy produced by a high-order UXO detonation is below a few hundred Hz, and there is a pronounced decline in energy levels above 5 to 10 kHz (von Benda-Beckmann *et al*., 2015; Salomons *et al*., 2021). Recent acoustic characterisation of UXO clearance noise has shown that there is more energy at lower frequencies (<100 Hz) then previously assumed (Robinson *et al*., 2022). Therefore, the primary acoustic energy from a high-order UXO detonation is below the region of greatest sensitivity for bottlenose dolphin (Southall *et al*., 2019).

8.1.35. As part of the underwater noise modelling, it has been assumed that a maximum explosive charge in each device is present and either detonates with the clearance (high-order) or alternatively a clearance method such as deflagration (low-order) can be used. On a precautionary basis, UXO clearance for the purposes of this assessment is considered to involve the high-order detonation of the UXO in situ to make it safe to undertake construction works in the surrounding area.

8.1.36. High order detonations are the traditional method for disposing of UXO and involve detonating a counter charge next to the UXO to neutralise it. High order detonations have the potential to kill, injure and disturb marine life (Popper *et al*., 2014). For the Proposed Development, an initial risk assessment determined the worst-case scenario is a UXO with a maximum equivalent charge weight of 750 kg. In addition to this, a range of smaller charge weights have been estimated as 25, 55, 120, 240, 525, 698 kg. An additional donor weight of 0.5 kg has been included to initiate detonation. A low-order clearance scenario has been modelled using a donor charge of 0.25 kg.

8.1.37. With respect to non-impulsive noise (or continuous noise) sources resulting from other works during construction, including cable lying, drilling, rock placement and trenching. The impact ranges for these noise sources are considered using a precautionary assessment scenario of constant operations for 24 hours (EIAR Volume 3, Appendix 3.1 (Subsea Noise Technical Report)).

8.1.38. Geophysical and seismic surveys result in the emission of underwater noise. The preconstruction geophysical and seismic surveys for the Proposed Development are likely to occur over a period of six months within the pre-construction phase (March to October).

8.1.39. Underwater noise levels during the O&M phase are predicted to be considerably lower than those of the construction phase, being limited to noise generated from operational turbines. Underwater noise from an operational floating wind turbine is mainly generated by turbine generators and gear boxes which radiates into water and seabed via the partially submerged turbine tower (Risch *et al.,* 2023). The noise level of a floating WTG is expected to be lower than a fixed-bottom monopile foundation, resulting in a smaller spatial extent of potential impact.

8.1.40. In addition, floating WTGs have the potential to produce mooring-related underwater noise which is not present in fixed offshore wind turbine arrays. It is believed that periodic tension release in the mooring system may produce a “snapping” sound, however, there is still relatively little known about the source of this sound (Martin *et al.,* 2011). The EIAR Subsea Noise Technical Report (Volume 3, Appendix 3.1) predicted that based on the HYWIND Scotland Pilot Park Project analysis, an equivalent potential SEL_{cum} ($L_{E,p,24h}$) for 10 WTGs would be 160 dB re 1 μPa^2_s. This prediction makes a series of worst-case assumptions (e.g., all WTGs producing the maximum number of snaps in a day, equivalent noise levels from multiple locations affecting a receptor to the same degree).

BEHAVIORAL DISTURBANCE

8.1.41. Underwater noise has the potential to cause behavioural change in marine mammals such as displacement and disturbance (Benhemma-Le Gall *et al*., 2024; Brandt *et al*., 2011; Culloch *et al*., 2016; Graham *et al*., 2019; Pirotta *et al*., 2014; Stone *et al*., 2017) which could lead to a loss in foraging opportunities (Nabe-Nielsen *et al.,* 2018) and consequently overall fitness. A quantitative approach has been taken to assess the impacts of disturbance on marine mammal receptors caused by pile driving.

8.1.42. As there is currently no guidance on the thresholds to assess behavioural disturbance from other construction activities, a qualitative assessment was undertaken for these impacts.

8.1.43. Disturbance from piling is addressed using a dose-response, see EIAR Volume 2, Chapter 13 (Marine Mammals). The dose-response is based on harbour porpoise data, which is commonly used as a proxy for bottlenose dolphins, acknowledging that this is likely to be overly precautionary given that harbour porpoises are particularly sensitive to acoustic disturbance. The application of dose-response function, based on current best practice methodology to provide evidence-based estimates rather than the fixed behavioural threshold approach, is used to quantify the probability of a response from an animal to a stressor or stimulus, which will vary according to the dose of stressor or stimulus received by the animal (Dunlop *et al*., 2017). It is based on the assumption that not all animals in an impact zone will respond, unlike traditional methods of threshold assessment. Noise contours were generated at 5 dB intervals and overlain on species density surfaces to predict the number of animals potentially disturbed. EIAR Volume 2, Chapter 12 (Marine Mammals) also uses a Level B threshold for comparison in the assessment of behavioural disturbance, due to the overly precautionary nature of using a harbour porpoise dose response for bottlenose dolphin.

8.1.44. iPCoD modelling was used to inform the potential for population level impacts from the predicted amount of disturbance resulting from piling. Two piling scenarios were used to cover a range of potential piling period:

- Piling scenario 1: assumes the piling of OEP jacket piles on 24 days and WTG anchor piles on 151 days, resulting in a total of 175 piling days between June 2029 and June 2031 inclusive; and
- Piling scenario 2: assumes the concurrent piling of OEP jacket piles and WTG anchor piles, resulting in 24 jacket piling days (of which 12 occur concurrently with anchor piles) and 151 anchor piling days (of which 12 occur concurrently with jacket piles), resulting in a total of 163 piling days between June 2029 and June 2031 inclusive.

8.1.45. Further details on the parameters and assumptions used in the iPCoD modelling are outlined in EIAR Volume 2, Chapter 12 (Marine Mammals).

8.1.46. For UXO clearance an Effect Deterrence Range (EDR) has been used to determine the impact area. The impact range for high-order clearance is 26 km as recommended by Tougaard *et al.* (2013) based on calculations using data from Dähne *et al.* (2013). There is no empirical data upon which to set thresholds for low-order UXO clearance. Therefore, for the purpose of the assessment, an EDR of 5 km has been assumed for low-order UXO clearance, which is based on worst-case EDRs provided by the Joint Nature Conservation Committee (JNCC) Marine Noise Registry (JNCC, 2023).

8.1.47. EIAR Volume 2, Chapter 12 (Marine Mammals) further identifies TTS-onset thresholds as a proxy for disturbance for UXO clearance. An estimation of the extent of behavioural disturbance can be based on the sound levels at which the onset of TTS is predicted to occur from impulsive sounds.

VESSEL COLLISION RISK AND DISTURBANCE FROM VESSELS

VESSEL DISTURBANCE

8.1.48. Vessel disturbance is likely driven by a combination of underwater vessel noise and the physical presence of the vessel itself (e.g. Pirotta *et al*., 2015). It is often difficult, if not impossible, to attribute the cause of disturbance to one or the other. Disturbance from vessels is therefore assessed in general terms separately from underwater noise assessments, covering disturbance driven by both underwater noise and vessel presence.

8.1.49. Disturbance and/or displacement caused by the physical presence of construction vessels (which may not be directly attributable to noise) can cause marine mammals to stop feeding, resting, travelling and/or socialising, with possible long-term effects of repeated disturbance including loss of weight, condition, and a reduction in reproductive success. It has been documented that bottlenose dolphins exhibit behavioural responses (e.g., surface-active behaviours) to an increase in number and/or close approaches by vessels (Lusseau, 2006; Heiler *et al.,* 2015). Activities that have the potential to result in a disturbance from the physical presence of vessels are greater during the construction phase when more vessels are on site, undertaking geophysical surveys, UXO clearance, piling and other construction activities, such as seabed preparation and cable laying.

8.1.50. The presence of vessels will be a factor during all phases of the development. Disturbance from vessel noise is only likely to occur where increased noise from vessel movements is greater than the background ambient noise. The magnitude and characteristics of vessel noise varies depending on ship type, ship size, mode of propulsion, operational factors and speed with vessels of varying size producing different frequencies, generally lower frequency with increasing size (Wilson *et al.,* 2007). The amount of noise that a ship produces is largely dependent on the engine revolution count and therefore the speed of the vessel, the acoustic quality of equipment on board (generators, cranes, etc.) and whether sound-reducing technologies and sound-dampening materials have been used. A key factor here is if the ship's propellor has been designed and maintained to reduce cavitation.

8.1.51. Vessel noise from medium to large-sized construction vessels will result in an increase in the level of non-impulsive and continuous sound within and around the Proposed Development. Vessels and associated equipment generally emit low frequency noise, such as large vessels

(up to 10 kHz), small vessels (up to 40 kHz), low-frequency active sonar (<1 kHz) and mid-frequency active sonar (1-10 kHz; Duarte *et al*. 2021).

8.1.52. The general characteristics of commercial vessel noise is dominated by sounds from propellers, thrusters and various rotating machinery. In general, noise from support and supply vessels (50 to 100 m in length) are expected to have broadband root mean square (RMS) SPL source levels ranging 165 to 180 dB re 1µPa @1m, with the majority of energy below 1 kHz (Oslo and Paris Conventions (OSPAR), 2009), whereas large commercial vessels (>100 m in length) produce relatively loud (180-190 SPL_{rms} dB re 1µPa @1m or greater) and predominately low frequency sounds, with the strongest energy concentrated below several hundred Hz (OSPAR, 2009; Erbe *et al*., 2019). Small vessels are reported to emit source levels of 130-175 SPL_{rms} dB 1µPa@1 m with higher frequency bands (above 1kHz) compared to large ships (Erbe *et al*., 2019). These frequencies overlap across the hearing sensitivity range of delphinids (i.e., 150 Hz – 160 kHz) (Southall *et al.,* 2019).

VESSEL COLLISION RISK

8.1.53. The area surrounding the study area already experiences a high density of vessel traffic, see Volume 2, Chapter 14 (Shipping and Navigation) within the EIAR for full details. The Navigational Risk Assessment for the Proposed Development (EIAR Volume 3, Appendix 14.1) recorded a maximum of 49 vessels on site at one time. This includes main installation vessels (e.g. jack-up or DP vessels with heavy lifting equipment), support vessels (including Service Operation Vessels (SOVs), tugs and anchor handlers, cable installation vessels, guard vessels, survey vessels, crew transfer vessels and scour/cable protection installation vessels. In addition, it is possible that helicopters will be used for crew transfers.

8.1.54. During all phases of the Proposed Development, a potential source of impact to marine mammals is from increased vessel activity resulting in physical trauma and/or death from collision with a vessel. Possible injuries include blunt trauma to the body or injuries consistent with propeller strikes. The risk of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed with which it is travelling (Laist *et al*., 2001) and indirectly by ambient noise levels underwater, and the behaviour the animal is engaged in.

8.1.55. There is currently a lack of information on the frequency of occurrence of vessel collisions as a source of marine mammal mortality. There is little evidence from marine mammals stranded in the UK that injury from vessel collisions is an important source of mortality. The UK Cetacean Strandings Investigation Programme (CSIP) documents the annual number of reported strandings and the cause of death for those individuals examined at post-mortem. The CSIP data shows that very few strandings have been attributed to vessel collisions, therefore, while there is evidence that mortality from vessel collisions can and does occur, it is not considered to be a key source of mortality highlighted from post-mortem examinations. However, it is important to note that the strandings data are biased to those carcasses that wash ashore for collection and therefore may not be representative.

8.1.56. With respect to this assessment, bottlenose dolphins will largely avoid collision because they are relatively small, highly mobile, and given observed responses to noise, are expected to detect vessels in close proximity. Predictable and slow vessel movement is known to be a key aspect in minimising the potential risks to marine mammals imposed by vessel traffic (Nowacek *et al*., 2001; Lusseau, 2003; 2006).

8.1.57. Construction vessels will comprise of installation vessels and smaller support vessels. Installation vessels include those for foundation, WTG and OEP installation and cable-lay vessels.

8.1.58. During O&M activity the WCS equates to a maximum of 12 daily Crew Transfer Vessel (CTV) trips with up to 509 vessel trips in total to support schedule routine and non-routine maintenance per year over an approximately 35-year operational period.

8.1.59. For decommissioning the number of vessels will be less than the predicted number for the construction phase.

8.1.60. Construction vessels are large (up to 80-100 m long), which normally stay offshore for 2-4 weeks before returning to port. They are either stationary (e.g. using dynamic positioning), jacked up or slow-moving on-site. The majority of vessels found within the Proposed Development site boundary will be CTVs. They are between 18 and 30+ meters in length, typically comprising twin aluminum hulls combined with high power propulsion system to obtain high bollard push against the wind turbine for transfer procedure of technicians offshore. Vessels transiting to site have the maximum potential for vessel collision risk with marine mammals. For all phases of the Proposed Development, vessel traffic will move along designated routes around the Array Area, and to/from port to the offshore infrastructure, as detailed within the VMP (part of VMNSP).

CHANGES IN WATER QUALITY

8.1.61. Changes in water quality could occur as a result of the accidental release of fuels, oils, and/or hydraulic fluids associated with the construction, O&M, and decommissioning of infrastructure and service/supply of vessels. In addition, increases in suspended sediment (e.g., during cable laying) may lead to changes in water quality. This has the potential direct impact on bottlenose dolphins or a reduction in prey availability either of which may affect species' survival rates.

8.1.62. With planned mitigation protocols under the Environmental Management Plan being used to manage this risk, it is anticipated that no accidental pollution events would occur; however, mitigation cannot be taken into account at screening. Therefore, accidental pollution has remained screened in for the construction, O&M, and decommissioning phases of the Proposed Development.

INDIRECT EFFECTS ON PREY SPECIES

8.1.63. As marine mammals are dependent on fish prey, there is a potential for indirect effects on marine mammals as a result of direct impacts on fish species or habitats that support them. During construction activities, there is a potential for impacts upon these fish species, including direct damage (e.g. crushing) and disturbance, temporary increase in Suspended Sediment Concentration (SSC) and sediment deposition, seabed disturbance leading to the release of sediment contaminants and / or accidental contamination, and additional underwater noise and vibration leading to mortality, injury, behavioural changes or auditory masking in fish.

8.1.64. The loss of habitats and the loss/disturbance of invertebrate species and displacement of fish from fishing grounds (and associated effect on reproductive success and survival) could affect prey availability. The presence of WTGs may exclude fish from suitable habitat by providing a physical or perceptual barrier or producing levels of noise that result in avoidance behaviour. Whilst it is considered that alternative feeding areas may be available to marine mammals, the Array Area and Offshore ECC may create a net loss of available feeding area. There may also be a knock-on effect on adjacent fish populations arising from increased competition for prey species in adjacent areas (AECOM, 2010).

8.1.65. As generalist feeders, bottlenose dolphins demonstrate a varied diet and ability to adapt to changes in availability of prey types. Species mostly include bottom dwelling fish or larger pelagic fish such as salmon, plaice, eels, small sharks, rays, hermit crabs, shrimps and mullet (Berrow *et al*. 2010; Hernandez-Milian *et al*., 2011; Santos *et al*., 2001).

8.1.66. Fish are vulnerable to underwater noise associated with piling or UXO clearance with different species having varying sensitivity to construction activities (Popper *et al.,* 2014). Similar to marine mammal species, the impacts can have a range of effects including behavioural changes, TTS and recoverable injury and mortality, with the extent of impact dependent on the prey species group. Whilst underwater noise associated with piling or UXO clearance may

result in localised mortality of fish, this is not predicted to result in wider scale effect and has no potential to result in population level impacts. Whilst disturbance associated with underwater noise may displace fish from a local area, the behaviour of fish in response to underwater noise is highly variable (e.g. Hawkins *et al*., 2014), and dependent on the behaviour which the fish is engaged with (e.g. Skaret *et al*., 2005).

ENTANGLEMENT

8.1.67. The offshore infrastructure associated with the Proposed Development may pose the risk of entanglement of marine mammals in mooring lines and dynamic cables. Entanglement occurs when an individual becomes captured within a mooring line, which can potentially lead to injury and mortality. The risk of entanglement is dependent on several physical factors (mooring tension, swept volume and curvature) and biological factors (body size, animals' ability to detect moorings, body flexibility and general feeding modes) (Benjamin *et at.,* 2014).

8.1.68. There are three types of entanglement risk associated with the Proposed Development; primary, secondary and tertiary entanglement. Primary entanglement involves the animal becoming directly entangled in the mooring lines and dynamic cables. Secondary entanglement involves animals becoming entanglement in marine debris which is caught on the lines and cables. Tertiary entanglement involves animals that have already been entangled with marine debris in another location getting snagged on mooring lines and cables within the Array Area.

8.1.69. Three different mooring configurations are presented in EIAR Volume 1, Chapter 3 (Project Description); catenary, semi-taut and taut. Catenary moorings have the highest risk of entanglement and are therefore considered the worst-case scenario. The Proposed Development will be utilising large diameter lines to create the mooring system, with a minimum diameter between 80 mm and 450 mm. Cables will have a minimum diameter of 150 mm and a maximum diameter of 250 mm.

BARRIER EFFECTS

8.1.70. Offshore floating wind infrastructure installations may cause barrier effects to marine mammals. There are no particular activities that have the potential to cause barrier effects from the physical presence of the offshore infrastructure; however, it is the presence of the infrastructure itself that poses the risk, which will occur during the O&M phase of the Proposed Development. The total Array Area for the Proposed Development will extend over 200 km^2 and the lateral cross section of the mooring system in the water column will be 10,800 km^2.

8.1.71. Barrier effects occur when a wind farm creates a physical obstacle to an animal's movement, potentially to and from important breeding or nursey sites, foraging grounds or migratory pathways. This could mean individuals would avoid the offshore wind farm site, resulting in an increased energetic cost to individuals through increased distances travelled and/or decreased foraging efficiency.

WORST CASE DESIGN SCENARIO

8.1.72. Table 8.2 below provides the Worst-Case Design Scenario(s) considered for marine mammals in relation to impacts. The full project description is provided in EIAR Volume 1, Chapter 3 (Project Description) for full reference.

Table 8.2 Worst case Design Scenario for effects on marine mammals

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
Construction			
PTS from geophysical surveys Disturbance from geophysical surveys	C-14, C-15	The geophysical survey will comprise the survey equipment listed below: • Multibeam Echo Sounder (MBES) Bathymetry; • Sidescan sonar (SSS); • Sub-bottom profiling (SBP); • Ultra-High Resolution Seismic (UHRS); • Magnetometer (MAG); and • Ultra-short Baseline (USBL). The geophysical survey campaign will take place over 6 months	Survey methods and duration of the survey campaign represent the maximum potential for underwater noise impacts. NOTE: Geophysical surveys are licensed under a separate Marine Licence but are included in this RIAA impact assessment for illustrative purposes.
PTS from UXO clearance Disturbance from UXO clearance	C-15, C-31	The primary method will be low-order deflagration, but high-order clearance is assessed as the realistic worst-case scenario. UXO clearance is anticipated to take place from the year prior to offshore construction commencing, potentially running concurrently with the first year of offshore construction.	A detailed UXO survey will be completed prior to construction to determine the maximum size of the UXO, number of UXOs to be cleared and clearance method, representing the maximum potential for direct and indirect effects. NOTE: UXO clearance will be licensed under a separate Marine Licence but is included in this RIAA impact assessment for illustrative purposes.
PTS from piling Disturbance from piling	C-15	Anchors: • Maximum of 67 WTGs on floating foundations; • Maximum of nine anchors per WTG, 1 pile per anchor, 603 piles for 67 WTGs; • Maximum anchor pile diameter of 4 m; • Maximum hammer energy of 2,400 kJ; • Maximum number of piling days: 151 (assumes 4 piled anchors per day); • Concurrent piling at two locations; • Maximum number of piles installed in 24 hours: 10; and • More likely number of piles installed in 24 hours: five. Offshore Electrical Platform (OEP): • Maximum of two jacket platforms; • Maximum 12 piles per platform; • Maximum pile diameter shall be five m; • Maximum hammer energy of 3,200 kJ; • Maximum number of piles installed in 24 hours: six; • More likely number of piles installed in 24 hours: four; • Maximum number of piling days: 24; and • Concurrent piling of OEP with single anchor location. Total duration of piling = 151 days (WTGs) + 24 (OEP(s)) = 175 days OEP piling: May to Aug 2030 Anchor piling: March to October 2029, 2030, and 2031	Temporal worst case: scenario with the largest number of piling days. Spatial worst case: concurrent piling at two locations provides the largest impact area for both auditory injury and disturbance.
PTS from other construction noise Disturbance from other construction noise		Other noise producing activities considered include: • cable plough; • jet trencher; • mechanical trenching; • drilling; and • rock placement.	Construction methods and duration of construction activities represent the maximum potential for underwater noise impacts.

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
		Construction will take place over approximately four years (2029 to 2032).	
Disturbance from vessels	C-10	The type and number of vessels on site: • Survey vessel (environmental, geophysical, geotechnical): ≤6; • Construction Support Vessels (CSV) (Light Construction Vessel (LCV), Guard Vessel (GV), CTV/daughter craft): ≤ 6; • Anchor and mooring pre-lay vessels (Anchor Handling Construction Vessel (AHCV) or CSV, Anchor Handling Tug (AHT)): ≤ 6; • IAC installation, pull-in and burial (CSV, Cable Lay Vessel (CLV), Installation Support Vessel (ISV), SOV): ≤ 9; • Floater tow-out and hook-up (AHT, AHCV, ISV, SOV): ≤ 7; • WTG integration (Jack-Up Vessel (JUV), CTV/daughter craft, SOV): ≤ 6; • Export cable installation (LCV, CSV, CLV, Flexible Fallpipe Vessel (FFPV), CTV): ≤ 7; • Substation installation (Heavy Lift Vessel (HLV), AHT, Heavy Transport Vessel (HTV), jack-up barge, SOV): ≤ 6; • Miscellaneous vessels (FFPV, ISV, SOV, LCV, CSV): ≤ 3; • Maximum number of vessels expected to be on site at the same time: 21; and • Realistic number of vessels expected to be on site at the same time: 10. Round trips: • Survey vessel (environmental, geophysical, geotechnical): ≤168; • Construction support vessels (LCV, GV, CTV/daughter craft): ≤444; • Anchor and mooring pre-lay vessels (AHCV or CSV, AHT): ≤201; • IAC installation, pull-in and burial (CSV, CLV, ISV, SOV): ≤100; • Floater tow-out and hook-up (AHT, AHCV, ISV, SOV): ≤201; • WTG integration (JUV, CTV/daughter craft, SOV): ≤445; • Export cable installation (LCV, CSV, CLV, FFPV, CTV): ≤60; • Substation installation (HLV, AHT, HTV, jack-up barge, SOV): ≤36; and • Miscellaneous vessels (FFPV, ISV, SOV, LCV, CSV): ≤56. Construction will take place over approximately four years (2029 to 2032).	The maximum number of vessels and associated vessel movements represents the maximum potential for disturbance.
Changes in water quality	C-38	**Total SSC released because of construction activities = 12,718,031 m^3**	Defining the Worst-Case Design Scenario for sediment disturbance activities is highly complex as the disturbance will be temporally and spatially variable (depending upon the metocean conditions at the time). For sediment plumes, the Worst-Case Design Scenario is intended to be representative in terms of peak concentration, plume extent and plume duration but will not correspond to a single sediment disturbance activity. The same applies for sediment deposition at the bed, where the Worst-Case Design Scenario is a representation of maximum deposit thickness, maximum footprint extent or likely duration. **Seabed preparation prior to foundation installation** Seabed preparation works, including boulder clearance, would be required prior to installation of certain foundation types. **Foundation installation (without drilling)** The installation of certain anchoring options will result in the
Indirect impacts on prey species associated with Increases in Suspended Sediment Concentrations (SSCs) and deposition of disturbed sediments to the seabed.	**C-02, C-09, C-34**	**Foundation installation (without drilling) = 6,030,000 m^3** *WTGs:* • Maximum sediment disturbance volume from 67 floating WTGs using drag embedded anchors with nine anchors per foundation (603 anchors total * 200m drag * 50 m target box = 6,030,000 m^2. **Foundation with drilling = 478,790 m^3** *WTGs:* • Anchor piles with a maximum diameter of 4 m to be drilled to a depth of 60 m below the seabed = 754 m^3 of drill arisings per pile; and • Maximum volume of drill arisings from 67 floating WTGs using piled anchors with nine anchors per foundation (603 anchors total) = 454,662 m^3. *OEP(s):* • Piled foundations for two jacket foundation OEP(s) with a maximum pile diameter of 4 m to be drilled to a depth of 80 m below the seabed = 1,005 m^3 of drill arisings per pile; and • Maximum volume of drill arisings from two OEP(s) with piled foundations for each OEP	

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
		having 2 piles per jacket leg and 6 jacket legs 12 piles total per OEP = 24,128 m^3 . **Cable Installation = 1,432,800 m^3** *Inter-array cables* • Inter-array cable installation method = Jetting; • Total IAC length on seabed = 250 km; • IAC cable seabed width = 3 m; • IAC cable burial depth = 2 m; • IAC trench cross sectional area = 6 m^2; • Assuming 30% of material is forced into suspension in the water column; • Maximum sediment disturbance volume = 250,000 m x 6 m^2 = 1,500,000 m^2 x 0.3 (spill factor) = 450,000 m^3; and • Assumed maximum installation rate of up to 700 m/hr. *OEP Interconnector Cable* • Interconnector cable installation method = Jetting; • Total length of Interconnector cable 3 km; • Interconnector cable seabed width = 3 m; • Interconnector cable burial depth = 4 m (excludes burial in sandwaves of up to 20 m); • Interconnector cable trench cross sectional area = 12 m^2; • Assuming 30% of material is forced into suspension in the water column • Maximum sediment disturbance volume = 3 ,000 m x 12 m^2 x 0.3 (spill factor) = 10,800 m^3; and • Assumed maximum installation rate of up to 700 m/hr. *Export cables* • Export cable installation method = Jetting; • Total length of three export cables = 270 km, each up to 90 km in length from array area to landfall; • Export cable seabed width = 3 m; • Export cable burial depth = 4 m (excludes burial in sandwaves of up to 20 m); • Export cable trench cross sectional area = 12 m^2; • Assuming 30% of material is forced into suspension in the water column; • Maximum sediment disturbance volume = 270 ,000 m x 12 m^2 x 0.3 (spill factor) = 972,000 m^3; and • Assumed maximum installation rate of up to 700 m/hr. **Seabed preparation for cable installation = 4,776,000 m^3** *Inter-array cables* • Seabed preparation method = Pre-Laid Grapple Runs (PLGR); • Total length inter-array cables = 250 km, up to 100 % of which require seabed preparation; • Maximum area of seabed affected = 250,000 m (100 % of total inter-array cable length) x 3 m (maximum width of disturbance) = 750,000 m^2; and • Maximum sediment disturbance volume = 750,000 m (area affected) x 2 m depth = 1,500,000 m^3. *OEP Interconnector Cable* • Seabed preparation method = PLGR; • Total length of up to three export cables = 3 km, up to 100 % of which require seabed	release of disturbed sediments. The greatest sediment release is anticipated to be from the installation of drag-embedded anchors, although the impact of potential sediment plumes is expected to be of relatively short duration and in close proximity to the bed. Drag-embedment anchors derive their holding capacity from being buried, or embedded in the sea floor and are installed by means of dragging, using a mooring chain. **Drilling as part of foundation installation** Of the anchoring options under consideration, the greatest sediment release is anticipated to be from the drilling of anchor piles. While some of the other options could result in the release of large sediment volumes (for example drag embedded anchors), the impact of these is expected to be of relatively short duration and in close proximity to the bed. Drilling has the potential to release larger volumes of relatively finer sediment as a result of the site geology. The worst-case assumption of the drill arisings being release at the surface of the water column has been adopted. **Cable Installation** Cable installation may require some combination of (e.g.) jetting, ploughing, trenching and/or cutting type installation techniques. The realistic worst-case option is represented by the use of jetting, having the greatest potential to fluidise and suspend fine sediments and therefore resulting in the largest amount of displaced sediment in the water column, with a realistic trenching rate of 500 m/hr and maximum trenching rate of 700 m/hr representing the highest release rate of sediments, and operating in locations with the largest contribution of fine sediments. **HDD Operations** Although other trenchless installation technologies are available, HDD is the established solution and has therefore been identified as the realistic worst-case option. HDD operations are expected to have localised and short-term impacts on SSC concentrations due to the potential release of bentonite (or drilling mud) during the punch-out in the nearshore exit pit. Accordingly, the total drilling fluid loss = 75 m^3 (3 conduits, 25m^3 per conduit).

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
		preparation; • Maximum area of seabed affected = 3,000 m (100 % of total interconnector cable length) x 3 m (maximum width of disturbance) = 9,000 m^2; and • Maximum sediment disturbance volume = 9,000 m^2 (area affected) x 4 m depth = 36,000 m^3. *Export cables* • Seabed preparation method = PLGR; • Total length of up to three export cables = 270 km, up to 100 % of which require seabed preparation; • Maximum area of seabed affected = 270,000 m (100 % of total export cable length) x 3 m; (maximum width of disturbance) = 810,000 m^2; • Maximum sediment disturbance volume = 810,000 m^2 (area affected) x 4 m depth = 3,240,000 m^3. **Horizontal Directional Drilling (HDD) drilling fluid release = 441 m^3** • 3 offshore HDD conduits and exit pits; • Maximum volume of drilling fluid loss per conduit = 25 m^3; • Total drilling fluid loss = 75 m^3; • 20% of the cut volume would be released per conduit; • Max 122 m^3 per conduit; and • Total other sediment lost = 366 m^3.	
Indirect impacts on prey species from temporary habitat loss and disturbance	**C-02, C-09, C-34**	**Total area of habitat disturbance = 7,731,870 m^2** **Foundation seabed preparation area = 6,066,000 m^2** *OEP(s):* • Seabed preparation method = Boulder clearance grabs; and • Maximum sediment disturbance area for two OEP(s) = 36,000 m^2 WTG anchoring operations • Deployment of 9 drag-embedment anchors, per WTG (total 603 anchors, 200 m drag distance x 50 m drag box) = 6,030,000 m^2 **Wave buoy anchoring operations = 2,000 m^2** • Seabed preparation for 4 x Wave rider buoys with 1 anchor point each = 2,000 m^2 **Jack-Up Vessels (JUV) and anchoring operations = 83,620 m^2** • Anchor deployment area of disturbance for installation of OEP jacket foundations = 35,000 m^2; • Anchor deployment area of disturbance for installation of OEP topside = 35,000 m^2; • OEP JUV footprint 6 legs per JUV, 227 m2 per leg = 1,362 m^2; • 5 jack-up operations x 2 OEP construction = 5 x 2 x 1,362 m^2 = 13,620 m^2; and • JUV operations for WTGs are not applicable for the offshore array, applies to nearshore port location only. **IAC Junction Box Installation** • Max Dimensions (L x W x H) = 15 x 6 x 4 m; • Seabed Footprint per unit = 90 m^2; • Max Number of Units = 20;	Temporary habitat disturbance relates to the maximum total area of habitat disturbance during the construction phase. The footprint of infrastructure is assessed as a temporary impact in construction, and as a permanent impact in O&M (see impact 7). It should be noted that for gravity anchors, the seabed preparation area is less than the footprint of the foundation scour protection. The Worst-Case Design Scenario presents a precautionary approach to temporary habitat disturbance because it counts both the total footprint of seabed clearance as well as cable burial across both the array and Offshore ECC. This approach counts the footprint of seabed habitat to be impacted by construction in the same area twice. However, this precautionary approach has been taken because there is some potential for recovery of habitats between the activities due to project timescales.

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
		• Total Seabed Footprint within Array = 90 * 20 = 1,800 m^2; and • Anchoring method = ballast/weight of the unit itself, no additional anchoring planned. **Cable seabed preparation and installation = 1,569,000 m^2** • Burial of export cables by jetting (270 km length x 3 m disturbance width) = 810,000 m^2; • Burial of Interconnector cable by jetting (3 km length x 3 m disturbance width) = 9,000 m^2; • Burial of inter-array cables (tether wave) by jetting (250 km x 3 m disturbance width) = 750,000 m^2; • Export cable jointing - largest cable diameter = 310 mm, therefore cross-sectional area = 0.0755 m^2 per cable. Joints every 25 km, 90 km length per cable = 4 joints; and • 4 joints * 0.0755m^2 per joint * 3 cables = 0.906 m^2 (no additional boulder and sandwave clearance planned for jointing. **HDD installation = 9,450 m^2** • Total installation area: cofferdam area (450 m^2) HDD bores x 3 = 3000 mL x 1mD x 3 = 9, 000 m^2	
Indirect impacts on prey species resulting from noise and vibration during construction activities		**Total duration of piling = 151 days (WTGs) + 24 (OEP(s)) = 175 days** OEP piling: May to Aug 2030 Anchor piling: April to Sept 2029, 2030, and 2031 **WTG Anchors** • Maximum of 67 semi-submersible Wind Turbine Generators (WTGs); • Maximum of nine anchors per WTG, one pile per anchor (nine piles in total); • Maximum mooring pile diameter of 4 m; • Maximum hammer energy of 2,400 kJ; • Maximum number of piling days: 151 (assumes four piled anchors per day); • Concurrent piling at two locations; • Maximum number of piles installed in 24 hours: 10; and • Piling dates: April to Sept 2029, 2030, and 2031. **OEP(s)** • Maximum of two HVAC jacket platforms; • Maximum 12 piles per platform; • Maximum pile diameter shall be 5 m; • Maximum hammer energy of 3,200 kJ; • Maximum number of piles installed in 24 hours: 6; • Maximum number of piling days: 24; • Concurrent piling with single anchor piling location; and • Piling dates: May to Aug 2030. **UXO Clearance** • The primary method will be low-order deflagration, but high-order clearance is assessed as the realistic worst-case scenario; and • UXO clearance is anticipated to take place from the year prior to offshore construction commencing, potentially running concurrently with the first year of offshore construction.	To justify the Worst-Case Design Scenario for noise and vibration impacts on fish species in the context of the project information provided, we consider the extensive duration and scale of piling activities. The project involves the installation of a significant number of semi-submersible WTGs with multiple anchors per WTG, totalling a substantial number of piles to be driven into the seabed. With a maximum hammer energy of 2,400 kJ for WTG anchors and 3,200 kJ for OEP(s), coupled with concurrent piling at two locations and a high rate of pile installation per day, the intensity and duration of noise and vibration generated during piling operations are considerable. The planned piling activities spanning 175 days between 2029 and 2031, with specific piling dates allocated for each year, indicate a prolonged period of disturbance. Moreover, the large-scale nature of the project involving numerous piles being driven into the seabed concurrently at high energy levels amplifies the potential impact on fish species in terms of noise and vibration impacts. This approach is precautionary and as a result, the outcome of the assessment is therefore inherently precautionary.
Operation and Maintenance			
Noise-related impacts associated with the O&M of floating WTGs	-	A maximum of 67 direct drive or geared turbines, with a maximum rotor size of 300 m. Maximum 12 mooring lines per WTG for all mooring arrangement options (maximum 804 mooring lines total where tension lines are used, 603 mooring lines where catenary, semi-taut or	The number, design and capacity of the WTGs represent the maximum potential for O&M noise-related impacts.

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
		taut lines are used). Mooring lines material: chain, wire, synthetic rope or combination. Worst case scenario based on chain (most impactful in terms of noise). The operational lifetime of the project is 35 years.	
Primary and secondary entanglement	C-37	**Mooring parameters:** • Maximum 12 mooring lines per WTG for all mooring arrangement options (maximum 804 mooring lines total where tension lines are used, 603 mooring lines where catenary, semi-taut or taut lines are used); • Maximum mooring line radius: 1,500 m (except for tension morning lines: 200 m). • Maximum mooring line length 1,600 m for catenary (1550 m for semi-taut, 1500 m for taut and less than 200 m for tension lines); • Total maximum lateral cross-section of the mooring system in the water column: 10,800 m^2 x 67 WTGs = 723,600 m^2; • Mooring lines material: chain, wire, synthetic rope or combination; • Minimum mooring line diameter: 80 mm; and • Maximum mooring line diameter: 190 mm for top/bottom chain, 450 mm for synthetic rope, 250 mm for wire rope. It should be noted that regardless of the mooring line design, the lines will be under high tension without the potential for creating a loop around a marine mammal. **Inter-array cables:** • Minimum external cable diameter: 150 mm; • Maximum external cable diameter: 250 mm; and • Using max diameter, total surface area assuming 67 x 300 m IAC in water column = 31,586 m^2. The presence of the moorings and dynamic cables will be restricted to the Array Area only. – IAC Junction Box = 1,200 m^2; – Max Dimensions (L x W x H) = 15 x 6 x 4 m ; – Cross section in water column = 15 m x 4 m = 60 m^2; – Max Number of Units = 20; and – Total cross section of units = 20 x 60 m^2 = 1,200 m^2.	The maximum spatial extent, dimensions and design of the mooring lines and inter-array cables represent the maximum potential for entanglement.
Risk of collision with WTG structures Long-term habitat changes, displacement and/or barrier effects due to the presence of WTGs	-	A maximum of 67 semi-submersible WTGs: • Below-sea surface area: 17,000 m2 per semi-submersible WTG; • Linear movements in the horizontal: 90 m during normal operation, 500 m during storm events; • Vertical movements of up to 30 m during normal operation; and • The maximum speed at which the WTG may be moving is dependent on hydrodynamic conditions. Total Array Area: 200 km^2 • Maximum lateral cross-section of the mooring system in the water column: 10,800 m^2; an • Total length of inter-array cables in the water column: 300 m. The operational lifetime of the project is 35 years.	The maximum number of floating structures and the extent of linear movements as well as the maximum spatial extent of mooring lines and inter-array cables in the water column represent the maximum potential for vessel collision risk and displacement/barrier effects.
Indirect impacts associated with the O&M of floating WTGs resulting in marine mammal prey item disturbance and/or displacement.	C-02, C-39	**Maximum area of permanent and/or long-term habitat loss/alternation = 2,718,400 m^2** **WTG anchor footprints, and scour protection = 1, 038,500 m^2** • Up to nine anchors per WTG (nine gravity anchors per WTG = [(9 x 500 m^2) x 67 WTGs] =	The Worst-Case Design Scenario is defined by the maximum area of seabed lost by the footprint of structures on the seabed, scour protection, cable protection, and cable crossings. Habitat loss from drilling and drill arisings is of a

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
		301,500 m^2 • Gravity anchor scour protection area (excluding anchor footprint) = 737,000 m^2 **Mooring line movement (strimming effect) = 874,350 m^2** • Any movement (strimming effect) will be at the transition where the mooring line touches down on the seabed, rather than the full chain length along the seabed; and • Assuming a 1 m movement corridor along the full chain length along the seabed. Potential moorings seabed movement area = 67 * 9 * 1450 * 1 = 874,350 m^2 **OEP foundation footprints** • 2 OEP(s) disturbance = 36,000m^2 **IAC Junction Box footprint** • Max Dimensions (L x W x H) = 15 x 6 x 4 m; • Seabed Footprint per unit = 90 m^2; • Max Number of Units = 20; and • Total Seabed Footprint within Array = 90 * 20 = 1,800 m^2. **Lidar and wave buoy anchor footprints = 4000 m^2** • Two Lidar buoys with two anchor point each (gravity anchors) = 2,000 m^2 • Four Wave rider buoys with one anchor point each = 2,000 m^2 **Dynamic inter-array cable (strimming effect)** • 50m^2 per each tether wave cable x 2 cables x 67 WTGs = 6,700 m^2 **Dynamic inter-array cable anchor footprints** • Tether wave cable, with up to 3 anchor points on seabed = 25 m^2 x 3 anchors x 2 cables x 67 WTGs = 10,050 m^2 **Inter-array cable protection = 375,000 m^2** • Up to 50% of IAC cables protected (total length 250 km) = 125 km at 3 m width; and • Maximum area of cable protection for IAC = 375,000 m^2 to a maximum height of 2 m above the seabed. **Interconnector cable protection = 1,500 m^2** • Up to 50% of interconnector cables protected (total length 3 km) = 1.5 km at 3 m width; and • Maximum area of cable protection for interconnector cables = 4,500 m^2 to a maximum height of 2 m above the seabed. **Export cable protection = 405,000 m^2** • Up to 50% of export cables protected (total length 270 km) = 135 km at 3 m width; and • Maximum area of cable protection for export cables = 405, 000 m^2 to a maximum height of 2 m above the seabed. **Export cable crossings = 1,500 m^2** • 3 crossings with existing infrastructure (based on the centreline of the offshore export cable route); and • Maximum total footprint = 500 m^2 (footprint) x 3 (number of crossings) = 1,500 m^2 to a maximum height of 5 m above the seabed.	smaller magnitude of impact than presence of project infrastructure. As a result, the outcome of the assessment is therefore inherently precautionary.
Indirect impacts on prey items from Electromagnetic Fields (EMF) due	C-02, C-29	**Total length of cables: 523 km**	The Worst Case Design Scenario is associated with the use of 67 WTGs as this results in the greatest length of inter-array

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
to the presence of subsea cabling.		**Inter-array cables = 250 km** • Maximum of 250 km of inter-array cables, operating at up to 132 kV; and • Minimum cable burial depth = 1 m. **Interconnector cable = 3 km** • Up to 3 km of interconnector, operating at up to 275 kV; and • Minimum cable burial depth = 1 m. **Export cables = 270 km** • Up to 270 km of export cables, operating at up to 275 kV; and • Minimum cable burial depth = 1 m. The operational lifetime of the project is 35 years.	and export cables. This considered length of cable network exposes the largest area and number of fish to potential EMF impacts.
Decommissioning			
PTS from decommissioning activities Disturbance from decommissioning activities (including vessels)	C-09, C-10	The final method chosen shall be dependent on the technologies available at the time of decommissioning. The number of vessels and/or plants required for each activity is therefore not available at this stage. The indicative options, however, would include: Removal of wind turbines in the reverse order of the installation procedure: • De-energizing and isolation from the electrical grid, which may be completed in stages; • Mobilisation of a suitable vessel to the site location; • Removal of the rotor component parts; • Disconnection of the turbine from inter-array cables; • Removal of the nacelle, including the electrical generator; • Removal of the WTG tower, which may be completed in stages; and • Transport of all WTG components to an onshore site. Removal of foundations (including anchors and mooring lines) in the reverse order of the installation procedure. To minimise seabed disturbance, it may be agreed that all of the scour protection at the foundations can be left in situ during decommissioning. Should a jacket with pin piles foundation be selected for OEP(s), it is anticipated that the jacket piles would be cut off at 1-2 m below natural seabed level and the jacket lifted off and removed. Removal of the cables by lifting the cable ends onto a cable retrieval vessel and spooling the cables back onto a drum. A water jetting or similar tool may be required to assist in the retrieval of the buried cables.	The methodology of the decommissioning and number of vessels involved represent the maximum potential for underwater noise impacts. It is assumed to be the same or less than construction.
Changes in water quality	C-38	The impact is the same as that for the construction phase.	
Indirect impacts on prey availability and distribution	C-02, C-05, C-08, C-09, C-14, C-15, C-29, C-31, C-37, C-39	The impact is the same as that for the construction phase.	

MORAY FIRTH SAC

8.1.73. Bottlenose dolphin has been screened in as a qualifying feature for further assessment.

BASELINE ENVIRONMENT

8.1.74. The Moray Firth SAC is located in the inner Moray Firth in north-east Scotland and lists bottlenose dolphins as a qualifying feature. The Moray Firth supports the only known resident population of bottlenose dolphin in the North Sea, but other UK resident populations are found in the Shannon Estuary, Republic of Ireland (Rogan *et al*., 2018) and Cardigan Bay, Wales. These populations consist of the coastal ecotype and occur in these sites year-round (Hague *et al*., 2020).

8.1.75. In Scottish waters, this population is primarily found in highly coastal waters, typically within 2-5 km of the shore and in water depths <30 m deep, with particular preference for water depths between 2 and 20 m (Thompson *et al*., 2015; Quick *et al*., 2014). This is supported by acoustic occupancy rates and habitat modelling in the East Coast Marine Mammal Acoustic Study (ECOMMAS) which found that occupancy rates throughout the survey range were generally higher for C-PODs situated closer to shore (Palmer *et al*., 2019). With this preference for coastal distribution, it is unlikely that individuals will be present within the offshore boundary of the Proposed Development; however, they are anticipated to be present within the nearshore area of the Offshore ECC and the wider regional area.

8.1.76. Mark-recapture analysis of photographs collected during photo-identification surveys indicates that the Moray Firth SAC supports an estimated number of 94 individuals (as of 2022; Cheney *et al*., 2024). Despite the population declining by 4.9% from 122 individuals in 2017, the population trend is still considered stable over longer timescales (2001-2022) despite some inter-annual variability (Cheney *et al*., 2024). It is considered that the Moray Firth SAC population is associated with the Coastal East Scotland (CES) MU population, which consists of a resident, protected population of approximately 245 (95% CI=214-234) bottlenose dolphins in 2022 (Cheney *et al.,* 2024).More than 50% of the east-coast population of bottlenose dolphin utilise the area within the Moray Firth SAC, with some individuals travelling further out into the Moray Firth, Pentland Firth, Tay and Forth Estuary, west coast of Scotland, west coast of Ireland, Isle of Man, south coast of England, the Netherlands, and Denmark (Cheney *et al*., 2013; Cheney *et al.,* 2024; Arso Civil *et al.,* 2019). There is evidence to suggest that the number of dolphins in areas further away from the SAC are increasing (Wilson *et al.,* 2004, Thompson *et al*., 2011, Arso Civil *et al*., 2019), primarily within Tayside and adjacent waters, where sightings increased from 111 to 195 between 2019 and 2022, increasing by approximately 4.8% a year (noting the interannual variability per year, Cheney *et al*., 2024). Although the Moray Firth is considered an important area for this species, the proportion of the population that uses the Moray Firth SAC is thought to be declining due to this expansion in range and suggests that the population is not restricted to either the Moray Firth SAC or the wider Moray Firth (Cheney *et al.,* 2018; 2024).

CONSERVATION OBJECTIVES

8.1.77. The conservation objectives for bottlenose dolphin as a qualifying feature of the Moray Firth SAC are:

- To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.
- To ensure that the integrity of Moray Firth SAC is maintained or restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for bottlenose dolphin:
  - 2a. The population of bottlenose dolphin is a viable component of the site.

- This objective seeks to minimise the risk to bottlenose dolphin from injury or killing posed by activities. It protects the species from significant risk of incidental killing and injury within and outwith the site.

– 2b. The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance.

- It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphins. It may result in the following effects:
  - Contributes to the long-term decline in the use of the site by bottlenose dolphin.
  - Changes to the distribution of bottlenose dolphin on a continuing or sustained basis.
  - Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

– 2c. The supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained.

- Supporting habitat, in this context, means the characteristics of the seabed and water column relevant to their use by bottlenose dolphin. Any consideration of supporting habitat in appraisals should include the particular habitat requirements of bottlenose dolphin prey species

8.1.78. The condition of bottlenose dolphin at the Moray Firth SAC is recorded as favourable, with the last assessment being carried out within 2022 (Cheney *et al.,* 2024).

CONSTRUCTION AND DECOMMISIONING

8.1.79. The screening report screens in the following effects for marine mammals during the construction and decommissioning phase:

- Injury and disturbance from underwater noise;
- Vessel collision risk and disturbance from vessels;
- Changes in water quality; and
- Indirect impacts on prey species.

8.1.80. The HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) determined that the potential for LSE for the decommissioning phase would be equal to or less than those outlined in the construction phase, with any such decommissioning being subject to the relevant licensing requirements at that time. Therefore, the main focus of this assessment is in relation to the potential for effects during the construction phase of the Proposed Development only.

AUDITORY INJURY FROM PILING

8.1.81. There is potential for auditory injury from piling during the construction phase, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.82. The relevant CO for Moray Firth SAC for impacts arising from underwater noise are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2a: To ensure the population of bottlenose dolphin is a viable component of the site. It specifically protects the species from significant risk of incidental killing and injury within and outwith the site.

8.1.83. As an unmitigated maximum value, the worst case design scenario predicted instantaneous PTS (SPL_{peak}) onset impact ranges for bottlenose dolphin are <50 m for the SW and NE

locations from anchor piles and also for the centre locations from jacket piles. Instantaneous PTS (SPL_{peak}) onset is not predicted to occur in any bottlenose dolphins from the Central East Scotland (CES) MU, for which the Moray Firth SAC population of bottlenose dolphins is considered synonymous.

8.1.84. Using cumulative PTS-onset thresholds (SEL_{cum}), the greatest predicted range for bottlenose dolphin is <100 m for the SW and NE locations from anchor piles and also for the centre locations from jacket piles. Cumulative PTS onset is not predicted to occur in any bottlenose dolphins from the CES MU, for which the Moray Firth SAC population of bottlenose dolphins is considered synonymous.

8.1.85. As an unmitigated maximum value, the predicted PTS onset impact ranges for bottlenose dolphin for the worst case design scenario (piling) for all instances and at all locations is at most 100 m (using SEL_{cum} PTS thresholds). This range is significantly less than the distance to the Moray Firth SAC itself (158.5 km distance to the Array Area) and to the CES MU (for which the Moray Firth SAC population of bottlenose dolphins is considered synonymous). Furthermore, in the context of the habitat range available to bottlenose dolphins, this is a severely limiting effect.

8.1.86. Therefore, no individuals from the population associated within Moray Firth SAC (considered synonymous with the spatial range of the CES MU) are predicted to be within the PTS onset impact area (either instantaneous or cumulative), and therefore are not expected to be at risk of auditory injury.

8.1.87. If PTS were to occur as a result of piling noise, it is expected to result in a “notch” of reduced hearing sensitivity in exposed individuals within a frequency range that is unlikely to significantly affect the fitness of individuals (i.e. its ability to survive and reproduce; Kastelein *et al*., 2017). As such, current scientific understanding is that PTS would not result in significant impacts to the fitness of individual bottlenose dolphin, for either adults or calves (Booth *et al.*, 2019).

8.1.88. During the expert elicitation workshop in 2018 funded by BEIS, experts concluded that the probability of PTS significantly affecting the survival and reproduction rates of bottlenose dolphins was very low, when considering an impact of a 6 dB PTS in the frequency range between 2 and 10 kHz (Booth *et al.*, 2019).

8.1.89. Furthermore, the Developer has provided an outline MMMP which will be submitted with the application. The outline MMMP has identified appropriate mitigation measures which could be employed during offshore activities that are likely to produce underwater noise and vibration levels capable of potentially causing injury to marine mammals to reduce the effect. Although the exact mitigation measures contained with the MMMP are yet to be determined, they will be in line with the latest relevant guidance at the time of this stage of the Proposed Development. This will be developed alongside the Piling Strategy and referred to in EPS licence applications.

8.1.90. Specifically, PTS-onset (using SPL_{peak} thresholds) is not predicted to result in any significant negative impacts on individuals or the population of the site, nor is it expected to result in death or injury to individuals to an extent that may ultimately affect the populations associated with the site. It is not expected to result in long term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from underwater noise during piling.

8.1.91. Therefore, it is concluded that there is no AEoSI to bottlenose dolphin associated with the Moray Firth SAC from the Proposed Development alone during construction and therefore,

subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to auditory injury from underwater noise from piling during construction.

DISTURBANCE FROM PILING

8.1.92. There is potential for disturbance from piling during the construction phase, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.93. The relevant CO for Moray Firth SAC for impacts arising from underwater noise are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, CO 2b: The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance, It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin;
- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis; and
- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

8.1.94. For the purposes of the RIAA, the assessment presented here for bottlenose dolphin is based on a dose response function. This is further described in EIAR Volume 2, Chapter 12 (Marine Mammals).

8.1.95. For bottlenose dolphin within the CES MU, for which the Moray Firth SAC population of bottlenose dolphins is considered synonymous, the highest disturbance levels for single piling events are predicted to occur in the southwest location from anchor piles, where a maximum of 8 bottlenose dolphins are predicted to be disturbed during the installation process. This represents 3.10% of the Moray Firth SAC population. For jacket piling, 75 individuals are predicted to be disturbed, which represents 3.76% of the Moray Firth SAC population.

8.1.96. The predicted highest disturbance levels for concurrent piling are in the NE and SW locations from anchor piles, where a maximum of 8 bottlenose dolphins are predicted to be disturbed during the installation process. This represents 3.23% of the Moray Firth SAC population (considered synonymous with the spatial range of the CES MU).

8.1.97. Disturbance will affect individuals within and/or associated with the site. Therefore, iPCoD modelling (see EIAR Volume 2, Chapter 12 Marine Mammals) was conducted to determine whether this level of disturbance is expected to result in population impacts for bottlenose dolphin associated with the Moray Firth SAC population (considered synonymous with the spatial range of the CES MU).The impact population is predicted to continue to increase at a stable trajectory, the same as the unimpacted population, and at 99.3 – 99.4% of the size of the unimpacted population from 1 to 18 years after the end of piling activities. This shows that the level of disturbance from piling is not predicted to result in significant change to the population trajectory.

8.1.98. Furthermore, the Developer has provided an outline MMMP (C-15 of Table 6.1) which will be submitted with the application. The outline MMMP has identified appropriate mitigation measures which could be employed during offshore activities that are likely to produce underwater noise and vibration levels capable of potentially causing disturbance to marine mammals to reduce the effect. Although the exact mitigation measures contained with the MMMP are yet to be determined, they will be in line with the latest relevant guidance at the time of this stage of the Proposed Development. This will be developed alongside the Piling Strategy and referred to in EPS licence applications.

8.1.99. Specifically, disturbance from piling is not predicted to result in any significant negative impacts on individuals or the population of the site. It is not expected to result in long term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from underwater noise during piling.

8.1.100. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development alone during construction and therefore, subject to natural change, the population of bottlenose dolphins will be maintained in the long-term with respect to disturbance from underwater noise from piling during construction.

AUDITORY INJURY FROM UXO CLEARANCE

8.1.101. There is potential for auditory injury from UXO clearance during the construction phase, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.102. The relevant CO for Moray Firth SAC for impacts arising from underwater noise are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2a: To ensure the population of bottlenose dolphin is a viable component of the site. It specifically protects the species from significant risk of incidental killing and injury within and outwith the site.

8.1.103. Prior to the start of construction, UXO investigation works will be required which may require clearance of UXO through in-situ detonation, resulting in the emission of underwater noise.

8.1.104. The maximum impact range from UXO clearance has been used to inform the assessment of Adverse Effects. Based on the EIAR Subsea Noise Technical Report (Volume 3, Appendix 12.1), the maximum distance at PTS is predicted to occur for bottlenose dolphins from a high-order UXO clearance (750 kg + donor) is 830 m. The maximum number of bottlenose dolphin predicted to be within the PTS onset impact area (using SEL_{peak} PTS thresholds), and therefore at risk of auditory injury, during high order UXO clearance is <1 animals (<0.01% of the CES MU population).

8.1.105. The maximum distance at which PTS is predicted to occur from low order UXO clearance is 0.06 km. The maximum number of bottlenose dolphins within the CES MU predicted to be within the PTS onset impact area (using SPL_{peak} thresholds), and therefore at risk of auditory injury, during low order UXO clearance is < 1 animals. This represents 0.01% of the Moray Firth SAC population (considered synonymous with the CES MU).

8.1.106. As an unmitigated maximum value, the predicted PTS onset impact ranges (using SPL_{peak}) for bottlenose dolphin for the WCS scenario for UXO is at most 830m. Due to the small proportion (<0.01%) of the individuals from the population associated with Moray Firth SAC within the predicted PTS onset impact range (using SPL_{peak} thresholds) for the worst-case scenario of high-order UXO clearance, there are no likely significant effects. Furthermore, the primary acoustic energy is below the range of greatest sensitivity for bottlenose dolphins and therefore unlikely to result in significant impact.

8.1.107. Most of the acoustic energy produced by a high-order detonation is below a few hundred Hz, decreasing on average by about SEL 10 dB per decade above 100 Hz, and there is a pronounced drop-off in energy levels above ~5-10 kHz (von Benda-Beckmann *et al*., 2015; Salomons *et al*., 2021). Therefore, the primary acoustic energy from a high-order UXO detonation is below the region of greatest sensitivity for bottlenose dolphins (Southall *et al*., 2019).

8.1.108. PTS may affect individuals within and/or associated with the site, however, as described above, this is not predicted to result in any significant change to individual fitness or reproductive success and so is therefore not expected to impact on the population at the site.

8.1.109. Furthermore, the Developer has committed to a UXO MMMP which will identify appropriate mitigation measures to reduce the risk of auditory injury from UXO clearance to negligible levels. The UXO MMMP will be updated prior to construction to capture the final project parameters. The same mitigation measures (including those outlined in the UXO MMMP as appropriate to the method of clearance used) would be applied to alternative design options; therefore, as this assessment is based on the WCS, any alternative scenario would not give rise to an effect which is more significant than has been assessed herein.

8.1.110. Specifically, PTS-onset (using SPL_{peak} thresholds) is not predicted to result in any significant negative impacts on individuals or the population of the site, nor is it expected to result in death or injury to individuals to an extent that may ultimately affect the population associated with the site. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from underwater during UXO clearance.

8.1.111. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development alone during construction and therefore, subject to natural change, the population of bottlenose dolphins will be maintained in the long-term with respect to auditory injury from underwater noise from UXO clearance during construction.

DISTURBANCE FROM UXO CLEARANCE

8.1.112. There is potential for disturbance from UXO clearance during the construction phase, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.113. The relevant CO for Moray Firth SAC for impacts arising from underwater noise are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2b: The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance. It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin;
- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis; and
- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

8.1.114. For the purposes of the RIAA, the assessment presented here for bottlenose dolphin is based on a 26 km Effective Deterrence Range (EDR) for high-order UXO-clearance and 5 km EDR for low-order UXO clearance. In addition, TTS has been used as a proxy for disturbance. TTS-onset impact areas and ranges are detailed in the EIAR Subsea Noise Technical Report. (Volume 3, Appendix 3.1).

8.1.115. Based on a 26 km EDR, the maximum number of bottlenose dolphins from the CES MU disturbed from UXO clearance is 15 animals. This represents 6.21% of the Moray Firth SAC population (considered synonymous with the spatial range of the CES MU).

8.1.116. Based on a 5 km EDR, the maximum number of bottlenose dolphins from the CES MU disturbed from UXO clearance is three animals. This represents 1.18% of the Moray Firth SAC population (considered synonymous with the spatial range of the CES MU).

8.1.117. Using TTS as a proxy for disturbance, the largest impact range for a high-order detonation at the maximum charge weight of 750 kg is predicted to be 1.5 km for bottlenose dolphin. For bottlenose dolphin associated with the CES MU, the maximum number of bottlenose dolphin disturbed from UXO clearance is <1 animals. This represents <0.01% of the Moray Firth SAC population (considered synonymous with the spatial range of the CES MU).

8.1.118. For low-order detonation, the largest TTS impact range is predicted to be 0.1 km for bottlenose dolphin. For bottlenose dolphin associated with the CES MU, the maximum number of bottlenose dolphin disturbed from UXO clearance is <1 animals. This represents <0.01% of the Moray Firth SAC population (considered synonymous with the spatial range of the CES MU).

8.1.119. With an impact range of 1.5 km for bottlenose dolphins considering the maximum charge weights of 750 kg (plus donor weight of 0.5 kg) and the adoption of 'high-order' clearance technique, there is no spatial overlap between this SAC and the TTS (as a proxy of behavioural disturbance) impact ranges of UXO clearance works on bottlenose dolphins.

8.1.120. The greatest estimated disturbance in terms of the Moray Firth SAC population is 15 animals. This represents 6.21% of the Moray Firth SAC population (considered synonymous with the CES MU). This is based on a high-order detonation, however it is anticipated that low-order techniques will be used.

8.1.121. It is noted in the JNCC guidance (2020) that UXO detonation is not expected to cause widespread and prolonged displacement of marine mammals. The impact is short-term and intermittent in nature with temporary behavioural effects, which is very unlikely to alter survival or reproductive rate to the extent to alter the population trajectory of bottlenose dolphins. Furthermore, impacts are not expected to manifest at levels that would compromise the distribution of the bottlenose dolphin with the SAC,.

8.1.122. Disturbance may affect individuals within and/or associated with the site, however, as described above, this is not predicted to result in any significant change to individual fitness or reproductive success and so is therefore not expected to impact on the population at the site.

8.1.123. Specifically, disturbance is not predicted to result in any significant negative impacts on individuals or the population of the site. It is not expected to result in long term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from underwater noise during UXO clearance.

8.1.124. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development alone during construction and therefore, subject to natural change, the population of bottlenose dolphins will be maintained in the long-term with respect to disturbance from underwater noise from UXO clearance during construction.

AUDITORY INJURY FROM GEOPHYSICAL SURVEYS

8.1.125. There is potential for auditory injury from geophysical surveys during construction phase, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.126. The relevant CO for Moray Firth SAC for impacts arising from underwater noise are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2a: To ensure the population of bottlenose dolphin is a viable component of the site. It specifically

protects the species from significant risk of incidental killing and injury within and outwith the site.

8.1.127. Geophysical survey equipment could include the following:

- MAG;
- SBP;
- MBES;
- SSS;
- USBL system; and
- UHRS.

8.1.128. The estimated sound frequency of the MBES and SSS is above the hearing range of the bottlenose dolphin and the estimated frequency of the MAG is below the hearing range of the bottlenose dolphin. The source levels of UBSL, SBP and UHRS are below the PTS-onset thresholds for bottlenose dolphin. Therefore, it is considered that there is no potential for auditory injury from these equipment types.

8.1.129. Further, the type of geophysical surveys carried out for OWFs is not typically considered likely to result in PTS or in marine mammals, as such a risk is mainly derived from surveys in water >200 m and/or using air guns (not typical of OWFs within the North Sea). If a risk were deemed to be present (which would be related to the type and nature of any seismic survey eventually proposed) that risk would be addressed through appropriate licensing measures at that time. The need for an individual geophysical survey to be subject to HRA will be assessed on a case-by-case basis nearer the time of the survey.

8.1.130. CSA (2020) presented modelled impact ranges for a wide range of geophysical survey equipment, based on the NMFS User Spreadsheet (NMFS, 2018) which has been designed to account for the limited horizontal propagation of sound from these systems, with impacts to “Level A” harassment thresholds (equivalent to PTS-onset values from Southall *et al*., 2019), all less than 36.5 m (CSA 2020). It is expected that the displacement effect caused by the presence of the vessels used for these works, which has been demonstrated in harbour porpoise (e.g. Benhemma-Le Gall *et al*., 2023), will be greater than the likelihood of individuals experience cumulative PTS-onset from non-impulsive (i.e. other) underwater sound sources.

8.1.131. In addition, Marine Mammal Observers (MMOb) and Passive Acoustic Monitoring Operators (PAMOs) will be used together as required to mitigate against any potential impacts to marine mammals associated with underwater noise from geophysical surveys. Technical discussions of these specific measures are presented within the MMMP. Together, these mitigation measures are considered sufficient to reduce the risk of PTS to any individual bottlenose dolphin to negligible, through a reduction in the potential impact zones and also to mitigate against the presence of marine mammals within the immediate area (i.e. the defined mitigation zone).

8.1.132. Specifically, PTS-onset is not predicted to result in any significant negative impacts on individuals or the population of the site, nor is it expected to result in death or injury to individuals to an extent that may ultimately affect the population associated with the site. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from underwater noise during geophysical surveys.

8.1.133. Therefore, it is concluded that there is no AEoSI to bottlenose dolphin associated with the Moray Firth SAC during construction and therefore, subject to natural change, the population

of bottlenose dolphin will be maintained in the long-term with respect to underwater noise from geophysical and seismic surveys during construction.

DISTURBANCE FROM GEOPHYSICAL SURVEYS

8.1.134. There is potential for disturbance from geophysical surveys during construction phase, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.135. The relevant CO for Moray Firth SAC for impacts arising from underwater noise are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2b: The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance, It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin;
- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis; and
- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

8.1.136. Considering the potential for disturbance from geophysical surveys, CSA (2020) present Level B harassment ranges for a wide range of geophysical survey equipment, which in the absence of more widely accepted behavioural thresholds (Southall *et al*., 2019), remain the best available option for considering the range within which behavioural effects could occur. Based on the modelling undertaken to inform the assessment therein, CSA (2020) identifies that Level B harassment ranges could extend up to 141 m from the source. It is expected that the displacement effect caused by the presence of the vessels used for these works, which has been demonstrated in harbour porpoise (e.g. Benhemma-Le Gall *et al*., 2023), will be greater than the disturbance effects of (other) underwater noise sources relating to the construction-related activities in which the vessels are engaged in. Therefore, this will not result in any significant disturbance or contribution to the thresholds.

8.1.137. As presented for auditory injury, the estimated sound frequencies for MBES and SSS are above the hearing range of the bottlenose dolphin, and therefore there is no potential for disturbance. The sound frequency for SBP, UBSL and UHRS are within the hearing range for bottlenose dolphin and therefore has the potential for disturbance effects. However, it is expected that disturbance will likely be over a very localized spatial extent and temporary nature. Disturbance is not predicted to result in any significant change to individual fitness or reproductive success due to the short periods of disturbance and so is therefore not expected to impact on the population at the site.

8.1.138. Specifically, disturbance is not predicted to result in any significant negative impacts on individuals or the population of the site. It is not expected to result in long term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from underwater noise during geophysical surveys.

8.1.139. Therefore, it is concluded that there is no AEoSI to bottlenose dolphin associated with the Moray Firth SAC during construction and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to underwater noise from geophysical and seismic surveys during construction.

AUDITORY INJURY FROM OTHER CONSTRUCTION ACTIVITIES

8.1.140. There is potential for PTS onset from geophysical surveys during construction phase, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.141. The relevant CO for Moray Firth SAC for impacts arising from underwater for Moray Firth SAC are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2a: To ensure the population of bottlenose dolphin is a viable component of the site. It specifically protects the species from significant risk of incidental killing and injury within and outwith the site.

8.1.142. While percussive piling and UXO clearance are considered to be the greatest sources of underwater noise, other construction activities will also produce underwater noise. This includes drilling, cable laying, rock placement and trenching.

8.1.143. The maximum impact range at which cumulative PTS (PTS_{cum}) for bottlenose dolphin could occur is <100 m for all other construction activities (such as cable laying, drilling, rock placement, and trenching).

8.1.144. Furthermore, according to the MMO (2015), the main energy of non-piling activities for pile installation and cable installation is listed as being below 1 kHz, which is out of the peak hearing ranges of bottlenose dolphin, and therefore unlikely to cause any PTS. Considering its estimated region of peak sensitivity ranges between 8.8 kHz and 110 kHz (Southall *et al*., 2007) any auditory injury arising from such low frequency sounds would result in little impact to cetacean vital rates. If PTS were to occur as a result of underwater noise, it is expected to result in a "notch" of reduced hearing sensitivity in exposed individuals within a frequency range that is unlikely to significantly affect the fitness of individuals (i.e. its ability to survive and reproduce; Kastelein *et al*., 2017). As such, current scientific understanding is that PTS would not result in significant impacts to the fitness of individual bottlenose dolphin, for either adults or calves (Booth *et al.*, 2019).

8.1.145. It is anticipated that auditory injury is highly unlikely to occur as the activity they are engaged in will likely deter the animal from the small (<100 m) PTS_{cum} injury zone.

8.1.146. Specifically, the onset of PTS is not predicted to result in any significant negative impacts on individuals or the population of the site, nor is it expected to result in death or injury to individuals to an extent that may ultimately affect the populations associated with the site. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from underwater noise from other construction activities.

8.1.147. Therefore, it is concluded that there is no AEoSI to bottlenose dolphin associated with the Moray Firth SAC from the Proposed Development alone during construction and decommissioning and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to underwater noise from other construction activities during construction and decommissioning.

DISTURBANCE FROM OTHER CONSTRUCTION ACTIVITIES

8.1.148. There is potential for disturbance from other construction activities, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.149. The relevant CO for Moray Firth SAC for impacts arising from underwater The relevant CO for Moray Firth SAC for impacts arising from underwater noise are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2b: The distribution of

bottlenose dolphin throughout the site is maintained by avoiding significant disturbance. It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin;
- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis; and
- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

8.1.150. The potential effects of cabling techniques used in the offshore windfarm industry was reviewed in a report by the Department of Business, Enterprise and Regulatory Reform (BERR) in association with the DEFRA (BERR and DEFRA, 2008). The report reviewed various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting and rock ripping. The review concluded that it would be "highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals". It is also highly likely that the presence of vessels will act as a deterrent and disturb marine mammals out of the area before any non-piling construction activity begins (Brandt *et al*., 2018).

8.1.151. Disturbance may affect individuals within and/or associated with the site, however, this is not predicted to result in any significant change to individual fitness or reproductive success due to the short periods of disturbance and so is therefore not expected to impact on the population at the site.

8.1.152. Specifically, disturbance is not predicted to result in any significant negative impacts on individuals or the population of the site. It is not expected to result in long term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from underwater noise during other construction activities.

8.1.153. Therefore, it is concluded that there is no AEoSI to bottlenose dolphin associated with the Moray Firth SAC from the Proposed Development alone during construction and therefore, subject to natural change, the population of bottlenose dolphins will be maintained in the long-term with respect to underwater noise from other construction activities.

VESSEL DISTURBANCE

8.1.154. There is potential vessel disturbance during the construction phase, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.155. The relevant CO for Moray Firth SAC for impacts arising from vessel collision risk and disturbance from vessels are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2b: To ensure the distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance. It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin;
- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis; and

- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

8.1.156. Vessel disturbance to marine mammals is driven by a combination of underwater noise and the physical presence of the vessel itself (e.g. Pirotta *et al*., 2015). As it is often difficult, if not impossible, to attribute whether individuals are responding to the noise of the vessel and/or the presence of the vessel, both are considered within the assessment of vessel disturbance.

8.1.157. Vessel disturbance have been found to elicit a variety of responses in bottlenose dolphins including reduced foraging (but varied responses, Pirotta *et al*., 2013; Pirotta *et al*., 2015; Piwetz, 2019), reduced or unchanged dolphin densities (Lusseau, 2006; Marley *et al*., 2017), increased swimming speeds (Marley *et al*., 2017; Piwetz, 2019), reduced resting and socialising behaviour (Constantine *et al*., 2004; Marley *et al*., 2017) and changes in acoustic behaviour (La Manna *et al*., 2013; Marley *et al*., 2017).

8.1.158. Tolerance to vessel disturbance within certain levels in bottlenose dolphins was however also observed in previous studies (La Manna *et al*., 2013; Pirotta *et al*., 2013). The degree to which an animal will be disturbed is likely linked to their baseline level of tolerance (Bejder *et al*., 2009).

8.1.159. New *et al*. (2013) simulated the complex interactions of the coastal population of bottlenose dolphins in the Moray Firth by increasing vessel traffic from 70 to 470 vessels a year to simulate the potential increase in vessel operations from proposed offshore development. It was found that the increase was not anticipated to result in biologically significant disturbance as bottlenose dolphins were able to compensate for their immediate behavioural responses and, therefore their vital rates remained unaffected (New *et al*., 2013).

8.1.160. Furthermore, as there is already a high existing level of vessel activity within the vicinity, it is expected that any vessel traffic as a result of the Proposed Development will not pose any additional risk above the current baseline levels.

8.1.161. As a result, the increase in number of vessels associated with construction activities is insufficient to result in significant disturbance to bottlenose dolphin as a qualifying feature of Moray Firth SAC. With the implementation and adherence of a VMP (part of VMNSP), the impact of disturbance to bottlenose dolphins from vessel presence is considered negligible.

8.1.162. Specifically, disturbance is not predicted to result in any significant negative impacts on individuals or the population of the site. It is not expected to result in long term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from vessel disturbance.

8.1.163. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development alone during construction and decommissioning and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to vessel disturbance from construction and decommissioning.

VESSEL COLLISION RISK

8.1.164. There is potential for risk of collision due to the physical presence of vessel during the construction phase, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.165. The relevant COs for Moray Firth SAC for impacts arising from vessel collision risk and disturbance from vessels are CO 1: To ensure that the qualifying features of Moray Firth SAC

are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2a: To ensure the population of bottlenose dolphin is a viable component of the site. It specifically protects the species from significant risk of incidental killing and injury within and outwith the site.

8.1.166. As outlined in paragraph 8.1.55 and 8.1.56, marine mammals are observed to be of low vulnerability to vessel collision risk, based on post-mortem examination of stranded animals. Furthermore, bottlenose dolphins are highly mobile and therefore individuals are expected to be able to avoid collision with vessels. However, should a collision event occur, this has the potential to kill the animal.

8.1.167. It is estimated that most construction vessels will be large, slow moving and stationary for long periods, with the most frequent movements being from CTVs and support vessels transiting between the site and the port. Due to the slow movement of vessels, it is unlikely that any collision incident will occur. Furthermore, underwater noise generated from vessels will likely deter the animal away, therefore minimizing any potential for interaction. All vessel traffic will move along designated routes around the Proposed Development, and to/from port to the Proposed Development site over the short periods of offshore construction activity, as detailed within the VMP (part of VMNSP). The VMP would also set out a Code of Conduct based on best practice vessel handing protocols such as the WiSe scheme (The WiSe Scheme, 2024) to minimise vessel interactions with marine mammals, and define how vessels should behave in the presence of animals.

8.1.168. Specifically, vessel collision risk is not predicted to result in any significant negative impacts on individuals or the population of the site, nor is it expected to result in death or injury to individuals to an extent that may ultimately affect the population associated with the site. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC vessel collision risk.

8.1.169. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC during construction and decommissioning and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to vessel collision risk from construction and decommissioning.

CHANGES IN WATER QUALITY

8.1.170. Activities during the construction phase of the Proposed Development may influence water quality which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.171. The relevant CO for Moray Firth for impacts arising from change in water quality are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2c: Supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained. Supporting habitat, in this context, means the characteristics of the seabed and water column relevant to their use by bottlenose dolphin. Any consideration of supporting habitat in appraisals should include the particular habitat requirements of bottlenose dolphin prey species.

8.1.172. As outlined in paragraph 8.1.61, changes in water quality may have potential direct impact on bottlenose dolphin or a reduction in prey availability either of which may affect species' survival rates.

8.1.173. As a result, adequate and appropriate mitigation measures will be required to reduce the risk on bottlenose dolphin. The Developer will implement a PEMP and Environmental Management Plan that will include a Marine Pollution Contingency Plan (MPCP) to address the risks, methods and procedures to deal with any spills and collision incidents of the

authorised project in relation to all activities carried out below MHWS and a chemical risk review to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance. With these measures established, a major incident that may impact any species at a population level is considered very unlikely. It is predicted that any impact would be of local spatial extent and of a short-term duration.

8.1.174. The small-scale, localised impact which may occur from a pollution incident is not expected to result in any changes to the fish communities that the bottlenose dolphin depends on or cause death or injury to individuals to an extent that may ultimately affect the bottlenose dolphin population associated with the site.

8.1.175. Specifically, changes in water quality are not predicted to result in any significant negative impacts on individuals or the population of the site, nor is it expected to result in death or injury to individuals to an extent that may ultimately affect the population associated with the site. Furthermore, impacts are not expected to manifest at levels that could compromise the extent, distribution, structure, and function of the habitats, and supporting processes of the species. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from changes in water quality.

8.1.176. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development alone during construction and decommissioning and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to changes in water quality from construction and decommissioning.

INDIRECT IMPACTS ON PREY SPECIES

8.1.177. Activities during the construction phase of the Proposed Development may result in changes in prey availability which could directly impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.178. The relevant CO for Moray Firth SAC for impacts arising from indirect impacts on prey species CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status. And CO 2c: supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained. Supporting habitat, in this context, means the characteristics of the seabed and water column relevant to their use by bottlenose dolphin. Any consideration of supporting habitat in appraisals should include the particular habitat requirements of bottlenose dolphin prey species.

8.1.179. As outlined in paragraph 8.1.65, bottlenose dolphin in this assessment are considered to be generalist feeders and are thus not reliant on a single prey species, the key prey species for bottlenose dolphins within the Moray Firth SAC are gadoids (whiting, blue whiting, pollock, saithe and haddock), Atlantic mackerel, Atlantic salmon, flatfish (flounder, plaice, dab, brill, sole) and cephalopods (Hernandez-Milian *et al.* 2011; Santos *et al*. 2001). While there are potential indirect impacts on prey species during the construction and decommissioning phase, prey species are highly mobile and able to avoid the majority of impacts that may occur as a result of construction and decommissioning activities. If mortality or injury to prey species were to occur, this is not predicted to result in wider scale effects and has no potential to result in population level impacts on bottlenose dolphins. Since herring is the only identified prey species requiring secondary mitigation due to development activities, it is considered that localised changes to the fish communities are not expected to result in the deterioration of prey resources for bottlenose dolphins, and therefore there will be low impacts to the bottlenose dolphin population as a result of any changes to prey.

8.1.180. Specifically, indirect impacts on prey species are not predicted to result in any significant negative impacts on individuals or the population of the site, nor is it expected to result in death or injury to individuals to an extent that may ultimately affect the population associated with the site. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. Furthermore, impacts are not expected to manifest at levels that could compromise the extent, distribution, structure, and function of the habitats, and supporting processes of the species. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from indirect impacts on prey species.

8.1.181. Therefore, it is concluded that there is no AEoSI to bottlenose dolphin associated with the Moray Firth SAC from the Proposed Development alone during construction and decommissioning and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to impacts on prey from construction and decommissioning.

OPERATION AND MAINTENANCE

8.1.182. The HRA screening report screens in the following effects for marine mammals during the O&M phase:

- Injury and disturbance from underwater noise;
- Vessel collision risk and disturbance from vessels;
- Changes in water quality;
- Indirect impacts on prey species;
- Entanglement; and
- Barrier effects.

NOISE IMPACTS FROM OPERATIONAL WTGS

8.1.183. There is potential for noise impacts from operational WTGs, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.184. The relevant CO for Moray Firth SAC for impacts arising from underwater noise are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, CO 2a: To ensure the population of bottlenose dolphin is a viable component of the site. It specifically protects the species from significant risk of incidental killing and injury within and outwith the site, CO 2b: The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance. It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin.
- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis.
- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

8.1.185. As outlined in paragraph 8.1.39 and 8.1.40, there is the potential for injury and disturbance from operational wind turbines, in particular “snapping” sounds from mooring lines. However, sound levels (as described in EIAR Volume 3, Appendix 3.1 (Subsea Noise Technical Report)) are below any PTS onset thresholds relevant to bottlenose dolphin, and therefore the sound levels from cable noise are not at a level sufficient to cause injury or disturbance to bottlenose dolphin. Furthermore, the operational WTG noise is considered non-impulsive and continuous

in nature, and its energy is primarily within low frequencies below 1 kHz (Thomsen *et al*., 2006), which is outside the peak hearing sensitivity of bottlenose dolphins, and therefore is expected to result in little impact to vital rates and/or behaviour.

8.1.186. The impact of underwater noise from operational WTGs is considered to be localised to the immediate vicinity of the Array Area and unlikely to lead to exclusion of the animals from the Array Area.

8.1.187. Specifically, underwater noise from operational WTGs is not predicted to result in any significant negative impacts on individuals or the population of the site, nor is it expected to result in death or injury or disturbance to individuals to an extent that may ultimately affect the population associated with the site. It is not expected to result in long term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC due to underwater noise from operational WTGs.

8.1.188. Therefore, it is concluded that there is no AEoSI to bottlenose dolphin associated with the Moray Firth SAC from the Proposed Development alone during the O&M phase and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to underwater noise from operational WTGs.

VESSEL DISTURBANCE

8.1.189. There is potential for vessel disturbance during the O&M phase, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.190. The relevant CO for Moray Firth SAC for impacts arising from vessel collision risk and disturbance from vessels are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, CO 2b: To ensure the distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance.

8.1.191. Given the lower number of vessels estimated for the O&M phase and implementation of a VMP (part of VMNSP), the impact of vessel collision risk during O&M would be similar or lower than that during the construction phase. It is considered that the potential for adverse effect during the O&M phase is the same as described above for the construction and decommissioning phases.

8.1.192. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC during O&M phase and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to vessel disturbance from O&M activities.

VESSEL COLLISION RISK

8.1.193. There is potential for vessel collision risk due to the physical presence of vessel during the O&M phase, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.194. The relevant CO for Moray Firth SAC for impacts arising from vessel collision risk and disturbance from vessels are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2b: To ensure the distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance. It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin;
- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis; and
- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

8.1.195. Given the lower number of vessels estimated for the O&M phase and implementation of a VMP (part after VMNSP), the impact of vessel collision risk during O&M would be similar or lower than that during the construction phase. It is considered that the potential for adverse effect during the O&M phase is the same as described above for the construction and decommissioning phase.

8.1.196. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development alone during O&M phase and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to vessel collision risk from O&M activities.

CHANGES IN WATER QUALITY

8.1.197. Activities during O&M of the Proposed Development may influence water quality which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.198. The relevant CO for Moray Firth SAC for impacts arising from change in water quality are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2c: Supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained.

8.1.199. It is considered that the potential for adverse effect during the O&M phase is the same or lesser than that described above for the construction and decommissioning phases.

8.1.200. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC during O&M phase and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to impacts changes in water quality from O&M activities.

INDIRECT IMPACTS ON PREY SPECIES

8.1.201. Activities during the O&M phase of the Proposed Development may result in changes in prey availability which could directly impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.202. The relevant CO for Moray Firth SAC for impacts arising from indirect impacts on prey species are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2c: Supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained. Supporting habitat, in this context, means the characteristics of the seabed and water column relevant to their use by bottlenose dolphin. Any consideration of supporting habitat in appraisals should include the particular habitat requirements of bottlenose dolphin prey species.

8.1.203. The potential indirect impacts on prey species from the O&M phase include the following impacts:

- Permanent and/or long-term habitat loss/alteration due to the addition of infrastructure to the area;
- EMF effects arising from cables during operational phase;
- Ghost fishing due to lost fishing gear becoming entangled in installed infrastructure;

- Introduction of new hard substrates and potential for fish aggregation; and
- Underwater noise and vibration from operational WTGs and vessels.

8.1.204. EIAR Volume 2, Chapter 10 (Fish and Shellfish Ecology) assessed the significance of all impacts as not significant in EIA terms. Studies have shown the presence of anthropogenic structures can act as fish aggregating devices and artificial reef systems (Guerin *et al.*, 2007, Zawawi *et al.*, 2012), which can lead to increased foraging potential for marine mammals. For this reason, it is not expected that there will be any adverse impacts to bottlenose dolphin through changes in prey abundance and distribution. Any localised changes to the fish communities are not expected to result in the deterioration of prey resources for bottlenose dolphin, and therefore there will be low impacts to the bottlenose dolphin from changes to prey.

8.1.205. Specifically, indirect impact on prey species is not predicted to result in any significant negative impacts on individuals or the population of the site, nor is it expected to result in death or injury to individuals to an extent that may ultimately affect the population associated with the site. Furthermore, impacts are not expected to manifest at levels that could compromise the extent, distribution, structure, and function of the habitats, and supporting processes of the species. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from indirect impacts on prey species.

8.1.206. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development alone during O&M phase and therefore, subject to natural change, the population of bottlenose dolphins will be maintained in the long-term with respect to impacts on prey from O&M activities.

ENTANGLEMENT

8.1.207. The presence of offshore wind infrastructure may result in entanglement which could directly impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.208. The relevant CO for Moray Firth SAC for impacts arising from entanglement are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2b: The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance. It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin;
- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis; and
- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

8.1.209. As outlined in paragraph 8.1.68, there are three types of entanglement associated with the Proposed Development; primary, secondary and tertiary entanglement. In relation to primary entanglement, studies have shown moorings are unlikely to pose a risk due to the mooring's size and mass in relation to their body size (Benjamin *et al.,* 2014). Furthermore, the risk of entanglement in mooring lines is considered modest in comparison to the risk of entanglement from other offshore activities. Entanglement events mostly occur when individuals become entrapped in the loose end or slack of a rope, however, compared to fishing gear, mooring lines on floating turbines do not have lose ends nor are they sufficiently slack to cause entanglement (Tethys, 2020). Catenary mooring lines are considered to pose the greatest risk of entanglement; however, these configurations are still considered to have too much tension

to generate any loops which are sufficient to cause entanglement (Benjamins *et al*., 2014, Harnois *et al*., 2015, Copping *et al*., 2020, Garavelli, 2020).

8.1.210. The risk of injury and mortality from secondary entanglement is difficult to quantify. EIAR Volume 2, Chapter 12 (Marine Mammals) states that mooring lines and floating inter-array cables will be inspected according to the maintenance plan to confirm the structural integrity of the cable systems using a risk-based adaptive management approach. These inspections will involve an evaluation of the risk of marine mammal entanglement from discarded fishing gear. The risk of tertiary entanglement has been considered as unlikely to occur.

8.1.211. Furthermore, the Array Area, which entanglement risk is limited to, will be located outside the CES MU and therefore is not within the known range of the Moray Firth SAC bottlenose dolphin population. Therefore, there will be no pathway for entanglement on bottlenose dolphin associated within the Moray Firth SAC population.

8.1.212. Consequently, entanglement will not cause a population-level impact to bottlenose dolphin as a qualifying feature of Moray Firth SAC. Furthermore, the Proposed Development has committed to an Entanglement Management Plan which will identify appropriate mitigation measures to reduce the risk of entanglement to marine mammals.

8.1.213. Specifically entanglement is not predicted to result in any significant negative impacts on the population of the site. It is not expected to result in long term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted.

8.1.214. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development alone during O&M and therefore, subject to natural change, the population of bottlenose dolphins will be maintained in the long-term with respect to impacts from entanglement.

BARRIER EFFECTS

8.1.215. The presence of offshore wind infrastructure may result in barrier effects which could directly impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

8.1.216. The relevant CO for Moray Firth SAC for impacts arising from barrier effects are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and CO 2c: supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained. Supporting habitat, in this context, means the characteristics of the seabed and water column relevant to their use by bottlenose dolphin. Any consideration of supporting habitat in appraisals should include the particular habitat requirements of bottlenose dolphin prey species.

8.1.217. As outlined in paragraph 8.1.70 and 8.1.71, the presence of floating wind infrastructure may cause barrier effects to bottlenose, such as restricting movement from important breeding or nursey sites, foraging grounds or migratory pathways. However, given the scale of the offshore infrastructure in relation to the size of bottlenose dolphins, it is expected that there will be no barriers to movement. Bottlenose dolphins are highly mobile and would be able to pass through the wind farm. Barrier effects are considered to be highly localised therefore not considered to cause population impact to bottlenose dolphin as a qualifying feature of Moray Firth SAC. behave in the presence of animals.

8.1.218. Furthermore, the Array Area will be located outside the CES MU and therefore is not within the known range of the Moray Firth SAC bottlenose dolphin population. Therefore, there will

be no pathway for barrier effects on bottlenose dolphin associated within the Moray Firth SAC population.

8.1.219. Specifically, barrier effects are not predicted to result in any significant negative impacts on individuals or the population of the site, nor is it expected to result in death or injury to individuals to an extent that may ultimately affect the population associated with the site. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. Furthermore, impacts are not expected to manifest at levels that could compromise the extent, distribution, structure, and function of the habitats, and supporting processes of the species. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from barrier effects.

8.1.220. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development alone during O&M and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term with respect to impacts from barrier effects from operational offshore wind infrastructure.

8.2. OFFSHORE AND INTERTIDAL ORNITHOLOGY

8.2.1. This section provides supporting information for Appropriate Assessment of the Project alone impacts in relation to offshore and intertidal SPA qualifying interests.

ASSESSMENT CRITERIA

8.2.2. As set out in Section 3, for those SPA qualifying interests at potential risk of Likely Significant Effect or LSE (Table 7.2), the Competent Authority is required to undertake Appropriate Assessment, informed by this Report to Inform Appropriate Assessment (RIAA) provided by the Developer, and further to the statutory advice given by NatureScot.

8.2.3. For Offshore and Intertidal Ornithology, the RIAA follows the process set out in NatureScot advice and guidance, as available from their website:

- Guidance to support Offshore Wind Applications: Marine Ornithology (under Advice on marine renewables development | NatureScot); and
- Legislative Requirements for European Sites | NatureScot.

SPA BREEDING SEABIRD POPULATIONS

8.2.4. The Appropriate Assessment undertaken by the Competent Authority will consider the identified impacts against SPA qualifying interests screened in for LSE (Table 7.2) in light of the SPA conservation objectives. These conservation objectives follow a standard format for terrestrial SPAs in Scotland, including breeding seabird colonies, and require the direct protection of the qualifying interests and their supporting habitat (Table 8.3).

Table 8.3 SPA conservation objectives for Scottish breeding seabird colonies

SPA conservation objectives
• To ensure that site integrity is maintained by: – Avoiding deterioration of the habitats of the qualifying species. – Avoiding significant disturbance to the qualifying species. • To ensure for the qualifying species that the following are maintained in the long term: – Population of the species as a viable component of the site

- Distribution of the species within the site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

8.2.5. These SPA conservation objectives primarily offer site-based protection, so will not apply to mobile species, such as seabirds, when they are outwith the SPA site boundaries. It is therefore the conservation objective relating to Maintenance of the population of the bird species as a viable component of the SPA which is key to the consideration of potential impacts from offshore wind farms to seabirds at sea.

8.2.6. This conservation objective addresses the population-level consequence of potential seabird mortalities arising from collision risk and/or distributional response impact pathways, in order to determine whether there could be any effect on population viability arising from Project alone or cumulative impacts, and thus an AEoSI.

8.2.7. Collision risk and distributional responses are the key, impact pathways to consider in relation to SPA breeding seabird interests, with the first step being to quantify the impacts, as set out in the following technical reports supporting assessment:

- Offshore and Intertidal Ornithology Collision Risk Modelling (CRM) Report (Volume 3, Appendix 11.2), which provides methodology and results on the modelling of species-specific collision risk mortalities associated with the Proposed Development; and
- Offshore and Intertidal Ornithology Distributional Responses Report (Volume 3, Appendix 11.3), which provides methodology and results on the modelling of species-specific displacement related mortalities associated with the Proposed Development.

8.2.8. Total quantified impacts for each species are then apportioned between all the relevant breeding seabird colonies (SPA and other), and the apportioned impacts considered against a specific ‘threshold of concern’ calculated for the species and SPA population in question.

8.2.9. For SPAs, impacts can be expressed as a change to adult baseline mortality rates which allows direct comparison against the advised threshold given by NatureScot (i.e., an increase in breeding adult mortality of ≥0.02 percentage point change compared to baseline). If quantified impacts are above the advised threshold, assessment progresses to population viability analysis (PVA), to investigate whether there could be population-level consequence.

8.2.10. The following technical reports provide the supporting information for these two stages of quantitative assessment:

- Offshore and Intertidal Ornithology Apportioning Report (Volume 3, Appendix 11.4), which provides methodology and results on the apportioning of mortality impacts to the SPAs and non-SPA colonies with connectivity to Proposed Development.
- Offshore and Intertidal Ornithology Population Viability Analysis Report (Volume 3, Appendix 11.5), which provides methodology and results on the assessment of the long-term viability of SPA populations with the development related impacts applied to them.

8.2.11. NatureScot (2023b) requests the following PVA outputs to be presented in the RIAA:

- Counterfactual of population size (CPS); and
- Counterfactual of growth rate (CGR).

8.2.12. These counterfactuals are the ratios of the impacted to unimpacted (baseline) scenarios (Searle *et al.*, 2019; Cook and Robinson, 2016). These metrics are requested because they

are the least sensitive to any misspecification in the modelling. CGR illustrates impacts regardless of population status or trend, whereas CPS is slightly more sensitive to this; however, when used in tandem, they are considered to be more informative than any other currently available alternatives (Jital *et al*., 2017, NatureScot, 2023b).

8.2.13. The key information presented in this RIAA relates to these SPA breeding seabird colonies. Section 8.3 presents the information to inform Project alone assessment of these interests and Section 9.3 provides that for the in-combination assessment.

MARINE SPAS

8.2.14. As set out in Table 7.2, the following marine SPAs and marine SPA extensions have been included under Stage 1 HRA screening:

- Outer Firth of Forth and St Andrews Bay Complex mSPA;
- Seas off Foula mSPA; and
- Seas off St Kilda mSPA.

8.2.15. NatureScot (2023c), Guidance Note 4, advises that the key purpose of marine SPAs is to give protection to birds at sea, including the foraging aggregations of true seabirds (both breeding and non-breeding). This protection primarily applies when the birds are within the mSPA, as well as affording protection to prey species and supporting habitat, again within the mSPA.

8.2.16. The mSPA designations are complementary to the network of SPA breeding colonies and should not duplicate existing protection measures or assessment processes. Therefore, NatureScot advise that consideration of connectivity and LSE for mSPAs is based on impact pathways and whether or not these will directly affect mSPA qualifiers or their supporting habitats and prey.

8.2.17. At the distances involved (over 115 km from closest Proposed Development infrastructure to closest mSPA), it can be readily concluded that there will be no AEoSI in relation to any supporting habitat or prey within the identified mSPAs from any Proposed Development activities or identified impact pathways.

8.2.18. In respect of direct impacts on mSPA seabird qualifiers, the guidance advises that: the population level consequences will be addressed through consideration of connectivity from functionally linked seabird colony SPAs. The key functionally linked SPA breeding colonies for each mSPA screened in for AA are given in Table 8.4.

Table 8.4 Marine SPAs and their functionally linked SPA breeding colonies

mSPA	Key functionally linked breeding seabird colonies
Outer Firth of Forth and St Andrews Bay Complex mSPA	Forth Islands SPA
Seas off Foula mSPA	Seas off Foula SPA
Seas off St Kilda mSPA	St Kilda SPA

8.2.19. Therefore, direct injury or mortality impacts to mSPA seabird qualifiers have been addressed via the HRA process and AA carried out for these functionally linked breeding seabird SPAs, adopting the process set out in the preceding section. There is no requirement for any separate process which duplicates this work.

WATERBIRD SPAS

8.2.20. As set out in Table 7 2, the following waterbird SPAs have been included under Stage 1 HRA screening:

- Loch of Strathbeg SPA and Ramsar
- Inner Firth of Forth SPA
- Dornoch Firth and Loch Fleet SPA and Ramsar
- Scapa Flow SPA
- Inner Moray Estuary SPA and Ramsar
- Cromarty Firth SPA and Ramsar

8.2.21. The WTGs to be constructed in the Array Area may present a collision risk to the waterbird interests of these SPAs during their migratory movements, either when flying to their wintering grounds in the UK, or when transiting between different locations within UK waters, or when returning to their breeding sites at the end of the season.

8.2.22. At the distances involved (between closest SPA and Array Area or offshore ECC), there are no other impact pathways likely to give rise to a significant effect (Table 7.2). Potential collision risk to SPA waterbirds is addressed in the relevant section under Operation and Maintenance (O&M) impacts.

WORST CASE DESIGN SCENARIO

8.2.23. In order to allow flexibility in potential design options, the Developer has adopted a design envelope approach to impact assessment (also known as a 'Rochdale Envelope'); see Volume 1, Chapter 3 (Project Description).

8.2.24. For Offshore and Intertidal Ornithology, Table 8.5 identifies the 'worst case design scenario' for each impact pathway and SPA receptor assessed. This represents the 'worst case' or highest level of potential ornithological impact from the Proposed Development and all other design options should lie within this limit.

Table 8.5 Worst Case Design Scenarios with respect to the offshore and intertidal ornithology Assessment

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
Construction			
Direct distributional responses	C-05, C-10, C-14, C-35, C-40	Array Area of 200 km^2 and ECC of 3 x 90 km = 270 km. Offshore construction period of approximately four years (24 hrs/day operations, 7 days/week) Maximum number of vessel round trips: 1711 • Up to 168 round trips for offshore surveys • Up to 444 round trips for construction support; • Up to 502 round trips for anchor, mooring and inter-array cable installation works and floating foundation tow-out and hook up; • Up to 445 round trips for WTG integration and commissioning; • Up to 60 round trips for export cable installation; • Up to 36 round trips for OEP installation and commissioning; and • Up to 56 round trips for miscellaneous works. Maximum number of vessels expected to be on site at the same time: 21. Realistic number of vessels expected to be on site at the same time: 10. Maximum piling duration of 175 days. OEP piling: May to Aug 2030 Anchor piling: April to Sept 2029, 2030, and 2031	The magnitude of the impact is dependent on the area of the Array Area, the length of the cable route, the amount of vessel activity, and the duration of construction activities.
Changes in prey	C-05, C-08, C-14, C-40	For disturbance effects to prey species, refer to the worst case design scenarios for Benthic, Subtidal and Intertidal Ecology (Volume 1, Chapter 10 (Benthic, Subtidal and Intertidal Ecology)) and Fish and Shellfish Ecology (Volume 1, Chapter 11 (Fish and Shellfish Ecology)).	Indirect effects on birds could occur through changes to any of the species and habitats considered within the Fish and Shellfish Ecology or Benthic, Subtidal and Intertidal Ecology assessments. The maximum indirect impact on birds would result from the maximum direct

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
			impact on fish, shellfish and benthic species and habitats.
Artificial lighting	C-36	Marine lighting will comply with requirements set out by the MCA in "MGN 654 (M+F) Offshore Renewable Energy Installations safety response.	Qualitative assessment has been undertaken based on these requirements.
Accidental pollution	C-08	Maximum number of vessel round trips during Construction: 1711 Maximum number of vessels expected to be on site at the same time: 21. Realistic number of vessels expected to be on site at the same time: 10.	Maximum vessel activity during construction is assumed to represent the worst case for risk of accidental pollution.
Operation and Maintenance			
Direct distributional responses	C-10, C-35, C-40	Up to 67 WTGs deployed across the full Array Area (200 km^2): • Maximum hub height above MSL: 195 m • Maximum rotor blade diameter: 300 m. Maximum number of vessel round trips per year: 509 Maximum of 12 vessels on site at any one time.	The magnitude of the impact is dependent on the area of the Array Area and number/size of WTGs, and the amount of vessel activity and repair activities that may occur.
Collision with operational WTGs	C-33	Turbine parameters: • Operational life of 35 years. • Number of turbines: 67 • Rotor radius (m): 118 • Latitude: 57.41 • Tidal offset (m): 0 • Maximum blade width (m): 8 • Minimum lower tip height (m above sea level): 30	The magnitude of the impact is dependent on each of these turbine parameters, with the worst-case scenario determined through use of collision risk modelling used to determine the parameters that collectively give the highest collision estimates (Volume 3, Appendix 11.2 (Offshore and Intertidal Ornithology Collision Risk Modelling Report)). NatureScot (2023d) guidance is to undertake CRM for both the worst-case scenario and the most likely scenario: three scenarios were modelled, and it is the

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
		• Mean rotational speed (mean RPM between cut-in and cut-off) +/- 1SD: 8.4 (+/- 1.5) • Blade pitch (mean) +/- 1SD: 8 (+/- 4) • Wind availability (%): 89.11 – 97.14 each month • Mean downtime (%): 3 each month • Standard deviation downtime (%): 2 each month	most likely scenario that was also deemed to be the worst-case scenario.
Artificial lighting:	C-36	Marine lighting will comply with requirements set out by the MCA in "MGN 654 (M+F) Offshore Renewable Energy Installations safety response.	Qualitative assessment has been undertaken based on these requirements.
Entanglement	C-37	Mooring parameters: • Maximum 12 mooring lines per WTG for all mooring arrangement options (maximum 804 mooring lines total where tension lines are used, 576 mooring lines for the other options). • Maximum mooring line radius: 1,500 m (except for tension morning lines: 200 m). • Maximum mooring line length 1,600 m for catenary (1550 m for semi-taut, 1500 m for taut and less than 200 m for tension lines). • Maximum lateral cross-section of the mooring system in the water column: 10,800 m^2 x 67 WTG = 723,600 m^2 • Mooring lines material: chain, wire, synthetic rope or combination • Minimum mooring line diameter = 80 mm (without marine growth accumulation) • Maximum mooring line diameter: 190 mm for top/bottom chain, 450 mm for synthetic rope, 250 mm for wire rope. • It should be noted that regardless of the mooring line design, the lines will be under high tension with no potential for creating a loop around a bird.	The magnitude of the impact is dependent on the number of moorings within the Array Area.

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
		Inter-array cables: • Minimum external cable diameter: 150 mm. • Maximum external cable diameter: 250 mm • Using max diameter, total surface area assuming 67 WTGs, 2 cables each x 300 m in water column = 31,586 m^2	
Changes in prey	C-08	For disturbance effects to prey species, refer to the worst-case design scenarios for Benthic, Subtidal and Intertidal Ecology (Volume 1, Chapter 10 (Benthic, Subtidal and Intertidal Ecology)) and Fish and Shellfish Ecology (Volume 1, Chapter 11 (Fish and Shellfish Ecology)).	Indirect effects on birds could occur through changes to any of their prey species and associated habitats. The maximum indirect impact on birds would result from the maximum direct impact on fish, shellfish and benthic species and habitats.
Accidental pollution	C-08	Maximum number of vessel round trips per year during O&M: 509 Maximum of 12 vessels on site at any one time.	The risk of accidental pollution during O&M is assumed to be no greater than that assessed for construction. There are fewer vessel round trips each year compared to the construction phase, albeit the risk extends over the 35 year operational lifespan of the Project.
Decommissioning			
Direct distributional responses	C-09, C-10, C-14, C-35	Impact over a decommissioning period of approximately three years. In the absence of detailed information regarding decommissioning works, the implications for offshore ornithology are considered analogous with or likely less than those of the construction phase. Therefore, the worst-case parameters defined for the construction phase also apply to decommissioning. The approach to decommissioning is set out in Volume 1, Chapter 3 (Project Description).	The magnitude of the impact is dependent on the area of the Array Area, the length of the cable route, the amount of vessel activity, and the duration of decommissioning activities.
Changes in prey from decommissioning activities	C-05, C-08, C-09, C-14		Indirect effects on birds could occur through changes to any of the species and habitats considered within the Fish and Shellfish Ecology or Benthic, Subtidal and Intertidal Ecology assessments. The maximum indirect impact on birds would result from the maximum direct impact on fish, shellfish and benthic species and habitats.
Artificial lighting:	C-36	Marine lighting will comply with requirements set out by the MCA in "MGN 654 (M+F) Offshore Renewable	Artificial lighting impacts during decommissioning are assumed to be no greater than those assessed for

Impact	Embedded Commitment	Worst Case Design Scenario	Justification
		Energy Installations safety response.	construction.
Accidental pollution	C-08	Maximum estimates of vessel activity and presence assumed to be the same as for Construction.	The risk of accidental pollution during decommissioning is assumed to be no greater than that assessed for construction.

CONSTRUCTION AND DECOMISSIONING

DIRECT DISTRIBUTIONAL RESPONSES

8.2.25. Shag (*Gulosus aristotelis*), guillemot (*Uria aalge*), razorbill (*Alca torda*) and puffin from ten SPAs are being addressed in relation to direct distributional responses during Construction and Decommissioning (Table 7.2):

- Buchan Ness to Collieston Coast SPA (shag (ECC Only), guillemot);
- Troup, Pennan and Lion's Heads SPA (guillemot, razorbill);
- Fowlsheugh SPA (guillemot, ECC Only, razorbill);
- East Caithness Cliffs SPA (guillemot);
- Forth Islands SPA (puffin);
- North Caithness Cliffs SPA (puffin);
- Farne Islands SPA (puffin);
- Hoy SPA (puffin);
- Fair Isle SPA (puffin); and
- Coquet Island SPA (puffin).

8.2.26. Direct distributional responses may occur during the construction phase due to disturbance from construction activities and presence of infrastructure as it is installed within the Array Area and offshore ECC. Construction activities (e.g. seabed preparation works, UXO removal, WTG installation and cable installation), and vessel movements can disturb or displace seabird species using marine habitats for roosting, foraging, loafing and/or molting. During decommissioning, activities are anticipated to be a reversal of the WTG and OEP installation process as set out in Volume 1, Chapter 3 (Project Description).

8.2.27. The presence of WTGs as they are installed within the Array Area may also have barrier effects; whereby individuals alter their flight paths to avoid such infrastructure, increasing energetic demands. This disturbance can result in temporary reductions in habitat availability or longer-term displacement from previously used areas. In extreme cases, such reductions may adversely affect individuals' body condition, potentially increasing mortality rates. The sensitivity of individual species to such disturbance is described in Volume 2, Chapter 11 (Offshore and Intertidal Ornithology).

8.2.28. A variety of vessels will likely be present during installation and decommissioning of the WTG sub-structures and anchors, including tugs and anchor handling vessels: with a maximum of 55 vessels to be on-site at any one time and a total estimated number of 1,711 vessel movements during the four-year duration offshore installation campaign. Even at these suggested maximums, the levels of vessel activity associated with the Proposed Development are well within the AIS baseline for this area (Volume 2, Chapter 14 Shipping and Navigation). In the absence of detailed information regarding decommissioning works, the implications for offshore ornithology are considered analogous with or likely less than those of the construction phase. Therefore, the worst-case parameters defined for the construction phase also apply to decommissioning.

8.2.29. During construction or decommissioning, the disturbance of seabirds will be localised around the Proposed Development activities and associated vessels; and will be both intermittent and temporary. The vessels involved in Proposed Development activities will transit to the area utilising existing and pre-defined shipping corridors where possible, thereby reducing the spatial extent of any possible impacts. Construction activities will be managed through the

adoption and implementation of the EMP (C-08), provision of a VMP (C-10), and adherence to guidelines laid out in the Scottish Marine Wildlife Watching Code (C-35), all proposed as embedded mitigation in Table 6.2.

8.2.30. The primary source of airborne and underwater noise for the Project is the from the piling of the Offshore Electrical Platforms (OEPs) and the anchoring of the WTG mooring lines. In total the piling would take place over a maximum of 175 days with the OEP piling occurring in May to August 2023 and the Anchor piling happening April to September in 2029 to 2031. Note that the hammer energy required to install floating WTG anchorage is generally much lower than that for fixed-bottom foundation installation, the latter requiring larger diameter monopiles than pin piles.

8.2.31. For guillemot, where Project alone PVA has been undertaken, three years of assumed construction impacts have been modelled in addition to the intended operational lifespan (35 years) – as presented in Annex F of the PVA appendix. This PVA modelling demonstrates that there is no risk of a population consequence from this impact pathway to guillemot at either Buchan Ness to Collieston Coast SPA or Troup, Pennan and Lion's Heads SPA.

8.2.32. Therefore, based on the qualitative assessment set out above, and the available PVA modelling, it is judged that there is no risk of any population-level consequence from this impact pathway on any of the shag, guillemot, razorbill and puffin populations at the SPAs listed above [8.3.25 and Table 7.2]. Thus, there is no risk of AEoSI from this impact pathway at any SPAs.

ARTIFICIAL LIGHTING

8.2.33. Deakin *et al*. (2022) identifies the following species as potentially at risk from this impact pathway: puffin, European storm petrel, Leach's petrel and Manx shearwater. These species from 17 SPAs have been screened in for potential effects from artificial lighting during Construction and Decommissioning (Table 7.2):

- Forth Islands SPA (puffin);
- North Caithness Cliffs SPA (puffin);
- Farne Islands SPA (puffin);
- Auskerry SPA (European storm petrel);
- Hoy SPA (puffin);
- Fair Isle SPA (puffin);
- Coquet Island SPA (puffin);
- Sule Skerry and Sule Stack SPA (Leach's petrel, European storm petrel);
- Mousa SPA (European storm petrel);
- Foula SPA (Leach's petrel);
- North Rona and Sula Sgeir SPA (Leach's petrel, European storm petrel);
- Flannan Isles SPA (Leach's petrel);
- Rum SPA (Manx shearwater);
- St Kilda SPA (European storm petrel, Leach's petrel, Manx shearwater);
- Cruagh Island SPA (Manx shearwater);
- Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA (Manx shearwater); and

- Skomer, Skokholm and the Seas off Pembrokeshire SPA (Manx shearwater).

8.2.34. As set out in Table 8.2, (worst case design scenario), it is assumed that potential lighting requirements during Proposed Development decommissioning, will be no greater than those assessed below for the construction phase.

8.2.35. The primary light sources during construction will come from navigational lights on the OEPs, and lights on vessels. Proposed Development lighting has the potential to act as an attractant for some species of birds or to otherwise modify their behaviour (Deakin *et al*. 2022). Attraction of birds to vessels may also increase the risk of collision with the vessel and/or increased energetic costs in investigating the light source (Fischer *et al*., 2021).

8.2.36. OEP and WTG navigation lighting and vessel lighting could potentially increase the collision risk of nocturnally active species (puffin, European storm petrel, Leach's storm petrel and Manx shearwater) due to light attraction. Deakin *et al*. (2022) suggests that attraction is mainly observed to intense lighting such as that from lighthouses, which are significantly more powerful, than navigational and vessel lighting.

8.2.37. While nocturnally active seabird species such as Manx shearwater could be considered at potential risk of attraction to artificial lighting at night, the potential for impacts is considered low. There is some limited evidence of Manx shearwater foraging during the night in Scotland, however, foraging occurs almost exclusively during daylight hours (Kane, 2020). The majority of nocturnal behaviour would typically be associated with birds rafting close to colonies in the evening and then returning to their burrows after dusk. As there are no Manx shearwater colonies in the immediate vicinity of the Proposed Development, and as foraging activity is likely to be low during nocturnal hours, potential impacts from attraction to turbine lighting in terms of impacts on breeding success are considered to be low.

8.2.38. For the SPAs considered here, the minimum distance to the Array Area is 171.62 km (Forth Islands SPA), and many of these SPAs are considerably more distant from the Array Area and offshore ECC. Based on the distances involved, it is considered that potential impacts from attraction to artificial lighting in terms of impacts on breeding success are considered to be low. In addition, the Environmental Impact Assessment Report: Volume 2, Chapter 11 Offshore and Intertidal Ornithology assessed the magnitude and overall significance of the impact of artificial lighting to be negligible for the species of concern.

8.2.39. One of the embedded mitigation commitments of the Project is the development of and adherence to a Lighting and Marking Plan (LMP), commitment C-36 in Table 6.2. The LMP will confirm appropriate lighting and marking mitigation whilst ensuring compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.

8.2.40. Given that all artificial lighting associated with the Proposed Development will be less powerful than other artificial light sources such as lighthouses (Deakin *et al*., 2022), and also that vessel lighting is already common within the area, it is anticipated that significant attraction is unlikely to occur. Furthermore, the implementation of the LMP will ensure the risk of impact to individual birds is minimized and any population consequence avoided. Therefore, it is concluded that there will be no AEoSI arising from artificial lighting on any of the SPA populations assessed for the species of concern.

CHANGES TO PREY

8.2.41. Potential indirect effects on seabirds resulting from changes to prey have been screened in for Construction and Decommissioning for all species and SPAs identified within Table 7.2.

8.2.42. Underwater noise arising in the construction or decommissioning of the Proposed Development may potentially displace noise-sensitive prey species for seabirds. Changes in prey distribution and abundance may also arise in response to increased levels of suspended

sediment, causing fish and mobile invertebrates to avoid affected areas or potentially smothering benthic prey species.

AUK SPECIES

8.2.43. The sensitivity of seabirds to such temporary changes in prey availability and distribution depends on their foraging flexibility, in particular their specific habitat and dietary requirements. Furness *et al*. (2012) identified guillemot, razorbill and puffin as having moderate habitat specialisation scores (i.e. moderate levels of foraging flexibility). During the breeding and post-breeding periods guillemot preferentially forage for sandeels (and, to a lesser extent, other wide-ranging mobile prey species), while razorbill and puffin feed mainly on sandeels, sprat and herring (Furness *et al*., 2012; Wanless, Harris and Greenstreet, 1998).

8.2.44. The potential for impacts from Construction and Decommissioning activities on fish, including seabird prey species is assessed in the Environmental Impact Assessment Report Chapter 10 Fish and Shellfish. Whilst there was deemed to be potential for effect from impacts such as increases in Suspended Sediment Concentration (SSC), direct and indirect disturbances, and impacts relating to underwater noise and vibration during Construction and Decommissioning, these were, with one exception, assessed to be of negligible or minor significance.

8.2.45. The significance of increases in SSC on demersal spawning herring was assessed as moderate. However, the diet of auks in the northwestern North Sea is comprised largely of sandeel (*Ammodytes tobianus*), and the main alternative, European sprat (*Sprattus sprattus*) (Wanless *et al*. 2018), therefore any changes to herring distribution or availability are considered unlikely to have significant impacts on foraging auks.

8.2.46. In general fish species which are the primary prey of auks are able to avoid temporary disturbance (EMU, 2004). However, herring and sandeel are demersal spawners and their reduced mobility makes them and their eggs more vulnerable. Both herring and sandeel have spawning grounds distributed across the North Sea. For herring, the Proposed Development overlaps with 5% of the spawning ground while for sandeel the overlap is 10% (NMPi, 2015, as categorised by Coull *et al*., 1998; Ellis, *et al*., 2012).

8.2.47. Whilst there may be intermittent disturbance or displacement of prey from the locations of Construction or Decommissioning activities, it is considered unlikely that the overall availability of prey for auks will be affected, as auks can typically target a range of prey species. Additionally, as auk species have relatively large foraging ranges (Woodward *et al*. 2019), is considered birds will be able to follow any redistribution of their prey species.

8.2.48. It is therefore considered that any temporary changes in local prey availability or distribution during construction or decommissioning will not result in any significant effects on individual survival for guillemot, razorbill or puffin. There is therefore no risk of any population-level consequence and no AEoSI for any of the SPA populations in question (Table 7.2) from these Project alone impacts.

OTHER SEABIRDS

8.2.49. Furness *et al*. (2012) identifies the following seabird species as having low or very low habitat specialisation scores (i.e., high levels of foraging flexibility): kittiwake, gannet, storm petrel, Leach's petrel, fulmar (*Fulmarus glacialis*), Manx shearwater and great skua (*Stercorarius skua*).

8.2.50. These species can exploit a wide range of foraging opportunities in the marine environment. In the breeding season, any changes to the availability or distribution of prey associated with construction or decommissioning activities are likely to be negligible when considering the Project area in relation to the total potential foraging ranges of these species (Woodward *et*

al., 2019). In non-breeding seasons these species forage over wider areas as they are unrestricted by the necessity to return to colonies provision young.

8.2.51. It is therefore considered, with a high degree of certainty, that changes to prey availability and distribution during construction or decommissioning will not result in any significant effects on individual survival for kittiwake, gannet, storm petrel, Leach's petrel, fulmar, Manx shearwater or great skua. There is no risk of a population-level consequence from this impact pathway and therefore no AEoSI for any of the SPA populations in question (Table 7.2) from these Project alone impacts.

ACCIDENTAL POLLUTION

8.2.52. Accidental pollution has been screened in for all species and SPAs identified within Table 7.2.

8.2.53. This impact pathway is the risk of accidental spillage of materials hazardous to the environment, which may then lead to impacts on the marine and/or intertidal environment. It can include spillage of fuel from vessels or plant, or from other hazardous substances such as lubricants or grout during construction activities. This could result in mortality to birds by means of prey and/or habitat effects, or through direct effects.

8.2.54. The risk of accidental pollution will be reduced by the measures to be included in the EMP (commitment C-08, Table 6.2), for implementation during all phases of development: construction, operation and decommissioning. The EMP (C-08) will include mitigation measures and procedures for pollution prevention and waste management to ensure accidental spillages are appropriately contained and dealt with.

8.2.55. All vessels associated with the Proposed Development will also be required to comply with the best practice standards set out by OSPAR (Oslo-Paris), International Maritime Organisation (IMO) and MARPOL (International Convention for the Prevention of Pollution from Ships). Similar pollution control measures will also be implemented for all other offshore WTG projects within foraging range of these SPAs.

8.2.56. Therefore, considering these embedded mitigation measures, it is considered that there is no risk of significant accidental pollution being so serious as to result in a population consequence for any of these SPA seabird interests. There is therefore no AEoSI from this impact pathway on any of the SPAs listed in Table 7.2 from these Project alone impacts.

OPERATION AND MAINTENANCE

8.2.57. This section assesses the identified impact pathways during the Proposed Development operation phase, for SPA ornithological and intertidal interests screened in under Stage 1 (Table 7.2).

DIRECT DISTRIBUTIONAL RESPONSES

8.2.58. Direct distributional responses may occur during Project Operation and Maintenance (O&M) with birds potentially disturbed by required maintenance activities and associated vessel movements. These aspects are addressed in the same manner as for distributional responses which may occur during Construction and Decommissioning, i.e., through adoption and implementation of an EMP (C-08), VMP (C-10), and adherence the Scottish Marine Wildlife Watching Code (C-35) (Table 6.2).

8.2.59. Importantly, this impact pathway also covers displacement and barrier effects due to birds avoiding, or otherwise responding to, the operational WTGs. These aspects are addressed in detail in Volume 3, Appendix 11.3 (Offshore and Intertidal Ornithology Distributional Responses Technical Report), as summarized below.

8.2.60. Table 7.2 in Section 7 of this report, screens in 33 SPAs for shag, guillemot, razorbill, gannet, puffin and kittiwake, which are considered to be sensitive to direct distributional responses relating to O&M vessel movements and associated activity (Table 8.2). Such disturbance impacts are considered in detail under Construction and Decommissioning, and this presents the maximum level of impact, for which disturbance to seabirds from O&M vessel movements and associated maintenance activities is not considered to be any more than that already assessed.

8.2.61. Volume 2, Chapter 11 (Offshore and Intertidal Ornithology) discusses the sensitivity of individual species to distributional responses in relation to operational WTGs, with guillemot, razorbill, puffin, kittiwake and gannet being the relevant species to address at the following SPAs:

- Buchan Ness to Collieston Coast SPA (guillemot, kittiwake);
- Troup, Pennan and Lion's Heads SPA (guillemot, razorbill, kittiwake);
- Fowlsheugh SPA (razorbill, kittiwake);
- East Caithness Cliffs SPA (kittiwake);
- Forth Islands SPA (gannet, puffin, kittiwake);
- North Caithness Cliffs SPA (puffin, kittiwake);
- Copinsay SPA (kittiwake);
- St Abb's Head to Fast Castle SPA (kittiwake);
- Farne Islands SPA (puffin, kittiwake);
- Hoy SPA (kittiwake, puffin);
- Calf of Eday SPA (kittiwake);
- Rousay SPA (kittiwake);
- Fair Isle SPA (gannet, puffin, kittiwake);
- Coquet Island SPA (puffin);
- West Westry SPA (kittiwake);
- Marwick Head SPA (kittiwake);
- Sumburgh Head SPA (kittiwake);
- Sule Skerry and Sule Stack SPA (gannet);
- Cape Wrath SPA (kittiwake);
- Noss SPA (gannet, kittiwake);
- Foula SPA (kittiwake);
- Flamborough and Filey Coast SPA (gannet);
- North Rona and Sula Sgeir SPA (gannet), and
- Hermaness, Saxa Vord and Valla Field SPA (gannet).

ARRAY AREA

8.2.62. The population consequence of any Project alone distributional responses was modelled under PVA for SPA populations of guillemot, razorbill, puffin, kittiwake and gannet only where there was an increase in the breeding adult mortality rate of 0.02 percentage points or more

(NatureScot 2023b); see Annex A of Appendix 11.5 Offshore and Intertidal Ornithology Population Viability Analysis Report.

GUILLEMOT

8.2.63. PVA is required and has been undertaken in respect of direct distributional response for the two SPA guillemot populations within mean max foraging range of the Array Area, screened in for assessment: Buchan Ness to Collieston Coast SPA and Troup, Pennan and Lion's Head SPA. Table 8.6 presents the Project alone impacts for the 'higher' (60%/3%) and 'lower' (60%/1%) scenarios modelled under PVA (figures are taken from Table 3.7 of t Appendix 11.4 Offshore and Intertidal Ornithology Apportioning Report).

Table 8.6 Guillemot Project alone impact scenarios modelled under PVA

SPA population	Scenario	Distributional response mortality estimates		
		Breeding season SeabORD modelling	Non-breeding season Displacement matrices	
Buchan Ness to Collieston Coast	Higher	239.063	60% / 3%	129.670
	Lower	143.437	60% / 1%	43.225
Troup, Pennan and Lion's Head	Higher	144.794	60% / 3%	78.538
	Lower	86.876	60% / 1%	26.180

8.2.64. Table 8.7 presents the outputs from the PVAs undertaken for these Project alone impacts, with the detailed methodology described Appendix 11.5 Offshore and Intertidal Ornithology Population Viability Analysis Report, and with the CPS and CGR figures taken from Table 3.7 and Table 3.8 of the results section in that report.

Table 8.7 Guillemot Project alone PVA outputs for modeled impact scenarios

SPA population	Scenario	PVA output at 35 years[1]	
		CPS	CGR
Buchan Ness to Collieston Coast	Higher	0.939 *0.924 - 0.954*	0.998 *0.998 - 0.999*
	Lower	0.979 *0.964 - 0.995*	0.999 *0.999 - 1.000*
Troup, Pennan and Lion's Heads	Higher	0.968 *0.954 - 0.982*	0.999 *0.999* - 0.999
	Lower	0.989 *0.974 - 1.000*	1.000 *0.999 - 1.000*

8.2.65. As presented in Table 8.7, the 'higher' Project alone impact scenario for Buchan Ness to Collieston Coast SPA resulted in an 0.2% reduction in growth rate (CGR) and a 6.1% reduction in end population size (CPS) over 35 years (the intended operational lifetime of the Project). Based on these PVA outputs, it is concluded that there is no risk of AEoSI to the guillemot population at this SPA from these Project alone distributional responses. Such Project alone impacts are not considered to present any significant risk to guillemot population viability at this SPA, however, in-combination impacts require further consideration and are addressed in Section 9.3.

8.2.66. For Troup, Pennan and Lion's Heads SPA, the 'higher' scenario gave rise to an 0.2% reduction in growth rate (CGR) and a 3.2% reduction in end population size (CPS) over 35

years. Such Project alone impacts are not considered to present any significant risk to guillemot population viability at this SPA and it is concluded that there is no risk of AEoSI, however, in-combination impacts require further consideration and are addressed in Section 9.3.

RAZORBILL

8.2.67. Razorbill Project alone annual adult mortality estimates do not exceed the threshold of concern advised by NatureScot for any of the SPA populations under consideration: i.e. the additional mortality rate to breeding adult birds did not result in increased mortality of 0.02 percentage points or more. The estimated annual mortality, based on the higher distributional response mortality scenario, at Troup, Pennan and Lion's Head SPA is 0.91 breeding adults (0.33 % point change in adult mortality) and at Fowlsheugh SPA is 0.95 breeding adults (0.65 % point change in adult mortality). .

8.2.68. There was therefore no need for PVA in order to determine that there is no AEoSI to any SPA razorbill population from this impact pathway (Project alone). However, in-combination impacts require further consideration as addressed in Section 9.3.

PUFFIN

8.2.69. Puffin Project alone annual adult mortality estimates do not exceed the NatureScot threshold of concern (0.02 %point change in adult mortality) for any of the SPA populations under consideration. The estimated annual mortality, for the higher distributional response scenario is as follows: Forth Islands SPA (10.20), North Caithness Cliffs SPA (0.39), Farne Islands SPA (4.20) and Coquet Island SPA (1.80).

8.2.70. Hoy and Fair Isle SPAs also have apportioned breeding adult mortalities of less than one bird, and less than the NatureScot threshold.

8.2.71. There was therefore no need for PVA in order to determine that there is no AEoSI to any SPA puffin population from this impact pathway (Project alone). However, in-combination impacts require further consideration as addressed in Section 9.3.

KITTIWAKE

8.2.72. As kittiwake may be susceptible to both distributional responses and collision impacts, the quantified mortality estimates from each of these impact pathways are summed to give a combined total which is then compared against the NatureScot advised thresholds for PVA. Please see Section 8.2, below under collision risk, where this process and PVA outputs are presented.

GANNET

8.2.73. As gannet may be susceptible to both distributional responses and collision impacts, the quantified mortality estimates from each of these impact pathways are summed to give a combined total which is then compared against the NatureScot advised thresholds for PVA. Please see Section 8.2, below under collision risk, where this process and PVA outputs are presented.

OFFSHORE ECC AND CABLE LANDFALL

8.2.74. During O&M there is potential for direct distributional responses related to the offshore ECC and cable landfall for shag, guillemot, razorbill and puffin from ten SPAs (Table 7.2):

- Buchan Ness to Collieston Coast SPA (shag (ECC Only), guillemot);
- Troup, Pennan and Lion's Heads SPA (guillemot, razorbill);
- Fowlsheugh SPA (guillemot, razorbill);

- East Caithness Cliffs SPA (guillemot);
- Forth Islands SPA (puffin);
- North Caithness Cliffs SPA (puffin);
- Farne Islands SPA (puffin);
- Hoy SPA (puffin);
- Fair Isle SPA (puffin); and
- Coquet Island SPA (puffin).

8.2.75. There will be no pathway for direct impact on these species from the operational cable once it has been laid. Within the offshore ECC and landfall area, there is potential for disturbance impacts from vessels during O&M and for any maintenance activities related to the cable, for example, should any cable protection restoration, reburial or section-replacement be required. Any required maintenance will be smaller in spatial extent and will require fewer vessels than during Construction and Decommissioning and so any maintenance activities during the O&M phase will be equal to or less than those during Construction and Decommissioning.

8.2.76. As referenced in Table 7.2, direct distributional responses of guillemot, razorbill, puffin and kittiwake may also occur in relation to Operation and Maintenance activity for the offshore ECC and landfall area. This impact pathway is also relevant to consider in relation to shag at Buchan Ness to Collieston Coast SPA (Table 7.2).

8.2.77. Similar to the conclusions for the Construction and Decommissioning phases, short term disturbance may occur due to vessel and other maintenance activities during O&M. However, there is no risk of a population-level consequence against any of the SPAs listed above and in Table 7.2. Impacts to individual birds will be further reduced or avoided by the adoption of an EMP (C-08), VMP (C-10) and any other relevant mitigation (Table 6.2). It is therefore concluded that there is no AEoSI for any SPA populations potentially affected by this impact pathway.

COLLISION

8.2.78. Volume 2, Chapter 11 (Offshore and Intertidal Ornithology) discusses the sensitivity of individual species to collision risk; the risk that any birds entering the operational wind farm will collide with the WTG blades and be fatally injured. This impact pathway is relevant to SPA seabirds and to SPA waterbird interests (Volume 3, Appendix 11.2 Offshore and Intertidal Ornithology Collision Risk Modelling Technical Report).

SEABIRDS

8.2.79. Table 7.2 screens in 26 SPAs for kittiwake, gannet, herring gull, lesser black-backed gull, sandwich tern and great skua, which are the seabird species considered to be sensitive to collision risk:

- Buchan Ness to Collieston Coast SPA (herring gull, kittiwake);
- Troup, Pennan and Lion's Heads SPA (kittiwake);
- Fowlsheugh SPA (kittiwake);
- East Caithness Cliffs SPA (kittiwake);
- Forth Islands SPA (gannet, lesser black-backed gull, kittiwake);
- North Caithness Cliffs SPA (kittiwake);
- Copinsay SPA (kittiwake);

- St Abb's Head to Fast Castle SPA (kittiwake);
- Farne Islands SPA (kittiwake);
- Hoy SPA (great skua, kittiwake);
- Calf of Eday SPA (kittiwake);
- Rousay SPA (kittiwake);
- Fair Isle SPA (gannet, great skua, kittiwake);
- West Westry SPA (kittiwake);
- Marwick Head SPA (kittiwake);
- Sumburgh Head SPA (kittiwake);
- Sule Skerry and Sule Stack SPA (gannet);
- Cape Wrath SPA (kittiwake);
- Noss SPA (gannet, great skua, kittiwake);
- Foula SPA (great skua, kittiwake);
- Handa SPA (great skua);
- Fetlar SPA (great skua);
- Flamborough and Filey Coast SPA (gannet);
- North Rona and Sula Sgeir SPA (gannet);
- Hermaness, Saxa Vord and Valla Field SPA (gannet, great skua); and
- St Kilda SPA (gannet, great skua).

8.2.80. Volume 3, Appendix 11.2 (as referenced above) sets out the methodology and input parameters to undertake CRM (where it is required) and reports on model outputs.

8.2.81. In terms of Project alone assessment, it is only kittiwake where quantified mortalities are such that they require further consideration under PVA. For all other species, the collision mortalities are below the threshold of concern advised by NatureScot. For gannet, the combined Project alone mortalities from collision and distributional responses together remain below the NatureScot threshold.

KITTIWAKE

8.2.82. As noted, kittiwake may express a distributional response as well as being affected by collision risk, and Table 8.6 below sets out the combined Project alone impact scenarios based on the outputs from Volume 3, Appendix 11.2 on CRM and Volume 3, Appendix 11.3 on distributional response.

8.2.83. The mortality estimates calculated for these two impact pathways have been summed prior to being apportioned by colony; as set out in Volume 3, Appendix 11.4, Offshore and Intertidal Ornithology Apportioning Report). Estimates are also apportioned by age-class so that the predicted adult mortalities can be compared against NatureScot's thresholds of concern for PVA (≥0.02 % point change in breeding adult mortality compared to baseline), see Volume 3, Appendix 11.5, Offshore and Intertidal Ornithology Population Viability Analysis Report.

8.2.84. From this comparison, it was determined that PVA was required for the kittiwake populations at Buchan Ness to Collieston Coast SPA and Troup, Pennan and Lion's Heads SPA, with Table 8.8 providing the relevant input parameters.

8.2.85. For all remaining SPA kittiwake populations listed in Table 7.2, none of the Project alone adult mortality estimates (for 'higher' distributional responses) exceeded NatureScot thresholds of concern; as set out in Table A3, Annex A of Appendix 11.5.

8.2.86. From Table A3, the relevant adult mortality estimates apportioned to each SPA are as follows (the figures in brackets being numbers of birds): Fowlsheugh SPA (4.950), East Caithness Cliffs SPA (7.221), Forth Islands SPA (1.805), North Caithness Cliffs SPA (0.823), Copinsay SPA (0.047), St Abb's Head to Fast Castle SPA (0.622), Farne Islands SPA (0.605), Hoy SPA (0.038), Calf of Eday SPA (0.041), Rousay SPA (0.069), Fair Isle SPA (0.057), West Westry SPA (0.499), Marwick Head SPA (0.116), Sumburgh Head SPA (0.068), Cape Wrath SPA (0.194), Noss SPA (0.020), and Foula SPA (0.036).

Table 8.8 Kittiwake PVA inputs: Project alone collision and displacement estimates for SPA populations where PVA is required

SPA population	Scenario	Breeding season		Autumn migration period				Spring Migration period			
		Collision impact	Displacement impact	Collision impact		Displacement impact		Collision impact		Displacement impact	
				Adults	Immatures	Adults	Immatures	Adults	Immatures	Adults	Immatures
Buchan Ness to Collieston Coast	Higher	20.357 (3.988-39.571)	9.652	0.017 (0.006-0.037)	0.01 (0.004-0.023)	0.009	0.006	0.2 (0.117-0.325)	0.092 (0.054-0.149)	0.162	0.074
	Lower	20.357 (3.988-39.571)	3.218	0.017 (0.006-0.037)	0.01 (0.004-0.023)	0.003	0.002	0.2 (0.117-0.325)	0.092 (0.054-0.149)	0.054	0.025
Troup, Pennan and Lion's Heads	Higher	10.094 (1.978-19.622)	4.786	0.021 (0.008-0.045)	0.012 (0.004-0.027)	0.011	0.007	0.234 (0.137-0.379)	0.108 (0.064-0.176)	0.189	0.088
	Lower	10.094 (1.978-19.622)	1.596	0.021 (0.008-0.045)	0.012 (0.004-0.027)	0.004	0.002	0.234 (0.137-0.379)	0.108 (0.064-0.176)	0.063	0.029

8.2.87. Table 8.9presents the outputs from the PVAs undertaken for these Project alone impacts, with the detailed methodology described Appendix 11.5 Offshore and Intertidal Ornithology Population Viability Analysis Report, and with the CPS and CGR figures taken from Table 3.1 and Table 3.2 of the results section in that report.

Table 8.9 Kittiwake Project alone PVA outputs for modelled impact scenarios

SPA population	Scenario	PVA output at 35 years[1]	
		CPS	CGR
Buchan Ness to Collieston Coast	Higher	0.973 *0.948 - 1.000*	0.999 *0.999 - 1.000*
	Lower	0.973 *0.948 - 1.000*	0.999 *0.999 - 1.000*
Troup, Pennan and Lion's Heads	Higher	0.983 *0.957 – 1.010*	1.000 *0.999 - 1.000*
	Lower	0.983 *0.957 – 1.010*	1.000 *0.999 - 1.000*

[1] *Intended lease period.*

8.2.88. The 'higher' Project alone impact scenario for Buchan Ness to Collieston Coast SPA resulted in a 2.7% reduction in end population size (compared to baseline) over 35 years. For Troup, Pennan and Lion's Heads SPA, it gave rise to a 1.7% reduction in end population size over 35 years. The SPA population growth rates are only marginally affected by the presence of the Project.

8.2.89. Although kittiwake populations are declining at these two SPAs, the PVA counterfactuals (which are used because they are the available metrics which are least sensitive to population trend) do not indicate that there would be an effect on population viability from these Project alone impacts, and so it is judged that there is no risk of AEoSI.

8.2.90. However, the Project is not being developed in isolation and there are already operational projects considered to affect these kittiwake SPA populations, as addressed in Section 9.3 on in-combination impacts.

GANNET

8.2.91. As set out in Annex A of Appendix 11.5 Offshore and Intertidal Ornithology Population Viability Analysis, gannet Project alone adult mortality estimates (distributional response and collision combined) do not exceed the NatureScot threshold of concern for any of the eight SPA populations under consideration for this species (Table 7.2): Forth Islands SPA (10.60), Fair Isle SPA (0.46), Sule Skerry and Sule Stack SPA (0.34), Noss SPA (1.22), Flamborough and Filey Coast SPA (1.19), North Rona and Sula Sgeir SPA (0.75), Hermaness, Saxa Vord and Valla Field SPA (0.55), St Kilda SPA (0.62).

8.2.92. It can therefore be determined (without the use of PVA) that there is no AEoSI on any of these SPA gannet populations due to Project alone impacts. However, in-combination impacts require further consideration for gannet, as addressed in Section 9.3.

HERRING GULL

8.2.93. Whilst herring gull were relatively abundant in the site-specific intertidal surveys, only 28 individuals were observed within the Array Area during the 24 months of site-specific DAS (Volume 3, Appendix 11.1). Therefore, when modelled for collision risk, the Project alone mortality estimates did not exceed NatureScot's threshold of concern for the single herring gull SPA population screened in for assessment: Buchan to Collieston Coast SPA (Table 7.2).

8.2.94. It can therefore be determined (without the use of PVA) that there is no AEoSI on herring gull at this SPA in relation to Project alone collision risk. However, in-combination impacts require further consideration, as addressed in Section 9.3.

GREAT SKUA

8.2.95. Whilst there were nine great skua recorded in the regional DAS (of the wider E1 and E2 Plan Option areas), only three great skua individuals were recorded during the site-specific DAS and only two of these were recorded in flight. There were no great skua observed during the intertidal surveys (Volume 3, Appendix 11.1). Therefore, the Project alone mortality estimates did not exceed NatureScot's threshold of concern for any of the SPAs screened in for this species (Table 7.2): Hoy SPA, Fair Isle SPA, Noss SPA, Foula SPA, Handa SPA, Fetlar SPA, Hermaness, Saxa Vord and Valla Field SPA, St Kilda SPA.

8.2.96. It can therefore be determined (without the use of PVA) that there is no AEoSI on any SPA great skua population (in relation to Project alone collision risk). However, in-combinations impacts require further consideration, as addressed in Section 9.3.

LESSER BLACK-BACKED GULL

8.2.97. Only 11 lesser black-backed gull recorded in the regional DAS (of the wider E1 and E2 Plan Option areas), and none in the Array Area (as detailed in Volume 3, Appendix 11.1). Therefore Project alone mortality estimates did not exceed NatureScot's threshold of concern for the single lesser black-backed gull SPA population screened in for assessment (Table 7.2), the Forth Islands SPA.

8.2.98. It can therefore be determined (without the use of PVA) that there is no AEoSI on the lesser black-backed gull population at this SPA (in relation to Project alone collision risk). However, in-combinations impacts require further consideration as addressed in Section 9.3.

WATERBIRD SPECIES

8.2.99. Offshore WTGs may also present a collision risk to waterbird species during migration, and this impact pathway has been screened in for 36 species of waterbird at the following SPAs (Table 7.2):

- Loch of Strathbeg SPA and Ramsar;
- Inner Firth of Forth SPA;
- Dornoch Firth and Loch Fleet SPA and Ramsar;
- Scapa Flow SPA;
- Inner Moray Estuary SPA and Ramsar;
- Cromarty Firth SPA and Ramsar; and
- Ythan Estuary and Meikle Loch SPA and Ramsar

8.2.100. In line with the assessment for EIA, these species are assessed (for Project alone / cumulative impacts) following the approach detailed in Offshore and Intertidal Ornithology Collision Risk Modelling Technical Report (Volume 3, Appendix 11.2: Section 2.2). This approach is based on the work published by Wildfowl & Wetlands Trust (WWT) (2014), accounting for the updates made by Woodward *et al*., (2023). The percentage of the migratory population of each species potentially at risk of collision has been calculated by multiplying the proportion at collision risk height by the avoidance rate and expressing it as a percentage.

8.2.101. This is the theoretical percentage at risk of collision of all of the migrating population passing through a given development. The indicative threshold used by WWT (2014) to indicate a

potentially significant impact is 1% of a passage population, which would then require further consideration.

8.2.102. Adopting this 1% threshold, it was found that no migratory wildfowl and wader species were at significant risk. Special consideration was given to Loch of Strathbeg as it is the closest SPA to the Array Area. However, at a distance of 71 km, there should be no barrier created by the WTGs to birds accessing the SPA. It is therefore concluded that there is no AEoSI at any of the wildfowl and wader SPAs screened in for AA.

ARTIFICIAL LIGHTING

8.2.103. Puffin, European storm petrel, Leach's petrel and Manx shearwater from 17 SPAs have been screened in to consider potential effects from artificial lighting during O&M (Table 7.2):

- Forth Islands SPA (puffin);
- North Caithness Cliffs SPA (puffin);
- Farne Islands SPA (puffin);
- Auskerry SPA (European storm petrel);
- Hoy SPA (puffin);
- Fair Isle SPA (puffin);
- Coquet Island SPA (puffin);
- Sule Skerry and Sule Stack SPA (Leach's petrel, European storm petrel);
- Mousa SPA (European storm petrel);
- Foula SPA (Leach's petrel);
- North Rona and Sula Sgeir SPA (Leach's petrel, European storm petrel);
- Flannan Isles SPA (Leach's petrel);
- Rum SPA (Manx shearwater);
- St Kilda SPA (European storm petrel, Leach's petrel, Manx shearwater);
- Cruagh Island SPA (Manx shearwater);
- Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA (Manx shearwater); and
- Skomer, Skokholm and the Seas off Pembrokeshire SPA (Manx shearwater).

8.2.104. Site infrastructure (such as the offshore substation and WTGs) will have lighting in place for navigational safety (in relation to both aircraft and shipping). These light sources have the potential to act as an attractant for puffin, European storm petrel, Leach's petrel and Manx shearwater or to otherwise modify their behaviour (Deakin *et al*. 2022). Lighting on vessels may also give rise to such effects.

8.2.105. Species that rear their young underground and use light as a navigational aid are particularly vulnerable to light attraction and there are examples of some birds becoming disorientated due to artificial light (Deakin *et al*. 2022). As a result, birds may experience increased collision risk, or other non-collision related consequences, such as increased energetic costs avoiding or investigating light sources.

8.2.106. One of the potential pathways to impact is the disorientation of fledglings as they leave the nests; however, the distances involved between the Proposed Development (Array Area /

offshore ECC) and the relevant SPAs identified for connectivity/LSE are sufficiently large (>100 km) that such lighting impacts on fledglings will not be a significant concern.

8.2.107. It is possible that breeding adult and juvenile birds of the above species may be attracted into the Array Area due to the WTG and OEP lighting, as Deakin *et al*. (2022) note such responses in regard to other light sources (e.g., coastal villages, lighthouses and offshore oil and gas platforms) whilst there is little published literature on the attraction of birds to navigation lighting on WTGs (NatureScot, 2020).

8.2.108. WTG lighting will be addressed in the Lighting and Marking Plan (C36, Table 6.2) and will comply with IALA Recommendation O-117 for navigation lighting, and with the Air Navigation Orders issued by the Civil Aviation Authority (CAP 393; CAP 764).

8.2.109. With the adoption of the LMP and EMP it is concluded that there is no AEoSI arising from artificial lighting on any of the SPA populations assessed for the species of concern.

ENTANGLEMENT

8.2.110. Guillemot, razorbill, puffin, Manx shearwater and gannet from 20 SPAs have been screened in to consider potential effects from entanglement during O&M (Table 7.2):

- Buchan Ness to Collieston Coast SPA (guillemot);
- Troup, Pennan and Lion's Heads SPA (guillemot, razorbill);
- Fowlsheugh SPA (razorbill);
- Forth Islands SPA (gannet, puffin);
- North Caithness Cliffs SPA (puffin);
- Farne Islands SPA (puffin);
- Hoy SPA (puffin);
- Fair Isle SPA (gannet, puffin);
- Coquet Island SPA (puffin);
- Sule Skerry and Sule Stack SPA (gannet);
- Noss SPA (gannet);
- Flamborough and Filey Coast SPA (gannet);
- North Rona and Sula Sgeir SPA (gannet);
- Hermaness, Saxa Vord and Valla Field SPA (gannet);
- Rum SPA (Manx shearwater);
- St Kilda SPA (gannet, European storm petrel, Leach's petrel, Manx shearwater);
- Cruagh Island SPA (Manx shearwater);
- Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA (Manx shearwater); and
- Skomer, Skokholm and the Seas off Pembrokeshire SPA (Manx shearwater).

8.2.111. It is established that fixed-bottom turbines can act as fish aggregating devices, offering new structures that can be used as habitats by prey (Wilhelmsson, Malm and Öhman, 2006; Haberlin, Cohuo and Doyle, 2022), which could encourage seabird species to forage directly near turbines; the same may apply for moorings associated with floating turbines. Diving seabirds (as listed above) are pursuit foragers following their prey underwater and are

therefore potentially at risk of encountering mooring lines from floating WTGs (primary entanglement).

8.2.112. However, it is secondary entanglement which is considered to be the greater risk to these species, where marine debris (i.e., fishing gear) is itself entangled with WTG mooring lines and presents the risk. The available evidence (e.g., Benjamins *et al*. 2014 and MacLennan *et al*. 2021) suggests that secondary entanglement should not be a major concern for diving seabirds given their increased agility and much smaller body sizes. And given that entangled nets are usually below the sea surface, it is only the diving seabirds that are considered to be at risk in the literature (Benjamins *et al*. 2014 and MacLennan *et al*. 2021).

8.2.113. Although this risk of secondary entanglement is slight, if an individual does become trapped in tangled fishing gear, the impact is fatal. The risk will be mitigated by the adoption and implementation of an Entanglement Management Plan (C-37) (Table 6.2) which will put in place regular monitoring of sub-surface cables, so that any entangled fishing gear can be identified and removed.

8.2.114. While the risk of secondary entanglement is highly unlikely to result in any population-level effects, the adoption and implementation of this proposed mitigation is a good practice measure that should significantly reduce the risk of individual seabird fatalities. It is therefore concluded that there is no AEoSI arising from this impact pathway in relation to any of the relevant SPA populations assessed.

CHANGES TO PREY

8.2.115. Potential indirect effects resulting from changes to prey have been screened in for Appropriate Assessment for all ornithology features during O&M for all breeding seabird interests and SPAs identified within Table 7.2 (including Sandwich tern at Loch of Strathbeg SPA).

8.2.116. As for Construction and Decommissioning, there is the potential for changes in distribution of bird prey species and/or potential habitat loss during O&M, to affect the birds themselves.

ARRAY AREA

8.2.117. The risk of changes to prey distribution and availability as a result of maintenance activities in the Array Area is considered to be equal to, or less than, that for Construction and Decommissioning (paragraphs 8.3.42 - 8.3.47 as there is less potential for underwater noise or vessel disturbance both of which are at much lower levels during O&M.

8.2.118. The underwater noise produced from operational WTGs is less than that associated with their installation (or decommissioning), and the annual rates of O&M vessel activity is also less than that given for Construction/Decommissioning (Table 8.5, WCDS).

8.2.119. Over the long-term, the installed WTGs may act as fish aggregating devices which can potentially draw prey and therefore seabirds into the Array Area (Wilhelmsson, Malm and Öhman, 2006; Haberlin, Cohuo and Doyle, 2022), While this may present a minor beneficial effect (potentially offsetting a displacement response) it is not currently possible to quantify it.

8.2.120. Therefore, the consideration and outcome is the same as that set out for Construction/Decommissioning. And the risk of any prey change during O&M will be further reduced by adoption and implementation of the relevant mitigation plans for this phase of development, including an EMP (C-08) and VMP (C-10) (Table 6.2). As a result, it is concluded that there is no AEoSI from this impact pathway (related to the Array Area) on any of the SPA populations listed in Table 7.2.

OFFSHORE ECC AND CABLE LANDFALL

8.2.121. The main impact to consider in relation to seabird prey species during Proposed Development O&M relates to the electromagnetic fields (EMFs) associated with the Offshore ECC and intra-

array cables. The effects of EMF on all types of fish and shellfish, including those which are seabird prey species, are considered in depth in Volume 2, Chapter 10 (Fish and Shellfish Ecology) and Chapter 9 (Benthic, Subtidal and Intertidal Ecology).

8.2.122. As assessed in the relevant chapters, EMF will be emitted throughout the operational lifespan of the Proposed Development, however, measures will be implemented to mitigate the exposure of sensitive fish and shellfish species to these EMF emissions. These measures include cable burial and other cable protection (where required), as set out in the EMP (C-08) and Cable Plan (CaP; C-02) (Table 6.2).

8.2.123. In instances where cables cannot be buried, regular monitoring will allow for early detection of any deterioration or damage, and its repair. If the cable shielding (a standard component of offshore wind cabling) is well maintained, this helps reduce EMF emissions, both temporally and spatially. As a result, the EIAR concludes that EMF impacts are of a low magnitude for all fish and shellfish receptors, and as such it is concluded that there is no AEoSI from this impact pathway on any of the SPAs listed in Table 7.2.

ACCIDENTAL POLLUTION

8.2.124. Accidental pollution has been screened in for AA for all species and SPAs identified within Table 7.2.

8.2.125. Accidental release of pollutants during O&M may result in mortality or injury to seabirds within affected areas. Pollution events may occur through leaks or spillage of fuel from vessels or plant, or from other hazardous substances such as lubricants or grout during maintenance activities.

8.2.126. As there will be far fewer vessels onsite during O&M than Construction and Decommissioning the risk of accidental pollution is concomitantly considered to be equal to or less (Table 8.5, WCDS).

8.2.127. The consideration and outcome is therefore the same as that set out above for Construction and Decommissioning. Adoption and implementation of an EMP (C-08), complying with best practice standards will ensure that there is no AEoSI from this impact pathway on any of the SPAs listed in Table 7.2.

8.3. MIGRATORY FISH

8.3.1. The approach taken to the assessment of migratory fish is based upon the following:

- The distance between the Array Area, offshore ECC and the relevant designated sites;
- Sensitivity of the receptors (including consideration of the vulnerability, recoverability, value and importance of the receptors);
- Magnitude of impact (drawing on the spatial extent of any interaction, the likelihood, duration, frequency and reversibility of a potential impact); and
- The effects screened in for LSE.

UPDATE TO SCREENING

8.3.2. With regards to migratory fish, the approach to the screening within the RIAA has been updated to be the UWN effects on diadromous fish ZoI associated with the Proposed Development. This is 120 km to the relevant estuary mouth associated with a designated site from the array area. This is considered a precautionary screening range on the basis of the consultation response from NatureScot, in which they have advised that diadromous fish be screened out of the HRA due to the uncertainty around pathways for effect (Table 4.1). The original screening range considered all designated sites with migratory fish receptors present within Scottish Territorial waters with an additional 100km range to consider transboundary sites.

8.3.3. Due to the change in the screening range from the HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023), one designated site is now screened in, with all other designated sites originally screened in now falling outside of screening range and are therefore scoped out of this RIAA.

WORST CASE DESIGN SCENARIO

8.3.4. Table 8.10 provides the Worst-Case Design Scenario(s) considered for fish and shellfish in relation to underwater noise impacts (the only effect screened in for assessment). The full project description is provided in the EIAR Volume 1, Chapter 3 (Project Description).

Table 8.10 Worst Case Design Scenario for underwater noise effects on fish

Project Phase	Worst Case Design Scenario Assessed	Justification
Construction and Decommissioning – Underwater Noise	**Total duration of piling = 151 days (WTGs) + 24 (OEP(s)) = 175 days** OEP piling: May to Aug 2030 Anchor piling: April to Sept 2029, 2030, and 2031 **WTG Anchors** • Maximum of 67 semi-submersible Wind Turbine Generators (WTGs); • Maximum of nine anchors per WTG, one pile per anchor (nine piles in total); • Maximum mooring pile diameter of 4m; • Maximum hammer energy of 2,400kJ; • Maximum number of piling days: 151 (assumes four piled anchors per day); • Concurrent piling at two locations; • Maximum number of piles installed in 24 hours: 10; and • Piling dates: April to Sept 2029, 2030, and 2031. **OEP(s)** • Maximum of two High Voltage Alternating Current (HVAC) jacket platform(s); • Maximum 12 piles per platform; • Maximum pile diameter shall be 5m; • Maximum hammer energy of 3,200kJ; • Maximum number of piles installed in 24 hours: 6; • Maximum number of piling days: 24; • Concurrent piling with single anchor piling location; and • Piling dates: May to Aug 2030. **UXO Clearance** • The primary method will be low-order deflagration, but high-order clearance is assessed as the realistic worst-case scenario; and • UXO clearance is anticipated to take place from the year prior to offshore construction commencing, potentially running concurrently with the first year of offshore construction.	To justify the Worst-Case Design Scenario for noise and vibration impacts on fish species in the context of the project information provided, we consider the extensive duration and scale of piling activities. The project involves the installation of a significant number of semi-submersible WTGs with multiple anchors per WTG, totaling a substantial number of piles to be driven into the seabed. With a maximum hammer energy of 2,400 kJ for WTG anchors and 3,200 kJ for OEP(s), coupled with concurrent piling at two locations and a high rate of pile installation per day, the intensity and duration of noise and vibration generated during piling operations are considerable. The planned piling activities spanning 175 days between 2029 and 2031, with specific piling dates allocated for each year, indicate a prolonged period of disturbance. Moreover, the large-scale nature of the project involving numerous piles being driven into the seabed concurrently at high energy levels amplifies the potential impact on fish species in terms of noise and vibration impacts. This approach is precautionary and as a result, the outcome of the assessment is therefore inherently precautionary.
Operation and Maintenance – Underwater Noise	A maximum of 67 direct drive/geared turbines, with a max rotor size of 300 m. Maximum 12 mooring lines per WTG for all mooring arrangement options (maximum 804 mooring lines total where tension lines are used, 603 mooring lines where catenary, semi-taut or taut lines are used). Mooring lines material: chain, wire, synthetic rope or combination. The operational lifetime of the project is 35 years.	The Worst-Case Design Scenario for underwater noise during the operation phase considers the ongoing maintenance of the Project, and other sources such as snapping mooring lines.

BASELINE ENVIRONMENT

8.3.5. The baseline information for all fish and shellfish species have been considered for the areas of the Array Area, Offshore ECC, intertidal area seawards of MHWS, and the underwater noise ZoI (120km). This is defined as the primary study area as defined within EIAR Volume 2 Chapter 10 (Fish & Shellfish Ecology). The baseline is informed by works and site-specific surveys undertaken in support of various OWF projects in the vicinity of the Proposed Development as well as wider information from publicly available sources (the sources are clarified in EIAR Volume 3, Appendix 10.1 (Fish & Shellfish Technical Report). The Developer's own site-specific surveys are presented in Table 8.11, survey results provided in EIAR Volume 3, Appendix 9.1 (Offshore Environmental Baseline Survey Reports).

Table 8.11 Project specific surveys to inform the Fish and Shellfish Ecology baseline characterisation

Survey	Summary	Coverage of the Study Area
Muir Mhòr Offshore Geophysical Survey (Electronic and Geophysical Services (EGS, 2023a) - Annex 1 of Volume 3, Appendix 9.1 (Offshore Environmental Baseline Survey Reports)	EGS carried out geophysical surveys, providing detailed information on underwater topography, seabed features, geological layers, and sediment composition within the study area. These surveys collectively enabled a comprehensive characterisation of the geophysical environment, crucial for assessing habitat suitability and potential impacts on fish and shellfish ecology.	Full coverage of the primary study area.
Muir Mhòr Offshore Environmental Survey (EGS, 2023b) – Annex II of Volume 3, Appendix 9.1 (Offshore Environmental Baseline Survey Reports)	EGS collaborated with Benthic Solutions Ltd (BSL) to assist in conducting an environmental survey focused on characterising the benthic environment in specific lots to identify habitats of conservation significance and gather baseline data. The survey utilised sediment grab samplers, high-resolution cameras, and water samplers for environmental DNA (eDNA) analysis. Sediment grab samplers were used, along with seabed video footage for habitat evaluation. Water samples collected for eDNA analysis provided valuable insights into fish and shellfish species diversity without disturbing their habitats directly. The high-resolution cameras also assisted in characterising the fish and shellfish assemblage by capturing visual data on species present within the study area.	

ATLANTIC SALMON

8.3.6. Atlantic salmon are a Priority Marine Feature in Scottish waters (Tyler-Walters *et al,* 2016) and are classified by the International Union for Conservation of Nature (IUCN) as "endangered" within the UK, and "near threatened" internationally (IUCN, 2023). Atlantic salmon are designated under Appendix III of the Bern Convention, The Conservation of Habitats and Species Regulations (2017), Schedule 5 of the Wildlife and Countryside Act and are on the Scottish Biodiversity List. They are anadromous fish, spawning in freshwater and then feeding at sea. They typically spawn in the upper reaches of rivers or where suitable and are recorded in multiple rivers both designated and undesignated that exit on the east coast of Scotland (EIAR Volume 3, Appendix 10.1 (Fish & Shellfish Technical Report)). Once the young Atlantic salmon reach two to three years old, they undergo a metamorphosis to adapt to the marine environment, after which, in spring, results in their migration out to sea where they will remain before returning to their natal river, generally after a year, to spawn. Many salmon die after spawning, though some return to sea and regain condition to be able to spawn again.

8.3.7. Atlantic salmon are designated features of the site screened in for assessment. A study investigating the migratory routes of adult Atlantic salmon in Scotland observed a general migratory pattern, whereby salmon migrate through the North Sea, travel along the coast back to their home river for spawning, and then return to the sea for feeding and growth (Malcolm *et al.*, 2010). This behaviour suggests the potential for Atlantic salmon to transit the fish and shellfish study area during migration. Based on fishery statistics, Atlantic salmon have been suffering a significant decline across the country, with a 77% decrease in catch numbers in 2023 compared to the previous 5-year average (Scottish Government, 2023). Site-specific eDNA surveys have not detected the presence of salmonids within the study area. However, as highlighted in the studies considered above and within EIAR Volume 3, Appendix 10.1, salmon are likely to be migrating to and from some inland rivers within close proximity to the Proposed Development and are considered likely to pass through the study area during the migratory period.

8.3.8. The condition of Atlantic salmon at River Dee SAC is recorded as favourable, although it should be acknowledged that the last condition assessment of this designated site was carried out in 2011 (Scottish Environmental Protection Agency (SEPA) & NatureScot, 2024).

FRESHWATER PEARL MUSSEL (FWPM)

8.3.9. FWPM are a classified as an endangered species by IUCN that plays a key role in aquatic ecosystems, and are a species of principal importance for biodiversity conservation in Scotland (NatureScot, 2020). They are long-lived filter feeders with a complex life cycle dependent on juvenile salmonid fish, and are highly sensitive to environmental changes and disturbances such a pollution. The only pathway for effect of the project on FWPM is during the point in their life cycle where FPWM reside within the gills of juvenile salmonids for up to 10 months of the year before dropping of in river habitat to establish themselves and reach maturity.

8.3.10. With consideration of the obligatory host phase of FWPMs development using Atlantic salmon as a carrier, the baseline environment for this species is considered the same as the Atlantic salmon as there is no other pathway for effect aside from during this life phase.

8.3.11. The condition of FWPM at the site is recorded as unfavourable, although it should be noted that the last condition assessment of this designated site was carried out in 2014 (SEPA & NatureScot, 2024).

CONSTRUCTION AND DECOMMISSIONING

8.3.12. Within the HRA Screening Report (Muir Mhòr Offshore Wind Farm Limited, 2023) the only effect screened in for the River Dee SAC was underwater noise. The HRA Screening Report determined that the potential for LSE in relation to underwater noise during decommissioning would be similar to and potentially less than that outlined in the construction phase. The potential for effect during decommissioning would therefore fall within, and be no worse than, the degree of effect during construction, with any such decommissioning being subject to the relevant licensing requirements at that time. The main focus of this assessment therefore relates to the potential for effects during the construction phase of the Proposed Development only.

8.3.13. There are two sources of underwater noise associated with the Proposed Development alone during construction with the potential for effect, which comprise;

- Underwater noise from piling; and
- Underwater noise from UXO clearance.

8.3.14. General construction noise (including that arising from vessel movements and seabed preparation works) is not assessed in this RIAA as it is considered that it only generates low levels of continuous sounds (i.e., from the vessels themselves and/or the sounds from other construction activities) throughout the construction phase. The primary study area around the Proposed Development as defined in Section 8.3.5 is subject to relatively high levels of shipping activity currently, and it is expected that the vessel activity would be no greater than the baseline during construction activities (as established in Volume 2, Chapter 10 (Fish and Shellfish)).

8.3.15. The underwater noise impacts from vessel noise are generally spatially limited to the immediate area around the vessel rather than having impacts over a wide area (e.g., Mitson, 1995). All general construction noise (including that arising from vessel movements and seabed preparation works) is considered to have a much smaller impact range than that of the piling and UXO noise considered below. Therefore, due to the high baseline activity, localised nature of the impact and tolerance of receptors, these noise sources are screened out.

8.3.16. The approach taken by this RIAA is to assess these effects individually. To inform the assessment of potential effects from underwater noise, predictive underwater noise modelling has been undertaken for the relevant piling Worst Case Design Scenario, and high and low order UXO clearance, and full technical details are provided in the EIAR Subsea Noise Technical Report (Volume 3, Appendix 3.1). The importance of underwater noise for migratory fish is discussed here in the context of the conservation objectives for each of the relevant designated sites.

UNDERWATER NOISE

8.3.17. Underwater noise during construction of the Proposed Development has been studied specifically through the following, including that of direct relevance to migratory fish:

- EIAR Volume 2, Chapter 10 (Fish and Shellfish Ecology); and
- EIAR Volume 3, Appendix 3.1 (Subsea Noise Technical Report).

8.3.18. Volume 3, Appendix 3.1 (Subsea Noise Technical Report) provides the technical evidence base for underwater noise, with Volume 2, Chapter 10 (Fish and Shellfish Ecology) providing the context for migratory fish, in relation to the potential for effects from underwater noise.

Underwater noise can potentially have a negative impact on fish species ranging from physical injury/mortality to behavioural impacts to masking of communication.

8.3.19. In general, biological damage because of underwater noise is either related to a large pressure change (barotrauma) or to the total quantity of sound energy received by a receptor. Barotrauma injury can result from exposure to a high intensity sound even if the sound is of short duration (i.e. UXO clearance or a single strike of a piling hammer). However, when considering injury due to the energy of an exposure, the duration of the exposure and total energy received by the receptor becomes important. Fish are also considered to be sensitive to the particle motion element of underwater noise.

8.3.20. Fish receptors can be grouped into the Popper *et al.,* (2014) categories based on their hearing system:

- Group 1: Fish with no swim bladder or other gas chamber-- which include sea and river lamprey and are sensitive only to particle motion and show sensitivity only to a narrow band of frequencies;
- Group 2: Fish with swim bladders in which hearing does not involve the swim bladder or other gas volume-- which includes salmonids, such as Atlantic salmon, and are more sensitive to particle motion than sound pressure; and
- Group 3: Fish in which hearing involves a swim bladder or other gas volume-- e.g. clupeids such as shad species are primarily sensitive to sound pressure, although they also detect particle motion (Hawkins and Popper, 2016).

8.3.21. Only Group 2 is considered within this assessment as they comprise of the species screened in for this assessment and are the hosts of FWPM. With consideration of the ecology for FWPM (Section 8.3.9 and 8.3.11), they are only considered to have potential to be directly impacted by the particle motion aspect of this impact, however, indirect impacts from the host species (Atlantic salmon) are also considered within this assessment.

8.3.22. The extent to which intense underwater sound might cause an adverse environmental impact in a particular fish species is dependent upon the level of sound pressure or particle motion, its frequency, duration and/or repetition (Hastings and Popper, 2005). The range of potential effects from intense sound sources, such as pile driving and explosions, includes immediate death, permanent or temporary tissue damage and hearing loss, behavioural changes and masking effects (Popper *et al*., 2014). Tissue damage can result in eventual death or may make the fish less fit until healing occurs, resulting in lower survival rates. Hearing loss can also lower fitness until hearing recovers. Specifically, when considering migratory fish features such as Atlantic salmon, underwater noise can cause barriers to migration, and therefore due consideration to this impact is given in this assessment.

8.3.23. The potential for mortality or mortal injury is likely to only occur in close proximity to the sound source, although for impact piling the risk of this occurring will be reduced by use of soft start techniques at the start of the piling sequence (as per the mitigation specified in Section 6.4). This means that fish near to piling operations will likely move outside of the impact range, before noise levels reach a level likely to cause irreversible injury. There is also a potential for mortality or mortal injury from UXO detonations, and it is anticipated that ADDs would be used prior to a UXO detonation (to be determined in the UXO-specific MMMP as part of the Marine Licence application). The reaction of free-swimming fish to ADDs is unknown and based on anecdotal evidence from UXO campaigns where records have been made of fish floating at the surface after an explosion, it is possible that some fish will experience mortality and injurious impacts, however, use of ADDs may cause a fleeing response in fish which could reduce the impact of UXO clearance.

8.3.24. The Developer has committed to the avoidance of UXO hazards where practicable and appropriate. If avoidance is not practicable, decision making will relate to removal, with detonation considered if avoidance or removal is not possible. If detonation is required, low-order deflagration will be the preferred method, over high-order detonations; low-order deflagration consists of the use of a small charge, which is fired at the explosive, causing the contents to ignite and burn out. This process causes the casing to crack open, but crucially, not detonation. Although low-order deflagration is still a kinetic process, it has greatly reduced effects on the surrounding environment (such as UWN) compared to those created during a clearance by high-order detonation.

8.3.25. Recent UXO clearance campaigns for Scottish offshore wind farm projects have had success with low-order deflagration. For example, in 2023, the Moray West OWF successfully cleared 81 UXOs using deflagration, without the need of high order clearance techniques. This method has been the primary clearance technique for recent projects, as it results in significantly lower UWN levels compared to high-order detonations. Based on the successful application of low-order detonations in recent Scottish projects and the preference for this technique by NatureScot and MD-LOT, it is assumed that low-order detonations will be the primary method for UXO clearance for the Proposed Development, unless all other options have been exhausted.

8.3.26. High order detonation of UXO activities are one of the loudest anthropogenic noise sources that occur underwater, with typically much higher source levels than those from piling. High-order detonation UXO clearance is expected to result in mortality, mortal injury, recoverable injury, TTS and disturbance to fish and shellfish species, depending on the proximity of the individuals to the UXO location and the size of the UXO. Small scale mortality of fish as a result of UXO detonation are frequently recorded (Dahl *et al.,* 2020).

8.3.27. Recoverable injury is defined as a survivable injury with full recovery occurring after exposure, although decreased fitness during this recovery period may result in increased susceptibility to predation or disease (Popper *et al*., 2014). The impact ranges for recoverable injury and mortality/potential mortal injury are more or less the same due to the thresholds used. The impact thresholds for the different groups of species are presented in Table 8.12.

8.3.28. TTS is a temporary reduction in hearing sensitivity caused by exposure to intense sound. TTS results from temporary changes in sensory hair cells of the inner ear and/or damage to auditory nerves. However, sensory hair cells are constantly added to fish and are replaced when damaged and therefore the extent of TTS is of variable duration and magnitude, with no potential for this to lead to permanent effects. Normal hearing ability returns following cessation of the noise causing TTS. When experiencing TTS, fish may have decreased fitness due to a reduced ability to communicate, detect predators or prey, and/or assess their environment. EIAR Volume 2, Chapter 10 (Fish and Shellfish Ecology) presents the ranges at which TTS in fish may occur as a result of piling operations during the Proposed Development construction phase. There are no available thresholds for TTS effects from other noise sources, however, any impacts are likely to be localised, and for single sound sources such as that from UXO explosions, effects are likely to be within that from cumulative piling exposure.

8.3.29. Behavioural effects in response to construction related underwater noise include a wide variety of responses including startle responses (C-turn), strong avoidance behaviour, changes in swimming or schooling behaviour, or changes of position in the water column (e.g. Hawkins *et al*., 2014). Depending on the strength of the response and the duration of the impact, there is the potential for some of these responses to lead to significant effects at an individual level (e.g. reduced fitness, increased susceptibility to predation) or at a population level (e.g. avoidance or delayed migration to key spawning grounds). There are no

quantitative thresholds advised for behavioural impacts assessment, however, Popper *et al.*, (2014) provide qualitative behavioural criteria for fish from a range of sources. These categorise the risks of effects in relative terms as "high, moderate or low" at three distances from the source: near (10s of metres), intermediate (100s of metres), and far (1000s of metres), respectively.

Table 8.12 Impact threshold criteria from Popper et al., 2014

Impact threshold noise level (dB re. 1 µPa sound pressure (SPL)/dB re. 1 µPa^{2}s sound exposure level (SEL))			
	Mortality and potential injury	**Recoverable injury**	**TTS**
Group 2	• 210 dB SEL_{cum} • 207 dB SPL_{peak}	• 203 dB SEL_{cum} • 207 dB SPL_{peak}	• 186 dB SEL_{cum}

8.3.30. Table 8.13 summarises the maximum predicted impact ranges for mortality and potential mortal injury, recoverable injury and TTS from piling activities in the Array Area. The impact ranges from piling within the Array Area are also presented in Figure 8-1 and Figure 8-2. Further detail with regards to the noise modelling is presented in EIAR Volume 3, Appendix 3.1 (Subsea Noise Technical Report).

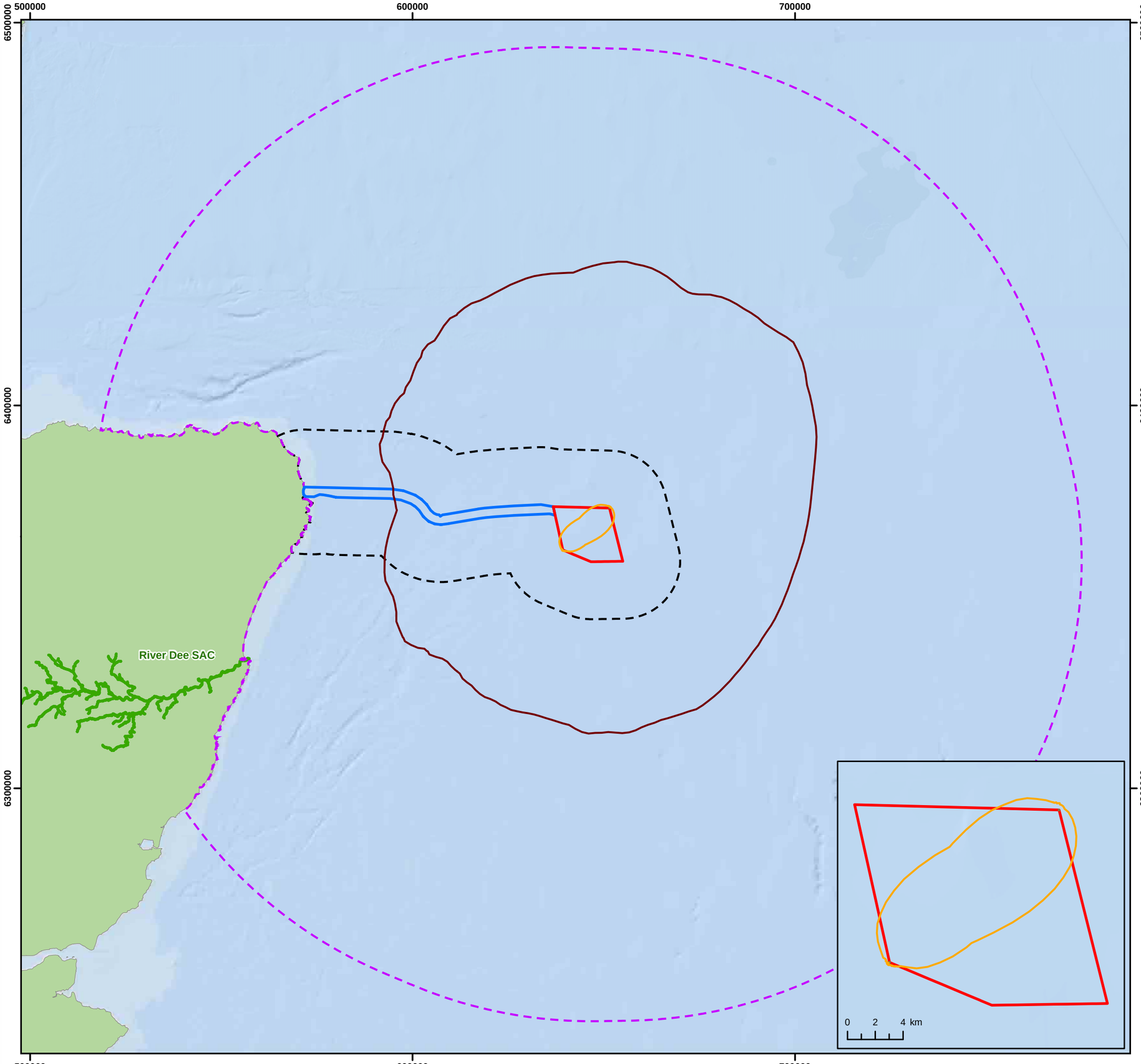
8.3.31. UXO detonations are considered to have a low likelihood of triggering a population level effect, due to the limited temporal footprint that would arise from UXO operations, therefore effects are likely to be no greater than those from cumulative piling exposure. Table 8.14 details the ranges for mortality or mortal injury for all fish groups. Behavioural impacts are discussed qualitatively below with respect to each species.

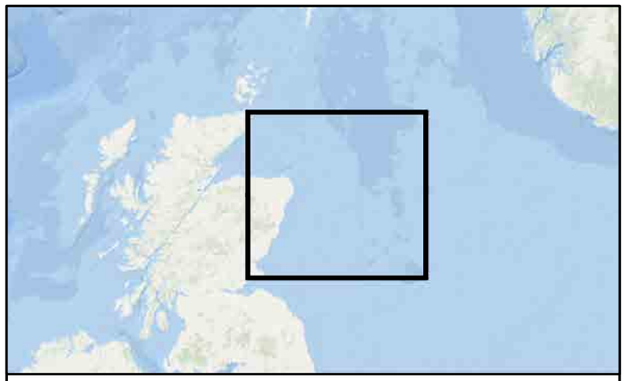
Table 8.13 Worst case scenario noise modelling results for injury ranges for fleeing Group 2 receptors from the concurrent piling of foundations in the Array Area

Receptor Group	Criteria	Noise Level (dB re 1µPa SEL/dB re 1µPa2 SEL)	Concurrent piling of up to five piled anchors in the Array Area at both the northeast and southwest locations	Concurrent piling of up to five piled anchors in the northeast location in Array Area, and up to three OEP foundation piles in the centre of the Array Area				
Piling location			**NE corner of the array area**	**SW corner of the array area**	**In combination area of effect**	**NE corner of the array area**	**Centre location in array area**	**In combination area of effect**
Mortality and Potentially Mortal Injury								
Group 2	SEL_{cum} (Fleeing)	210 dB	< 0.1 km^2	< 0.1 km^2	No in combination effect from piling concurrently	< 0.1 km^2	< 0.1 km^2	No in combination effect from piling concurrently
Recoverable Injury								
Group 2	SEL_{cum} (Fleeing)	203 dB	< 0.1 km^2	< 0.1 km^2	100 km^2	< 0.1 km^2	2.3 km^2	75 km^2
TTS								
Group 2	SEL_{cum} (Fleeing)	186 dB	7,200 km^2	7,200 km^2	11,000 km^2	7,200 km^2	8,400 km^2	13,000 km^2

Table 8.14 Summary of impact ranges for UXO detonation

Charge Weight	Mortality and Potentially Mortal Injury	
	234dB	229 dB
Low order deflagration		
0.25 kg	<50 m	60 m
High-order detonation		
25 kg + donor	170 m	290 m
55 kg + donor	230 m	380 m
120 kg + donor	300 m	490 m
240 kg + donor	370 m	620 m
525 kg + donor	490 m	810 m
698 kg + donor	530 m	890 m
750 kg + donor	550 m	910 m





Legend:

- Array Area
- Offshore Export Cable Corridor
- Secondary Zone of Influence
- Underwater Noise Zone of Influence
- Special Area of Conservation

UWN Contours - Concurrent Piling of Anchors

- 186dB (SELcum - Fleeing)
- 203dB (SELcum - Fleeing)
- 210dB (SELcum - Fleeing)

Project:	Report:
Muir Mhòr	RIAA

Predicted impact ranges for fleeing Group 2 receptors (migrating salmon) from the concurrent piling of anchors in the northeast and southwest locations of the Array Area (2,400 kJ hammer energy, 4m pile diameter)

Figure:	Drawing No:		
8-1	GoBe-0199		
Revision:	**Date:**	**Drawn:**	**Checked:**
01	12/11/24	EV	BPHB

Map scale 1:1,000,000 @ A3

0 10 20 km

N

Co-ordinate system: ETRS 1989 UTM Zone 30N **EPSG:** 25830

MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred. Olsen Seawind & Vattenfall

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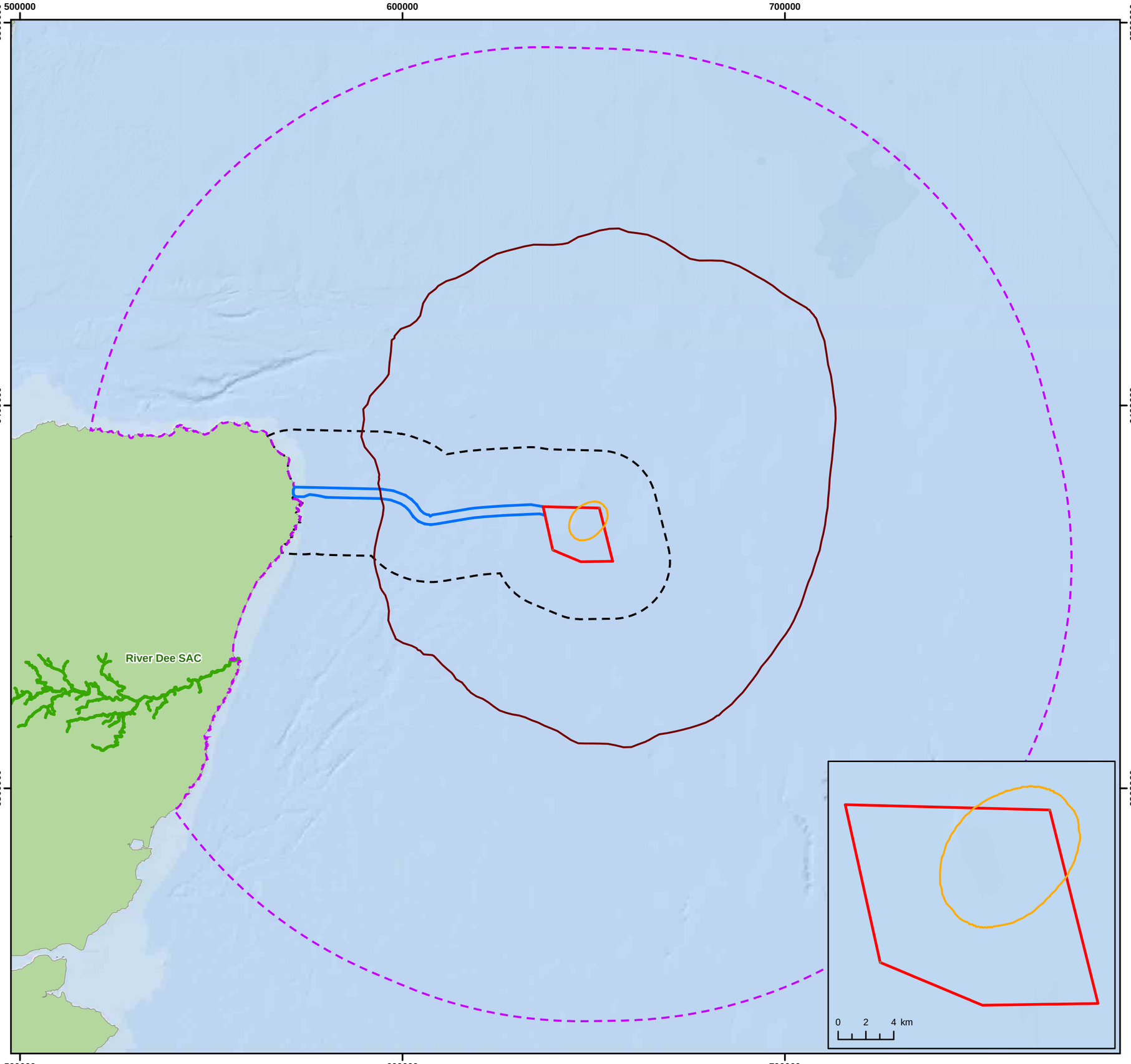

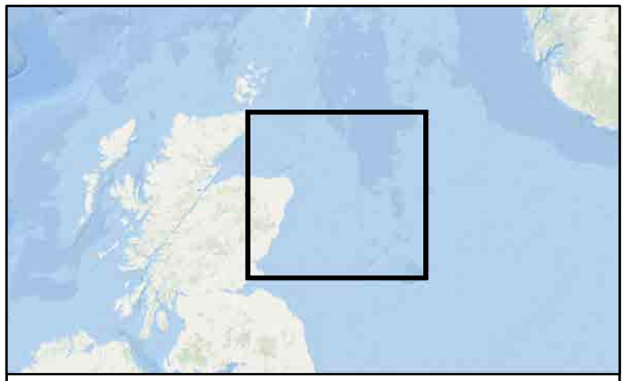

Legend:

- Array Area
- Offshore Export Cable Corridor
- Secondary Zone of Influence
- Underwater Noise Zone of Influence
- Special Area of Conservation

UWN Contours - Concurrent Piling of Anchors

- 186dB (SELcum - Fleeing)
- 203dB (SELcum - Fleeing)
- 210dB (SELcum - Fleeing)

Project:	Report:
Muir Mhòr	RIAA

Predicted impact ranges for fleeing Group 2 receptors (migrating salmon) from the concurrent piling of anchors in the northeast location of the Array Area (2,400 kJ hammer energy, 4 m pile diameter) and OEP foundation piles in the Array Area

Figure: 8-2	Drawing No: GoBe-0200		
Revision:	Date:	Drawn:	Checked:
01	12/11/24	EV	BPHB

Map scale 1:1,000,000 @ A3

0 10 20 km

N

Co-ordinate system: ETRS 1989 UTM Zone 30N **EPSG:** 25830

MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred. Olsen Seawind & Vattenfall

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UNDERWATER NOISE FROM PILING WITHIN THE ARRAY AREA

8.3.32. As summarised in Table 8.10, the Worst Case Design Scenario in relation to underwater noise impacts from piling of foundations within the Array Area, when considering the worst-case impacts on migratory fish species is the following:

- The concurrent piling of up to five piled anchors in the Array Area at both the northeast and southwest locations; or
- The concurrent piling of up to five piled anchors in the northeast location in Array Area, and up to three OEP foundation piles in the centre of the Array Area.

RIVER DEE SAC

8.3.33. A potential for LSE has been identified for the Atlantic salmon *(Salmo salar)* and freshwater pearl mussel *(Margaritifera margaritifera)* features at this site for underwater noise during the construction and decommissioning phases. The conservation objectives of the River Dee SAC are:

- 1) To ensure that the qualifying features of the River Dee SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status;
- 2) To ensure that the integrity of the River Dee SAC is restored by meeting objectives 2a, 2b, 2c for each qualifying feature (and 2d for freshwater pearl mussel);
  - Atlantic salmon
    - 2a) Maintain the population of Atlantic salmon, including range of genetic types, as a viable component of the site;
    - 2b) Maintain the distribution of Atlantic salmon throughout the site; and
    - 2c) Maintain the habitats supporting Atlantic salmon within the site and availability of food.
  - Freshwater Pearl mussel
    - 2a) Restore the population of freshwater pearl mussel as a viable component of the site;
    - 2b) Restore the distribution of freshwater pearl mussel throughout the site;
    - 2c) Restore the habitats supporting freshwater pearl mussel within the site and availability of food; and
    - 2d) Maintain the distribution and viability of freshwater pearl mussel host species and their supporting habitats.

ATLANTIC SALMON

PILING WITHIN THE ARRAY AREA

8.3.34. Atlantic salmon are classed as a Group 2 species (Popper *et al*., 2014), with a swim bladder that is not involved in hearing. These receptors are more sensitive to particle motion than sound pressure. Atlantic salmon are of mobile nature and are considered potentially transient across the Proposed Development during migration, although no evidence of presence has been found. As they are mobile, they are therefore able to flee from noise disturbance.

8.3.35. In late spring to early summer, adult Atlantic salmon return to rivers to spawn, whilst juvenile salmon migrate out to sea to feed. As the River Dee SAC is 86 km from the Array Area where piling will be occurring, there is no potential for the underwater noise to result in a barrier to migration. Based on their low vulnerability to noise impacts, and their mobile nature, should Atlantic salmon be present, they are expected to recover quickly, returning to normal behaviours, and returning to disturbed areas soon after any disturbance occurs.

8.3.36. Given the nature of noise effects and the likely transient nature of Atlantic salmon (if present) across the Proposed Development during migration, it is anticipated that they would display a fleeing response to noise, and therefore will experience less exposure to underwater noise. In the context of the assessment, fleeing receptors are anticipated to flee from the source at a consistent rate of 1.5 ms^{-1}. Based on the WCSs for underwater noise from piling of foundations within the Array Area, which results from the concurrent piling of foundations, mortality and potential mortal injury of Atlantic salmon will only occur in the immediate vicinity (< 0.1 km^2) of the piling activity (note there is no in-combination impact from either concurrent piling scenario, this is where the ranges are small enough that the distant piling sites do not produce an influencing additional exposure of underwater noise on a receptor). Recoverable injury of Atlantic salmon is expected to occur over a larger area from the concurrent piling of anchor piles in the array area, and the concurrent piling of anchor and OEP foundation piles in the array area, with recoverable injury occurring over an area of 100 km^2 at 75 km^2 respectively. TTS impact areas from the concurrent piling of anchor piles in the array area, and the concurrent piling of anchor and OEP foundation piles are predicted across areas of up to 11,000 km^2 and 13,000 km^2 respectively.

8.3.37. Taking into consideration the distance of the Array Area from the River Dee SAC (86.89 km), with no spatial overlap with the SAC and modelled noise contours (Figure 8-1 and Figure 8-2), and recovery from TTS once the effect causing it stops or is out of range, there are not anticipated to be any injurious effects or TTS from underwater noise on the Atlantic salmon feature at this designated site. Embedded mitigation may reduce risk of effect further by implementing soft starts and use of ADDs (C-14 and C-15 in Table 6.3), however this is not considered necessary to prevent adverse effect on the feature.

8.3.38. There are no quantitative thresholds advised to be used to assess behavioural impacts, however, Popper *et al.,* (2014) provide qualitative behavioural criteria for fish from a range of sources. When considering these criteria, the risk of behavioural effects from piling is high in the nearfield, moderate in the intermediate field and low in the far field. The risk of auditory masking for Atlantic salmon is moderate in the near field and low within the intermediate and far fields. Near field impacts are considered contained within the TTS effects described above considering the different ranges. With consideration of the above ranges and lack of evidence of presence it is concluded there will be no significant behavioural impacts on Atlantic salmon.

8.3.39. Considering the localised nature of underwater noise from piling within the Array Area, and the transient nature of the migratory receptors and the low sensitivity of the receptors to underwater noise, there will be no direct impacts from underwater noise from piling activities on migratory fish features within the designated site, and consequently no barriers to migratory behaviours. Any impacts from underwater noise from piling activities on Atlantic salmon within the vicinity of the Array Area that may be attributed as features of the designated sites will be of localised nature, with no population level effects anticipated.

8.3.40. As stated above, the potential for effects during decommissioning will likely fall within, and be no worse than, the degree of effect during construction, with any such decommissioning being subject to the relevant licensing requirements at that time. Therefore, there are no adverse effects on migratory fish features of the River Dee SAC anticipated to occur during the decommissioning phase of the Proposed Development.

8.3.41. With consideration of no confirmation of presence within the primary study area, though they are expected to migrate through the ZoI the low sensitivity of Atlantic salmon, and the localised impact ranges from underwater noise, with expected movement away from the effects, it is considered **that there is, negligible potential for effect on the Atlantic salmon feature of the River Dee SAC from the Proposed Development alone during construction and decommissioning. Therefore, subject to natural change, the population of Atlantic**

salmon will be maintained in the long-term with respect to underwater noise from construction and decommissioning within the Array Area. As there will be no residual effects on the site or feature, it is no longer considered for in-combination impacts and is screened out of Section 1.

UXO CLEARANCE

8.3.42. Consideration of impacts from UXO is made on a risk of injury basis and a disturbance element. EIAR Volume 2, Chapter 10 (Fish and Shellfish Ecology) considers that UXO clearance activities are one of the loudest anthropogenic noise sources that occur underwater, with source levels that can be higher than those from piling (depending on the methodology used). UXO clearance has the potential to result in mortality, potential mortal injury, recoverable injury, TTS and disturbance to fish and shellfish species, depending on the proximity of the individuals to the UXO location and the size of the UXO. Small scale mortality of fish as a result of UXO detonation has been evidenced (Dahl *et al*., 2020), with dead fish recorded floating at the surface following detonation, typically within the immediate vicinity of the detonation and as such this is expected to be a localised impact.

8.3.43. Deflagration or "low order" detonation clearance methods will be prioritised (C-31 in Table 6.3). Evidence to date (e.g., Cheong *et al*., 2020) suggests these methods give rise to a much quieter, standard source level (regardless of UXO charge size, with the sound level emitted only relating to the donor charge size) which may result in reduced impacts on the marine environment.

8.3.44. There are no quantitative thresholds for recoverable injury, TTS or disturbance with regards to UXO, however with consideration of the nature of the impact and no cumulative effects from UXO due to the instantaneous nature of the detonation, it is considered that these impacts are not capable of resulting in an adverse effect on the site. EIAR Volume 2, Chapter 10 (Fish and Shellfish Ecology) concluded that while individual UXO detonations have the potential to result in impact ranges comparable to piling events (as described above) the short-term (seconds) and discrete nature of a UXO detonation is considered to result in a lesser effect. This is because UXO detonation is a discrete event, and while this may result in some temporary disturbance to migratory fish, with potential for mortality/ mortal injury in close proximity, it is unlikely to result in any significant disturbance or loss of population compared to more continuous noise sources such as piling that may occur intermittently over a longer period.

8.3.45. Furthermore, Atlantic salmon are considered transient receptors with no confirmation of being present across the site, though they are expected to pass through during migration, and therefore, consequently will have low risk of exposure to underwater noise. Taking the above into consideration, there are negligible impacts on Atlantic salmon within the River Dee SAC anticipated. Furthermore, there are not anticipated to be any population level effects outside of the SAC that may be attributed as features of the designated site.

8.3.46. Therefore, based on the transitory nature of Atlantic salmon, short-term and spatially limited nature of the impact, mitigation and the separate UXO Marine Licence application and associated assessments, it is concluded that **there is negligible potential for effect on the Atlantic salmon feature of the River Dee SAC from the Proposed Development alone during construction and decommissioning. Therefore, subject to natural change, the population of Atlantic salmon will be maintained in the long-term with respect to underwater noise from construction and decommissioning within the Array Area. As there will be no residual impacts on the site or feature, it is no longer considered for in-combination impacts and is screened out of Section 1.**

FRESHWATER PEARL MUSSEL

8.3.47. Freshwater pearl mussel is a species of shellfish that spend the majority of their lifecycle within riverine systems, however in their larval stage they attach to the gills of salmonid fishes (including Atlantic salmon) within rivers and remain attached for up to 10 months of the year. Therefore, given the migratory movements of Atlantic salmon from this site, it is considered that any impacts acting on Atlantic salmon would also apply to freshwater pearl mussel, including underwater noise.

8.3.48. On the basis that shellfish do not possess swim bladders or other gas filled organs, it is considered that freshwater pearl mussel are primarily sensitive to particle motion rather than sound pressure (Popper and Hawkins, 2018). As there are currently no criteria for assessing particle motion, it is not possible to undertake a threshold-based assessment of the potential for injury to freshwater pearl mussel and as such, a qualitative assessment of the potential for mortality or mortal injury has been made based on peer-reviewed literature.

8.3.49. Pile driving is recognised as a source of particle motion, generating high levels of particle motion in the nearfield (Hazelwood and Macey, 2016) which could potentially result in injury or mortality to sensitive shellfish receptors. Impacts from particle motion are also likely to occur locally to the source, with studies having demonstrated the rapid attenuation of particle motion with distance (Mueller-Blenkle *et al*, 2010). No studies have been undertaken on freshwater pearl mussel, however studies on other similar mollusc species (e.g., blue mussel *Mytilus edulis* and periwinkles *Littorina spp.*) show that exposure to a single airgun at a distance of 0.5m has no effects after exposure (Kosheleva, 1992). Furthermore, given the period of exposure is while they are within the gills of Atlantic salmon, which are considered transient across the Proposed Development though not detected, they are therefore likely to be transported away from the noise source as their host flees from the noise disturbance. Therefore, risk of mortality is considered negligible. As described in the Atlantic salmon assessments (paragraph 8.3.34 to 8.3.46) there are no barriers to migration in and out of spawning rivers, and therefore it is considered that there is no barrier to migration for freshwater pearl mussel as they are attached to the salmon. Taking this into consideration, freshwater pearl mussel from the River Dee SAC are deemed to impacted solely on their carriers (Atlantic salmon).

8.3.50. Considering the likely broad distribution of these receptors across the study area due to Atlantic salmon being considered transient across the area during migration, the available literature suggesting a low risk of mortality or significant injury, and the relatively short-term nature of the impact, it is considered unlikely that there will be any more than a highly localised effect, which would be subject to rapid recovery post any effects.

8.3.51. Due to the potentially transient nature of freshwater pearl mussel across the site, being reliant on Atlantic salmon to pass through the location for there to be any potential effect, with baseline establishing Atlantic salmon have not been recorded within the primary study area the low sensitivity of the features, and the localised impact ranges from underwater noise it is considered that **there is negligible potential for effect on the FWPM feature of the River Dee SAC from the Proposed Development alone during construction and decommissioning. Therefore, subject to natural change, the population of FWPM will be maintained in the long-term with respect to underwater noise from construction and decommissioning within the Array Area. As there will be no residual impacts on the site or feature, it is no longer considered for in-combination impacts and is screened out of Section 1.**

OPERATION AND MAINTENANCE

8.3.52. The screening report establishes that the only effect screened in for all migratory fish sites is underwater noise. Underwater noise levels during the operational phase are predicted to be considerably lower than those of the construction phase, being limited to noise from operational turbines and maintenance vessel traffic.

8.3.53. Underwater noise from an operational turbine mainly originates from the gearbox and the generator and has tonal characteristics (Madsen, 2005; Tougaard *et al*., 2009). The radiated levels are low and the spatial extent of the potential impact of the operational wind farm noise on marine receptors is generally estimated to be small and thus unlikely to result in any injury to fish (Wahlberg and Westerberg, 2005). Besides the sound source level, the potential for impact will also depend on the propagation environment, the receptor's hearing ability and the ambient sound levels.

8.3.54. Marine animals may perceive the radiated tonal components where they exist above the ambient noise levels, which may result in a behavioural response of the receptor or lead to a reduced detection of other sounds due to masking. Previous studies show that behavioural responses of fish are only likely at close ranges from the turbine, (i.e., a few metres) (Wahlberg and Westerberg, 2005).

8.3.55. Although effects on fish are difficult to establish given the lack of information available in the scientific literature, there is indicative evidence that fish would be unlikely to show significant avoidance to the noise levels radiating from the turbine. The International Council for the Exploration of the Sea (ICES) has formulated recommendations for maximum radiated underwater noise from research vessels which are approximately 30dB above the hearing threshold of cod and herring (Mitson, 1995). The implication of this is that the presence of continuous noise that is not significantly above the hearing threshold of fish is not thought to cause any significant movement of fish away from the source. Studies of very low frequency sound have indicated that consistent deterrence from the source is only likely to occur at particle accelerations equivalent to a free-field sound pressure level of 160 dB re 1 µPa (RMS) (Sand *et al*., 2001).

8.3.56. This is higher than the noise levels reported in the open literature for operational wind farms measured at a number of ranges, all within a few hundred meters of the turbine (Nedwell *et al*., 2007a; Edwards *et al*., 2007; Betke *et al*., 2004, see also Wahlberg and Westerberg, 2005 and Madsen *et al*., 2006). The particle acceleration resulting from an operational wind turbine has also been measured by Sigray *et al*. (2011) with the resultant levels being considered too low to be of concern for behavioural reactions from fish.

8.3.57. Furthermore, the particle acceleration levels measured at 10 m from the turbine were comparable with hearing thresholds. Whilst limited, the available data provides an indicator that operational wind turbines are unlikely to result in disturbance of fish except within very close proximity of the turbine structure, as postulated by Wahlberg and Westerberg (2005). However, the available measurement data is mostly for smaller turbines (up to 1.5 Megawatt (MW)), and it would be expected that larger wind turbines would result in different acoustic characteristics, with foundation type also having an influence on the acoustic characteristics of the noise radiated from the structure.

8.3.58. There is little empirical data for the operational noise produced by floating WTGs. For example, Tougaard *et al*. (2020) and the study by Stöber and Thomsen (2021) did not consider any floating designs and reliable noise thresholds are recommended to identify disturbances from rare or intermittent impulses of this type. Mooring lines have been described as producing a "snapping" noise related to tension release (Jasco *et al*., 2011). According to Jasco (2011), up

to 23 snaps were identified per day were identified at the Hywind Test site. Over two months of monitoring, fewer than 10 snaps exceeding 160 dB re 1 µPa (Lp) at 150 meters from the WTG were recorded on most days. Since any snapping occurs at an average rate of less than one snap per hour, disturbance leading to avoidance behaviour is considered unlikely. Additionally, this prediction includes worst case assumptions (e.g., all WTGs producing the maximum number of snaps daily, equivalent noise levels from multiple locations affecting a receptor equally) and is below any injury criteria for fish.

8.3.59. Noise would also result from surface vessels servicing the wind farm. However, noise levels reported by Malme *et al*. (1989) and Richardson *et al*. (1995) for large surface vessels indicate that physiological damage to fish and shellfish is unlikely, although the levels could be sufficient to cause local disturbance of sensitive marine fauna (e.g., clupeids such as herring and sprat) in the immediate vicinity of the vessel, depending on ambient noise levels.

8.3.60. Considering the operational turbine noise of the wind farm and any associated service vessels, the ambient noise levels within the site would be expected to be lower than those present in the vicinity of nearby shipping lanes.

8.3.61. As the effects of underwater noise are predicted to be long term, continuous and irreversible (during the lifetime of the project), there may be some indirect effects on all identified migratory fish associated with the identified sites. However, the extremely localised spatial extent of the impact and the mobile nature of all species, having not been detected within the primary study area, means it is considered that there will be no direct effects or any barriers to migration, and individuals will be able to avoid any potential impacts from underwater noise.

8.3.62. Therefore, due to the potentially transient nature of individuals across the site, the low sensitivity of the features, the localised impact ranges from underwater noise, and the distances to site (86.9 km to the River Dee SAC) it is considered that there is, negligible potential for effect on the Atlantic salmon or FWPM features of the River Dee SAC from the Proposed Development alone during O&M phase. Therefore, subject to natural change, the population of Atlantic salmon and FWPM will be maintained in the long-term with respect to underwater noise from the O&M phase within the Array Area. As there will be no residual impacts on the site or feature, it is no longer considered for in-combination impacts and is screened out of Section 1.

9. STAGE 2: ASSESSMENT OF ADVERSE EFFECT IN-COMBINATION

9.1.1. Screening for designated sites and features in-combination is presented in Section 7.2, identifying the plans and projects to be considered for assessment. The assessment presented here draws on that presented within relevant topic specific chapters of the EIAR, tailored for the requirements of this RIAA, to inform the assessment of AEoSI in-combination to the features and effects screened in.

9.1.2. In assessing the potential for in-combination effects associated with the Proposed Development, it is important to bear in mind that some projects, predominantly those 'proposed' or identified in development plans etc. may or may not actually be taken forward or taken forward in the same form as currently presented. There is thus 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, relevant projects/plans with consent and (if required) CfD (or similar) are more likely to contribute to in-combination impact with the Proposed Development (providing temporal and spatial pathways exist), whereas projects/plans not yet approved or not yet submitted are less certain to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors.

9.1.3. For this reason, all relevant projects/plans considered in-combination alongside the Proposed Development have been allocated into 'Tiers', reflecting their current stage within the planning and development process. Where the tiering approach differs between receptor groups, this is noted in the relevant section. The tiering approach allows the in-combination impact assessment to present several future development scenarios, each with a differing potential for being ultimately built out. The definition of each tier is described in (Section 7.2), with the plans and projects screened in for further consideration here defined within Table 9.1.

9.1.4. For each plan/project screened in, the in-combination WCS draws on the information presented in topic specific chapters of the EIAR. The aim is to identify, for each receptor group, the aspects of the plans, projects and programmes screened in to be assessed. Consideration is given to the following points:

- Level of detail available for project/plans;
- Potential for an effect-pathway-receptor link;
- Potential for a physical interaction; and
- Potential for temporal interaction.

9.1.5. Table 9.1 below identifies, for all plans and projects screened in for consideration in combination, the relevant receptor group(s), the Worst Case Design Scenario as it applies to that receptor group(s) and the relevant years within which the works are planned to occur. It is of note that, for a number of projects, insufficient information exists to provide a Worst Case Design Scenario, with that noted where relevant.

Table 9.1 In-combination projects and relevant years

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
Offshore wind farms								
Inch Cape	Pre-construction	1	1	125.84	105.72	Bottlenose dolphin	Included for in-combination PVA for all relevant SPA populations under O&M. Construction timings unlikely to overlap with those for Proposed Development.	Construction – 2024-2025, Operational – 2026 onwards
Moray West	Construction	1	1	144.31	87.53	Bottlenose dolphin	Included for in-combination PVA for all relevant SPA populations under O&M. Construction timings unlikely to overlap with those for Proposed Development.	Construction – 2024, Operational – 2025 onwards
Neart na Gaoithe	Construction	1	1	150.54	134.89	Bottlenose dolphin	Included for in-combination PVA for all relevant SPA populations under O&M. Construction timings unlikely to overlap with those for Proposed Development.	Construction – 2024, Operational – 2025 onwards
Pentland	Consent	1	1	224.99	171.38	Bottlenose	Potential in-	Construction –

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
Floating	authorised					dolphin	combination effects considered for Construction / Decommissioning and O&M.	2024-2025, Operational – 2026 onwards
Ayre	Concept/early planning	2	3	161.99	135.86	Bottlenose dolphin	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2029-2031, Operational – 2032 onwards
Berwick Bank	Submitted	2	2	110.04	107.31	Bottlenose dolphin	Potential in-combination effects considered for Construction / Decommissioning and O&M.	Construction - 2025-2033, Operational – 2034 onwards
Caledonia	Concept/early planning	2	3	116.97	62.87	Bottlenose dolphin	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction- 2028-2030, Operational – 2031 onwards
Ossian	Submitted	2	2	51.38	62.42	Bottlenose dolphin	Potential in-combination effects considered for Construction / Decommissioning and O&M.	Construction – 2031-2034, Operational – 2034 onwards
Salamander	Submitted	2	3	28.37	9.10	Bottlenose	The possibility of in-	Construction –

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
						dolphin	combination impacts is acknowledged, but until an application is submitted there is no data to reference.	2028-2030, Operational – 2031 onwards
West of Orkney	Submitted	2	2	243.82	193.71	Bottlenose dolphin	Potential in-combination effects considered for Construction / Decommissioning and O&M.	Construction – 2028-2031, Operational – 2032 onwards
Aberdeen Offshore Wind Farm	Operational	N/A	1	77.49	31.22	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2045
Beatrice Offshore Wind Farm	Operational	N/A	1	150.21	96.83	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2044
Blyth Demo Phase 1	Operational	N/A	1	250.47	256.15	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2044
Blyth Demonstration Site	Construction	N/A	1	241.48	246.85	N/A	Included for in-combination PVA for all relevant SPA populations under	Construction – 2024, Operational – 2025-2050

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
							O&M. Construction timings unlikely to overlap with those for Project.	
Culzean Pilot Offshore Wind Farm	Consented	N/A	1	139.18	158.05	N/A	Included for in-combination PVA for all relevant SPA populations under O&M. Construction timings unlikely to overlap with those for Proposed Development.	Construction and Operational – 2025 onwards
Dogger Bank Offshore Wind Farm – Creyke Beck A	Construction	N/A	1	308.00	327.02	N/A	Included for in-combination PVA for all relevant SPA populations under O&M. Construction timings unlikely to overlap with those for Proposed Development.	Construction – 2024, Operational – 2025 onwards
Dogger Bank Offshore Wind Farm – Creyke Beck B	Construction	N/A	1	280.32	299.46	N/A	Included for in-combination PVA for all relevant SPA populations under O&M. Construction timings unlikely to overlap with those for Proposed Development.	Construction – 2024, Operational – 2025 onwards

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
Dogger Bank Offshore Wind Farm – Teeside B (Sofia)	Construction	N/A	1	294.73	314.95	N/A	Included for in-combination PVA for all relevant SPA populations under O&M. Construction timings unlikely to overlap with those for Proposed Development.	Construction – 2024-2025, Operational – 2026-2061 onwards
Dogger Bank C Offshore Wind Farm – Teeside A	Construction	N/A	1	310.56	331.22	N/A	Included for in-combination PVA for all relevant SPA populations under O&M. Construction timings unlikely to overlap with those for Proposed Development.	Construction – 2024-2025, Operational – 2026 onwards
Dudgeon Offshore Wind Farm	Operational	N/A	1	463.06	479.91	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2042
Dudgeon Extension	Consented	N/A	1	456.47	473.02	N/A	Potential in-combination effects considered for Construction / Decommissioning and O&M.	Construction – 2025-2028, Operational – 2029 onwards
Forthwind	Consented	N/A	1	196.07	167.92	N/A	Potential in-	N/A

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
demo Offshore Wind Farm							combination effects considered for Construction / Decommissioning and O&M.	
Green Volt Offshore Wind Farm (GV)	Consented	N/A	1	36.26	35.64	N/A	Potential in-combination effects considered for Construction / Decommissioning and O&M.	Construction – 2025-2027, Operational – 2028 onwards
Hornsea Project One	Operational	N/A	1	399.22	417.29	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2044
Hornsea Project Two	Operational	N/A	1	390.12	407.76	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2047
Hornsea Project Three Offshore Wind Farm	Consented	N/A	1	409.02	427.91	N/A	Potential in-combination effects considered for Construction / Decommissioning and O&M.	Construction – 2025-2029, Operational – 2030 onwards
Hornsea Project Four Offshore Wind	Consented	N/A	1	360.50	377.39	N/A	Potential in-combination effects considered for	Construction – 2025-2028, Operational – 2039

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
Farm							Construction / Decommissioning and O&M.	onwards
Humber Gateway Offshore Wind Farm	Operational	N/A	1	411.89	426.86	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2040
Hywind Offshore Wind Farm	Operational	N/A	1	35.56	0.06	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2042
Inner Dowsing Offshore Wind Farm	Operational	N/A	1	463.75	478.72	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	2009 onwards
Kincardine Offshore Wind Farm	Operational	N/A	1	78.38	54.12	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2046
Lincs Offshore Wind Farm	Operational	N/A	1	460.45	475.59	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2037
Lynn Offshore Wind Farm	Operational	N/A	1	471.05	485.99	N/A	Included for in-combination PVA for	2009 onwards

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
							all relevant SPA populations under O&M.	
Methil Demo Offshore Wind Farm	Operational	N/A	1	196.02	167.50	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	2014 onwards
Moray East Offshore Wind Farm	Operational	N/A	1	131.63	79.87	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	2024 onwards
Norfolk Boreas Offshore Wind Farm	Consented	N/A	1	508.31	527.57	N/A	Potential in-combination effects considered for Construction / Decommissioning and O&M.	Construction – 2025-2029, Operational – 2030 onwards
Race Bank Offshore Wind Farm	Operational	N/A	1	453.42	469.18	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2043
Sandbank Offshore Wind Farm	Operational	N/A	1	503.54	524.48	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	2017 onwards
Seagreen	Operational	N/A	1	96.32	89.12	N/A	Included for in-	Up to 2048

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
Phase 1 Offshore Wind Farm							combination PVA for all relevant SPA populations under O&M.	
Sheringham Shoal Offshore Wind Farm	Operational	N/A	1	474.64	490.89	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Construction – 2025-2028, Operational – 2029 onwards
Sheringham Shoal Extension	Consented	N/A	1	467.07	483.40	N/A	Potential in-combination effects considered for Construction / Decommissioning and O&M.	2029 onwards
Teeside Offshore Wind Farm	Operational	N/A	1	301.98	311.08	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2038
Triton Knoll Offshore Wind Farm	Operational	N/A	1	431.51	447.27	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2047
Westermost Rough Offshore Wind Farm	Operational	N/A	1	392.23	406.87	N/A	Included for in-combination PVA for all relevant SPA populations under O&M.	Up to 2040

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
Arven Offshore Wind Farm	Planning	N/A	3	296.49	294.65	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2030-2033, Operational – 2034 onwards
Broadshore Offshore Wind Farm	Planning	N/A	3	93.43	63.34	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2028-2031, Operational – 2032 onwards
Buchan Offshore Wind Farm	Planning	N/A	3	89.95	79.21	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2028-2030, Operational – 2031 onwards
Cenos Offshore Wind Farm	Planning	N/A	3	105.68	125.48	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2029-2033, Operational – 2034 onwards
Dogger Bank South East Offshore Wind Farm	Planning	N/A	3	330.53	349.48	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2026-2030, Operational – 2031 onwards

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
Dogger Bank South West Offshore Wind Farm	Planning	N/A	3	309.77	328.03	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2026-2030, Operational – 2031 onwards
Marram Offshore Wind Farm	Planning	N/A	3	58.90	58.35	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2026-2029, Operational – 2030 onwards
Morven Offshore Wind Farm	Planning	N/A	3	58.16	60.80	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2027-2029, Operational – 2030 onwards
Outer Dowsing Offshore Wind Farm	Planning	N/A	3	426.21	443.27	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2027-2029, Operational – 2030 onwards
Spiorad na Mara Offshore Wind Farm	Planning	N/A	3	363.77	300.58	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2028-2031, Operational – 2032 onwards

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
Stromar Offshore Wind Farm	Planning	N/A	3	127.79	95.74	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	Construction – 2026-2030, Operational – 2031 onwards
Wave and Tidal Projects								
Bluemull Sound Tidal Array	Operational	N/A	1	358.30	352.10	N/A	Operational impacts are too low to be considered quantitatively under PVA.	Up to 2038
Deer Sound Tidal Array	Operational	N/A	1	205.30	166.11	N/A	Operational impacts are too low to be considered quantitatively under PVA.	Up to 2047
EMEC BIllia Crooo Wave Energy	Operational	N/A	1	226.40	180.20	N/A	Operational impacts are too low to be considered quantitatively under PVA.	2003 onwards
EMEC Fall of Warness Tidal Array	Operational	N/A	1	219.60	183.05	N/A	Operational impacts are too low to be considered quantitatively under PVA.	2007 onwards
EMEC Scapa Flow Wave	Operational	N/A	1	203.60	161.30	N/A	Operational impacts are too low to be considered	2012 onwards

Project/Plan Name	Status	Tier – Marine Mammals	Tier – Offshore and Intertidal Ornithology	Distance to array (km)	Distance to ECC (km)	Relevant Receptor/ pathway		Relevant Years
						Marine Mammals	Offshore and Intertidal Ornithology	
Energy							quantitatively under PVA.	
EMEC Shapinsay Tidal Array	Operational	N/A	1	210.30	170.79	N/A	Operational impacts are too low to be considered quantitatively under PVA.	2011 onwards
Inner Sound Tidal Array	Operational	N/A	1	191.20	142.71	N/A	Operational impacts are too low to be considered quantitatively under PVA.	2018 onwards
Ness of Duncasby Tidal Array	On hold	N/A	1	188.00	140.23	N/A	Project on hold.	N/A
Yell Sound Tidal Array	Operational	N/A	1	335.50	327.53	N/A	Operational impacts are too low to be considered quantitatively under PVA.	Up to 2039
Westray South Tidal Array	Planning	N/A	3	224.10	187.25	N/A	The possibility of in-combination impacts is acknowledged, but until an application is submitted there is no data to reference.	N/A
Offshore wind farm cables								
Shetland HVDC Link	Construction	1	N/A			Bottlenose dolphin	N/A	N/A

9.1.6. Following the identification of the plans and projects with the potential to result in an AEoSI in-combination with the Proposed Development, the assessment is made below. The information is presented according to the following receptor groupings:

- Marine Mammals;
- Offshore and Intertidal Ornithology; and

9.2. MARINE MAMMAL ECOLOGY

9.2.1. The potential for LSE in-combination from the Proposed Development with regard to marine mammals is summarised in Section 7.2, with the in-combination assessment presented below.

9.2.2. Information to inform the Proposed Development alone assessment for marine mammals is provided in Section 8.1 which assesses adverse effects on Moray Firth SAC during construction, decommissioning and, O&M.

9.2.3. Certain impacts assessed solely for the Proposed Development are screened out of the marine mammal in-combination assessment due to several factors:

- The highly localised nature of the impacts; and
- Management and mitigation measures (embedded commitments) in place at the Proposed Development and on other projects will reduce the risk of in-combination effects occurring.

9.2.4. The impacts screened out from the marine mammal in-combination assessment for these reasons are outlined in Table 9.2.

Table 9.2 Impacts screened out from further consideration in the in-combination assessment with justification for screening

Impact	Justification
Auditory injury (PTS)	Where PTS may result from activities such as pile driving, geophysical surveys and UXO clearance, as a requirement of European Protected Species legislation, suitable mitigation must be put in place to reduce injury risk to marine mammals to negligible levels across all projects considered in the in-combination assessment (JNCC, 2010b, a, 2017). Similarly, any risk of PTS during decommissioning will be determined via appropriate decommissioning plans and if required, mitigated. Any non-piling construction noise sources will have an extremely local spatial extent and therefore represent a minimal risk of injury. Moreover, it is anticipated that underwater noise associated with vessel activity will deter animals from the injury zone. As such, assuming application of appropriate mitigation measures, any risk of injury it is considered highly unlikely and potential for in-combination effects on marine mammals due to PTS as a result of piling, UXO, other non-piling construction activities and decommissioning was not considered further.
Disturbance from UXOs	In line with the Defra *et al*. (2021) joint interim position statement, it is expected that, where feasible, across all projects, UXO clearance campaigns will be conducted using low-order deflagration techniques. These techniques are now considered to have a 100% success rate (Ocean Winds, 2024). Moreover, it is expected that the detonation of a UXO would elicit a startle response and potentially very short-duration behavioural responses and would therefore not be expected to cause widespread and prolonged displacement (JNCC, 2020). Given that behavioural disturbance is considered negligible in the context of UXO clearance as the duration of the impact (underwater noise) is extremely short, the potential for in-combination effects is considered unlikely, and this impact was not considered further.
Disturbance from other construction activities	Disturbance from other (non-piling) construction activities is anticipated to be highly localised and is closely associated with the disturbance from vessel presence required for the activity. As such, in-combination effects have been assessed under “disturbance from vessels” impact and potential for in-combination effects due to other (non-piling) construction activities was not considered further.

Impact	Justification
Vessel collision	It is expected that across all projects and/ or plans, vessel movements will be managed through the implementation of vessel codes of conduct that will mitigate the negative impacts to marine mammals (e.g. limited vessel speeds, adherence to vessel transit routes), following relevant guidance to minimise the risks of injury to marine mammals. As such, the potential for significant in-combination effects is minimal and this impact was not considered further.
Indirect impacts on prey species	The changes in prey availability are expected to be highly localised across all projects. As such, the potential for significant in-combination effects is minimal and therefore this impact was not considered further.
Barrier effects	The potential risks associated with long term displacement and barrier effects are expected to be highly localised across floating projects. The habitat loss is considered to be temporary during construction only. As such, the potential for significant in-combination effects is minimal and therefore this impact was not considered further. The Array Area will be located outside the CES MU. Therefore, there will be no pathway for effect on bottlenose dolphin associated within the Moray Firth SAC population.
Entanglement	The risk of entanglement is restricted to the Array Area and therefore expected to be highly localised across floating project. As such, the potential for significant in-combination effects is minimal and therefore this impact was not considered further.

9.2.5. Consequently, the impacts considered within the marine mammal in-combination assessment are primarily focused on the following:

- The potential for disturbance from underwater noise from piling during construction of offshore wind farms (where data are available) and the construction of other projects and developments;
- Vessel disturbance;
- Disturbance from geophysical surveys; and
- Noise-related impacts associated with the O&M of floating WTGs.

9.2.6. The projects screened in for the in-combination assessment are presented in Table 9.1.

9.2.7. As with the Project alone assessments presented in Section 8.1, the in-combination assessment for marine mammals assesses whether the impacts listed above have the potential to prevent the conservation objectives of the relevant designated sites being met.

9.2.8. The in-combination assessment for marine mammals has been determined based on the plans and projects described within Table 9.1 where there is potential for any phase of such projects to have temporal or spatial overlap with that of the Proposed Development, and there is a potential for the effects screened in to occur from the project. No information is currently available regarding oil and gas seismic surveys, so they have not been included further within this assessment.

9.2.9. For clarity, a ZoI has been applied to screen in relevant offshore projects. The ZoI for marine mammals is the species-specific MU. The assessment presented here draws on the cumulative assessments presented in the EIAR, Volume 2, Chapter 12 (Marine Mammals). The sites/features included in-combination are then those that are located within the species-specific screening distance from one or more of the projects identified for in-combination assessment.

9.2.10. Each project has been considered on the basis of effect–receptor pathway, data confidence and the temporal and spatial scales involved. Therefore, this screened in only some of the projects presented in Section 7.2 The time period considered for marine mammals is 2028-2034 inclusive to account for projects constructing up to a year on either side of the Proposed Development. This allows for the quantification of impacts to the MUs both prior to and post construction of the Proposed Development and during the period when piling at the Proposed

Development is anticipated (2029 and 2031). The tiering structure discussed in Section 7.2 was used for the assessment.

9.2.11. Where possible for each project, information on the expected impacts on marine mammal features of the relevant designated sites have been collated and used to inform the in-combination assessment presented below.

MORAY FIRTH SAC

9.2.12. Consideration of the potential for an in-combination effect on bottlenose dolphin, on a site-by-site basis, applies the same conservation objectives as the assessment alone.

9.2.13. The projects selected as relevant to the assessment of impacts to marine mammals are based upon an initial screening exercise undertaken. A ZoI was applied to screen in relevant projects. The ZoI used to screen in projects for the bottlenose dolphin in-combination assessment is based on the CES.

9.2.14. Further, the projects included are limited to those with potential for construction phase overlap. Specifically, based on the screening range and the timeline of projects, this would include the following projects:

9.2.15. Tier one:

- Inch Cape;
- Moray West;
- Neart Na Gaoithe;
- Pentland Floating; and
- Shetland HVDC Link.

9.2.16. Tier two:

- Ayre;
- Berwick Bank;
- Caledonia;
- Ossian;
- Salamander Offshore Wind; and
- West of Orkney.

9.2.17. The in-combination assessment assesses whether the impacts from projects in-combination have the potential to prevent the conservation objectives of the Moray Firth SAC being met. In this case, impacts to the CES MU (considered synonymous with the Moray Firth SAC) are considered.

DISTURBANCE FROM PILING

9.2.18. There is potential for disturbance from piling during the construction phases across the in-combination projects, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

9.2.19. The relevant CO for Moray Firth SAC for impacts arising from disturbance from piling are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, CO 2b: The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance. It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin;

- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis; and
- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

9.2.20. Of the projects identified in Table 9.1 above, those with potential for in-combination effect with the project with respect to disturbance from piling are limited to those with potential for a temporal overlap of the construction phase (i.e., between 2028 and 2034). The following projects were identified as constructing between 2028-2034 that have disturbance contours that overlap with the CES MU boundary:

- Ayre (Tier 2);
- Berwick Bank (Tier 2);
- Caledonia (Tier 2);
- Ossian (Tier 2); and
- Salamander (Tier 2).

9.2.21. The potential for disturbance from piling to result during construction of the Proposed Development, has been discussed in Section 8.1 as part of the Proposed Development alone assessment, with that information not repeated here. To inform the potential for population level impacts to bottlenose dolphin from piling noise, cumulative iPCoD modelling was undertaken as part of the in-combination assessment.

9.2.22. EIAR Volume 2, Chapter 12 (Marine Mammals) identifies the impact from construction phase piling from all identified projects. No tier one projects screened into assessment are expected to be constructed between 2028 and 2034. Across the tier 2 projects, during the construction period, the number of bottlenose dolphin from the Moray Firth SAC (considered synonymous with the CES MU) predicted to be disturbed per day ranges between 2 in 2034 (0.8% CES MU) to 44 individuals (18.0% CES MU) in 2028. Over the piling duration at the Proposed Development, the cumulative numbers of bottlenose dolphins potentially impacted within the CES MU range from 24 individuals (9.8% CES MU) in 2031 to 34 (13.9% CES MU) in 2029-2030. The latter assumes piling activities at three Scottish offshore wind farms taking place within the CES MU over one day.

9.2.23. To determine whether this level of cumulative disturbance is expected to result in population level impacts, iPCoD modelling was conducted. Salamander was not included as the piling at Salamander does not overlap with the piling at the Array Area.

Table 9.3 Number of bottlenose dolphins in the CES MU disturbed per piling day per project in the iPCoD CEA

Project	Piling years	# CES MU dolphins disturbed
Proposed Development	2029 – 2031	8 (WTG), 7 (OEP)
Berwick Bank	2026 – 2031	5 (WTG). 4 (OEP)
Ossian	2031 – 2038	2 (WTG). 4 (OEP)
Ayre	2029 – 2033	9
Caledonia	2028 - 2030	17

9.2.24. The results of the cumulative iPCoD modelling show that for CES MU, although the level of disturbance has the potential to result in changes at the population level, the impacted population is predicted to continue on an increasing trajectory at 95.1 (unimpacted = 303 bottlenose dolphins, impacted = 288 bottlenose dolphins) - 98.5% (unimpacted = 271 bottlenose dolphins, impacted = 267 bottlenose dolphins) of the size of the un-impacted population.

9.2.25. Disturbance will affect individuals within and/or associated with the Moray Firth SAC, however, this is not predicted to result in any significant change to individual fitness or reproductive success due to the short periods of disturbance. It is not expected to result in long term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC from underwater noise during piling. Therefore, there is not expected to be an impact on the population associated with the site as a result of piling, in-combination. In-combination risks of disturbance impacts are not expected to manifest at levels that could compromise the extent, distribution, structure, and function of the habitats, structure and function of the species, supporting processes, or the population and distribution of the species.

9.2.26. Specifically, disturbance from piling is not predicted to result in any significant negative impacts on individuals or the population of the site. It is not expected to result in long term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted.

9.2.27. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development in-combination with identified plans and projects and therefore, subject to natural change, the populations of bottlenose dolphin will be maintained in the long-term with respect to disturbance from piling associated with the construction.

VESSEL DISTURBANCE

9.2.28. There is potential for disturbance from vessel activity across the in-combination projects, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

9.2.29. The relevant CO for Moray Firth SAC for impacts arising vessel disturbance are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, CO 2b: The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance. It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin;
- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis; and
- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

9.2.30. The potential for disturbance from vessels to result during construction and decommissioning of the Proposed Development has been discussed in 8.1 as part of the Proposed Development alone assessment, with that information not repeated here.

9.2.31. Vessel disturbance may affect individuals associated with Moray Firth SAC, however as identified in the project alone assessment (Section 8.1.163), this is not predicted to result in any significant change to individual fitness or reproductive success and so is therefore not expected to impact on the populations associated with the site.

9.2.32. Vessel traffic is expected to move along predefined routes around the projects, and to/from the designated ports to the respective projects, in line with existing Marine Wildlife Watching Codes and detailed within the VMP (part of VMNSP). Vessels are not expected to travel through the SAC outside of the project footprints and defined routes. Therefore, the level of vessel activity from Tier 1, 2 and 3 projects in-combination with the Proposed Development would is not expected to cause an increase in vessel disturbance.

9.2.33. Consequently, no significant change to individual fitness or reproductive success is expected, meaning there is no expected impact on the population associated with the site.

9.2.34. Specifically, vessel disturbance is not predicted to result in any significant negative impacts on individuals or the population of the site. It is not expected to result in long term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted.

9.2.35. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development in-combination with identified plans and projects and therefore, subject to natural change, the populations of bottlenose dolphin will be maintained in the long-term with respect to disturbance from vessels associated with the construction and decommissioning phase.

DISTURBANCE FROM GEOPHYSICAL SURVEYS

9.2.36. There is potential for disturbance from geophysical survey activity across the in-combination projects, which could impact upon bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

9.2.37. The relevant CO for Moray Firth SAC for disturbance from geophysical surveys are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, CO 2b: The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance. It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin;
- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis; and
- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

9.2.38. The potential for disturbance from geophysical surveys to result during construction of the Proposed Development has been discussed in Section 8.1 as part of the Proposed Development alone assessment, with that information not repeated here.

9.2.39. In relation to disturbance from geophysical and seismic surveys, no specific information on their requirements for the Proposed Development alone is identified at this point; although any surveys that are required will occur prior to the main construction phase in 2028 to 2034. No specific information on planned or proposed surveys in-combination has been identified within the relevant timeframe for inclusion in the assessment here. As a Worst-Case Design Scenario, it is assumed that all projects which overlap with the piling window for the Proposed Development (i.e., 2029-2031) will have overlapping timeframes for geophysical surveys. Under this precautionary scenario, it is expected that there will be 11 projects which have geophysical surveys taking place at the same time. Given the proximity to the Proposed Development, it is anticipated that that most of these project's EECs overlap with the CES MU, and therefore any geophysical surveys as a result of these projects in-combination have the potential to disturb the Moray Firth SAC bottlenose dolphin population. However, if a risk were deemed to be present from in-combination projects (which would be related to the type and nature of any geophysical survey eventually proposed) that risk would be addressed through appropriate licensing measures nearer to the time and the commitments in the respective project's MMMPs.

9.2.40. Specifically, disturbance from geophysical surveys is not predicted to result in any significant negative impacts on individuals or the population of the site. It is not expected to result in a long-term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose

dolphin in such a way that maintaining it as favourable condition in the long term would be impacted.

9.2.41. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development in-combination with identified plans and projects and therefore, subject to natural change, the populations of bottlenose dolphin will be maintained in the long-term with respect to disturbance from geophysical surveys associated with the construction.

NOISE RELATED IMPACTS-FLOATING INFRASTRUCTURE

9.2.42. There is potential for noise impacts from floating infrastructure, which could impact bottlenose dolphin as a qualifying feature of the Moray Firth SAC.

9.2.43. The relevant CO for Moray Firth SAC for impacts arising from underwater noise are CO 1: To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, CO 2a: To ensure the population of bottlenose dolphin is a viable component of the site. It specifically protects the species from significant risk of incidental killing and injury within and outwith the site, CO 2b: The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance. It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects:

- Contributes to the long-term decline in the use of the site by bottlenose dolphin;
- Changes to the distribution of bottlenose dolphin on a continuing or sustained basis; and
- Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.

9.2.44. The potential for noise related impacts from floating infrastructure during the O&M of the Proposed Development has been discussed in Section 8.1 as part of the Proposed Development alone assessment, with that information not repeated here.

9.2.45. As outlined in the alone assessment, it is expected that noise impacts from floating WTGs will be localised and limited to the Array Area of the respective projects. The Array Area will be located outside the CES MU and therefore is not within the known range of the Moray Firth SAC bottlenose dolphin population. There will be no pathway for effect on bottlenose dolphin associated within the Moray Firth SAC population. Furthermore, noise from operational turbines is outside the peak hearing sensitivity of bottlenose dolphins and therefore, no significant change to individual fitness or reproductive success is expected.

9.2.46. Specifically, noise related impacts from floating infrastructure are not predicted to result in any significant negative impacts on individuals or the population of the site, nor is it expected to result in death or injury or disturbance to individuals to an extent that may ultimately affect the population associated with the site. It is not expected to result in a long-term decline in the population use of the site, nor any changes to the distribution on continuing or sustained basis. Additionally, it is not predicted to adversely affect bottlenose dolphin in such a way that maintaining it as favourable condition in the long term would be impacted. It is considered that there will be low impact to the bottlenose dolphin qualifying feature of the SAC due to noise impacts from floating infrastructure.

9.2.47. Therefore, it is concluded that there is no AEoSI to bottlenose dolphins associated with the Moray Firth SAC from the Proposed Development in-combination with identified plans and projects and therefore, subject to natural change, the populations of bottlenose dolphin will be maintained in the long-term with respect to noise impacts from operational WTGs.

9.3. OFFSHORE AND INTERTIDAL ORNITHOLOGY

9.3.1. This section introduces the in-combination assessment for Offshore and Intertidal Ornithology, discussing the sites and effects considered. The other development assessed in combination with the Proposed Development is listed in Table 9.1 with the key offshore wind projects shown on Figure 9-1. A tiered approach has been used to categorise these other projects for inclusion in assessment:

- Tier 1 – Plans/projects which are either operational (with an ongoing impact of relevance) or which have become operational since baseline characterisation of the Proposed Development t, plus those under construction or that are consented and yet to be constructed. Data is available and can be included in a quantitative assessment, i.e., impact modelling (collision risk / distributional response) and population modelling (i.e., PVA).
- Tier 2 – Plans/projects at application stage (pending determination) for which data is available and can be included in a quantitative assessment.
- Tier 3 – Plans/projects have submitted a Scoping Report and are in the planning process, but for which there is limited or no data available to be able to inform a quantitative assessment.

9.3.2. Table 9.1 sets out how each of these other projects are considered for in-combination assessment.

1 West of Orkney
2 Pentland
3 Beatrice
4 Moray East
5 Moray West
6 Green Volt
7 Hywind Scotland
8 Aberdeen
9 Kincardine
10 Ossian
11 Seagreen
12 Inch Cape
13 Neart Na Gaoiithe
14 Fortwind Demo
15 Berwick
16 Blyth Demo
17 Dogger Bank + Sofia
18 Teesside
19 Hornsea
20 Westermost Rough
21 Humber Gateway
22 Outer Dowsing
23 Triton Knoll
24 Race Banks
25 Dudgeon
26 Lincs
27 Lynn and Inner Dowsing
28 Sheringham Shoal
29 Norfolk Boreas
30 Norfolk Vanguard
31 East Anglia
32 Five Estuaries
33 Galloper
34 Greater Gabbard
35 North Falls
36 Gunfleet Sands
37 London Array
38 Kentish
39 Rampion

Legend:

- Array Area
- North Sea BDMPS Region
- Offshore Wind Farms

Project:	Report:
Muir Mhòr	RIAA

Location of current UK offshore wind farms in reference to Muir Mhòr

Figure:	9-1	Drawing No:	GoBe-0001	
Revision:	Date:	Drawn:	Checked:	
01	20/11/24	LR + PB	BPHB	

Map scale 1:3,768,299 @ A3

0 40 80 km

Co-ordinate system: ETRS 1989 UTM Zone 30N **EPSG:** 25830

MUIR MHÒR OFFSHORE WIND FARM
A joint venture between Fred. Olsen Seawind & Vattenfall

Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

CONSTRUCTION AND DECOMMISSIONING

9.3.3. The Construction and Decommissioning impact pathways assessed in Section 8.2 for the Project alone now also require consideration in relation to potential in-combination interactions with the development listed in Table 9.1 for Offshore and Intertidal Ornithology.

9.3.4. As summarised in Table 9.4, the Project alone impacts are assessed as negligible and would not materially affect the conservation objectives, or lead to a population-level consequence, for any of the SPA populations of birds under consideration (Table 7.2). All of the Proposed Development's Construction and Decommissioning impacts will be mitigated, as set out in Table 6.2 which gives the Project commitments in this regard.

9.3.5. In respect of the other projects listed in Table 9.1 which are either under construction or consented and yet to be built, it is assumed that all necessary mitigation in relation to Construction and Decommissioning impact pathways has been secured under their Section 36 and marine licence (or other necessary consent) conditions. It is assumed that the equivalent will also be done under future consenting for any projects still at application stage.

9.3.6. For all the operational projects listed in Table 9.1, it is assumed that decommissioning impacts will not be greater than those assessed for construction (as for Project alone, see Table 8.5). It is assumed that all necessary mitigation for the decommissioning phase has been secured for operational projects via their Section 36 and marine licence (or other necessary consent) conditions. For these reasons, it is therefore considered that there is no risk of in-combination AEoSI from the four impact pathways listed in Table 9.5.

Table 9.4 Impact pathways not taken forward to in-combination assessment

Impact pathway	Reasons
Direct distributional responses	The EIAR predicted very low increases in Proposed Development -related annual mortality in the construction phase. Based on this, it is considered that there will be no population-level effects on SPAs, in combination with other developments.
Artificial lighting	The expected minimal change from baseline lighting levels along with the embedded mitigation commitments result in negligible Proposed Development impacts.
Changes to prey	There may be intermittent changes to local prey for auks and other seabirds, however any disturbance to prey would be temporary. Auks and other seabirds of concern typically target a range of prey and have large foraging areas, therefore the impact from the Project alone is negligible.
Accidental pollution	Due to embedded mitigation, it is considered that there is no risk of significant accidental pollution resulting in a population consequence.

OPERATION AND MAINTENANCE

This section will assess all identified measures for the O&M phase for all designated sites.

9.3.7. In-combination assessment for O&M impact pathways primarily needs to address those where there is a risk of population consequence (and therefore risk of AEoSI in relation to SPA conservation objectives), i.e., seabird distributional responses, seabird collision risk and also non-seabird (i.e., SPA waterbirds) collision risk. In this regard, key reference is made to the

Offshore and Intertidal Ornithology Population Viability Analysis Report (Volume 3, Appendix 11.5) which includes the information on how in-combination mortalities are compiled (see Annex B of that report).

9.3.8. The remaining O&M impact pathways – artificial lighting, entanglement, changes to prey and accidental pollution – have been assessed qualitatively, as set out in Section 8.2, and there are no additional considerations to make in relation to in-combination impacts. Such impacts have been assessed as negligible as set out in Table 9.5 and the Proposed Development would not make any material contribution to any in-combination effects.

9.3.9. Furthermore, such Project alone impacts will be fully mitigated as set out in Table 6.2 and it is assumed that equivalent mitigation will be required for the other projects listed in Table 9.1 which are at application stage, as well as already having been secured under Section 36 and marine licence (or other necessary consent) conditions for all projects either already built, or which have been consented. For these reasons, it is therefore considered that there will not be any risk of in-combination AEoSI from the four impact pathways listed in Table 9.5.

Table 9.5 Impact pathways not taken forward to in-combination assessment

Impact pathway	Reasons
Artificial lighting	The expected minimal change from baseline lighting levels along with the embedded mitigation commitments result in the negligible impact for Project alone.
Changes to prey	There may be intermittent changes to local prey for auks and other seabirds, however any disturbance to prey would be temporary. Auks and other seabirds of concern typically target a range of prey and have large foraging areas, therefore the impact from the Project alone is negligible.
Entanglement	The Entanglement Management Plan will put in place regular monitoring to identify and remove any debris that could result in secondary entanglement. This mitigation measure makes the Project alone impact negligible.
Accidental pollution	Due to embedded mitigation, it is considered that there is no risk of significant accidental pollution resulting in a population consequence.

DIRECT DISTRIBUTIONAL RESPONSES

9.3.10. For direct distributional response, where in-combination impacts are quantified for the Proposed Development and other development included for in-combination assessment (Table 9.1), the same process of comparing impacts against the NatureScot advised threshold (an increase in breeding adult mortality of ≥0.02 percentage point change compared to baseline), has been undertaken. This determines which SPA seabird populations require PVA in order to consider potential population-level consequences. The following section provides a summary of the PVAs undertaken for each species requiring quantitative assessment in relation to distributional response.

- Each PVA input table expresses the impacts as the relative proportion by which demographic rates are decreased.
- Each PVA output table provides the counterfactual of population size (CPS) and the counterfactual of growth rate (CGR) at 35 years, this being the intended period of wind farm operation, and CPS / CGR being the metrics used in the consideration of population-level effects, as further discussed in Section 8.2 (Assessment criteria).

9.3.11. For each species-population combination, the higher and lower scenarios were modelled simultaneously within a single PVA run. ‘Higher’ and ‘lower’ scenario terminology relates to

distributional responses as described in the Displacement Report (Volume 3, Appendix 11.3), with 'higher' being the NatureScot advised rates of displacement and displacement mortality used in displacement matrices, and 'lower' being those proposed by the Developer.

9.3.12. Further to the Muir Mhòr Scoping Opinion (Volume 3, Appendix 5.2) in-combination PVA was undertaken both with and without Berwick Bank and Green Volt projects as denoted in the tables.

GUILLEMOT

9.3.13. This section sets out the guillemot SPA populations for which in-combination PVA has been run to explore the population consequences of such impacts.

9.3.14. Table 9.6 summarises the input parameters and estimated impacts on demographic parameters for each SPA (extracted from Table 2.9 of the Population Viability Analysis Report (Volume 3, Appendix 11.5))., The table numbers (B.14 and B.15) provided in the SPA column reference Annex B of the PVA Report, as this is where the in-combination impact scenarios are set out in detail, showing how the mortality estimates (numbers of birds) have been derived across all the projects included for assessment, and then how the impacts on survival rates and productivity (where relevant) have been calculated.

Table 9.6 Guillemot in-combination PVA inputs

SPA population	Scenario	Adult mortalities	Predicted reduction in		
			Adult survival rate	Immature survival rate	Productivity rate
Buchan Ness to Collieston Coast **Table B.14**	Higher (no BB/GV[1]	78.30	0.0019208	0.0020253	0
	Higher (with BB/GV)	192.77	0.0047290	0.0036656	0
	Lower (no BB/GV)	29.09	0.0007136	0.0007487	0
	Lower (with BB/GV)	77.10	0.0018914	0.0014531	0
Troup, Pennan and Lion's Heads **Table B.15**	Higher (no BB/GV)	68.65	0.0014385	0.0013599	0.0000964
	Higher (with BB/GV)	103.17	0.0021619	0.0017143	0.0000964
	Lower (no BB/GV)	28.90	0.0006055	0.0005353	0.0000964
	Lower (with BB/GV)	43.15	0.0009043	0.0006831	0.0000964

[1]BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.

9.3.15. Table 9.7presents a summary of the key PVA outputs for guillemot (CPS and CGR), taken from the PVA report; Table 3.9 (CPS) and Table 9.10 (CGR). As 35 years is the anticipated operational lifetime of the Proposed Development, assessment references the PVA outputs at this point in time.

9.3.16. The supporting rationale for each conclusion is presented after the table.

Table 9.7 Guillemot in-combination PVA outputs

SPA population	Scenario	PVA output at 35 years[1]		Conclusions
		CPS[2]	CGR[3]	
Buchan Ness to Collieston Coast **Table B.14**	Higher (no BB/GV[4])	0.924 *0.910 - 0.939*	0.998 *0.997 - 0.998*	Potential risk of AEoSI only for the highest distributional response scenario which is not considered to be realistic.
	Higher (with BB/GV)	0.840 *0.827 - 0.854*	0.995 *0.995 - 0.996*	
	Lower (no BB/GV)	0.971 *0.956 - 0.987*	0.999 *0.999 - 1.000*	
	Lower (with BB/GV)	0.933 *0.917 - 0.948*	0.998 *0.998 - 0.998*	
Troup, Pennan and Lion's Heads **Table B.15**	Higher (no BB/GV)	0.945 *0.931 - 0.959*	0.998 *0.998 - 0.999*	No AEoSI.
	Higher (with BB/GV)	0.923 *0.909 - 0.936*	0.998 *0.997 - 0.998*	
	Lower (no BB/GV)	0.977 *0.963 - 0.992*	0.999 *0.999 - 1.000*	
	Lower (with BB/GV)	0.967 *0.953 - 0.982*	0.999 *0.999 - 0.999*	

[1]Values are median values with 95% confidence intervals in italics below.
[2]CPS refers to counterfactual population sizes.
[3]CGR refers to counterfactual growth rates.
[4]BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.

9.3.17. The guillemot population at Buchan Ness to Collieston coast SPA is currently stable (Burnell *et al*., 2023), although the PVA modelling resulted in an increasing trend (Figure F.21 of Annex F, in Appendix 11.5, the PVA report). Only the highest in-combination impact scenario (including Berwick Bank and Green Volt) gave rise to counterfactuals of potential concern: CGR of 0.5% with an associated CPS of 16%. However, it is not considered that this impact scenario represents a realistic estimate of risk against this SPA breeding population, as the mortalities during the non-breeding season are considered to be overinflated due to use of the displacement matrix method. Therefore, the potential **risk of AEoSI** associated with the highest impact scenario is not considered to be realistic.

9.3.18. The guillemot population at Troup, Pennan and Lion's Heads SPA shows a decline since *Seabird 2000* and the most recent *Seabirds Count* (Burnell *et al,* 2023). However, the PVA outputs of CGR and CPS are less than 1% and 10%, respectively. On this basis it is considered to be unlikely that in-combination displacement impacts would give rise to any significant population consequence. Thus, there is **no risk of AEOSI**.

RAZORBILL

9.3.19. This section sets out the razorbill SPA populations for which in-combination PVA has been run to explore the population consequences of such impacts.

9.3.20. Table 9.6 summarises the input parameters and estimated impacts on demographic parameters for each SPA (extracted from Table 2.9 of the Population Viability Analysis Report (Volume 3, Appendix 11.5)). The table numbers (B.17 and B.18) provided in the SPA column reference Annex B of the PVA Report, as this is where the in-combination impact scenarios are set out in detail, showing how the mortality estimates (numbers of birds) have been

derived across all the projects included for assessment, and then how the impacts on survival rates and productivity (where relevant) have been calculated.

Table 9.8 Razorbill in-combination PVA inputs

SPA population	Scenario	Adult mortality estimates	Predicted reduction in		
			Adult survival rate	Immature survival rate	Productivity rate
Fowlsheugh **Table B.17**	Higher (no BB/GV[1])	135.79	0.0065068	0.0077383	0.0002683
	Higher (with BB/GV)	135.79	0.0065068	0.0077383	0.0002683
	Lower (no BB/GV)	77.32	0.0037052	0.0035811	0.0002683
	Lower (with BB/GV)	77.32	0.0037052	0.0035811	0.0002683
Troup, Pennan and Lion's Heads **Table B.18**	Higher (no BB/GV)	27.44	0.0031175	0.0023012	0.0000909
	Higher (with BB/GV)	29.97	0.0034049	0.0025738	0.0000909
	Lower (no BB/GV)	10.13	0.0011507	0.0008153	0.0000909
	Lower (with BB/GV)	11.65	0.0013231	0.0009789	0.0000909

[1]BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.

9.3.21. Table 9.9 presents a summary of the key PVA outputs for razorbill (CPS and CGR), taken from the PVA report; Table 9.13 (CPS) and Table 9.14 (CGR). As 35 years is the anticipated operational lifetime of the Proposed Development, these are the PVA outputs brought forward for consideration. The supporting rationale for each conclusion is presented after the table.

Table 9.9 Razorbill in-combination PVA outputs

SPA Population	Scenario	PVA output at 35 years[1]		Conclusions
		CPS[2]	CGR[3]	
Fowlsheugh **Table B.17**	Higher	0.744 *0.703 - 0.784*	0.992 *0.990 - 0.993*	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.91 razorbill mortalities).
	Lower	0.855 *0.810 - 0.902*	0.996 *0.994 - 0.997*	
Troup, Pennan and Lion's Heads **Table B.18**	Higher (no BB/GV[4])	0.887 *0.816 - 0.959*	0.997 *0.994 - 0.999*	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.95 razorbill mortalities).
	Higher (with BB/GV)	0.876 *0.805 - 0.949*	0.996 *0.994 - 0.998*	
	Lower (no BB/GV)	0.956 *0.884 - 1.033*	0.999 *0.997 - 1.001*	
	Lower (with BB/GV)	0.949 *0.875 - 1.031*	0.999 *0.996 - 1.001*	

[1]Values are median values with 95% confidence intervals in italics below.

[2]CPS refers to counterfactual population sizes.
[3]CGR refers to counterfactual growth rates.
[4]BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.

9.3.22. The razorbill population at Fowlsheugh SPA shows a strongly increasing trend between *Seabird 2000* and the most recent *Seabirds Count* (Burnell *et al*., 2023) which has not been reflected in the PVA modelling (Figure F.24 of Annex F, in Appendix 11.5, the PVA report). For all in-combination impact scenarios, the predicted CGR is less than 1% for all in-combination impact scenarios, however, the maximum predicted difference in CPS is 25.6%. While this may represent a potentially significant population-level effect and a potential risk of AEoSI, the Proposed Development's contribution (0.91 razorbill mortalities), is not judged to be material.

9.3.23. At Troup, Pennan and Lion's Heads SPA, modelled population trend (for impacted and baseline scenarios) is decreasing (Figure F.25 of Annex F, in Appendix 11.5, the PVA report). which aligns with the decreasing trend reported from the SPA count data (Burnell *et al.* 2023). For all in-combination impact scenarios, the predicted CGR is less than 1%, however, the maximum predicted difference in CPS is 12.4%. While this may represent a potentially significant population-level effect and a potential risk of AEoSI, the Project's contribution (0.95 razorbill mortalities), is not judged to be material.

PUFFIN

9.3.24. This section sets out the puffin SPA populations for which in-combination PVA has been run to explore the population consequences of such impacts.

9.3.25. Table 9.10 summarises the input parameters and estimated impacts on demographic parameters for each SPA (extracted from Table 2.9 of the Population Viability Analysis Report (Volume 3, Appendix 11.5)). The table numbers (B.20 - B.24) provided in the SPA column reference Annex B of the PVA Report, as this is where the in-combination impact scenarios are set out in detail, showing how the mortality estimates (numbers of birds) have been derived across all the projects included for assessment, and then how the impacts on survival rates and productivity (where relevant) have been calculated.

Table 9.10 Puffin in-combination PVA inputs

SPA Population	Scenario	In-combination adult mortality estimates	Predicted reduction in		
			Adult survival rate	Immature survival rate	Productivity rate
Coquet Island **Table B.20**	Higher (no BB/GV[1])	15.61	0.0003118	0.0003029	0
	Higher (with BB/GV)	21.61	0.0004316	0.0004824	0
	Lower (no BB/GV)	10.10	0.0002018	0.0001821	0
	Lower (with BB/GV)	13.70	0.0002737	0.0002898	0
Farne Islands **Table B.22**	Higher (no BB/GV)	38.92	0.0004448	0.0006631	0.0000183
	Higher (with BB/GV)	60.32	0.0006894	0.0011922	0.0000183
	Lower (no BB/GV)	25.08	0.0002866	0.0003986	0.0000183

SPA Population	Scenario	In-combination adult mortality estimates	Predicted reduction in		
			Adult survival rate	Immature survival rate	Productivity rate
	Lower (with BB/GV)	37.92	0.0004333	0.0007160	0.0000183
Forth Islands **Table B.23**	Higher (no BB/GV)	257.09	0.0028474	0.0034514	0.0001285
	Higher (with BB/GV)	291.13	0.0032243	0.0038919	0.0001285
	Lower (no BB/GV)	158.37	0.0017540	0.0020713	0.0001285
	Lower (with BB/GV)	178.80	0.0019802	0.0023356	0.0001285
North Caithness Cliffs **Table B.24**	Higher (no BB/GV)	50.98	0.0093742	0.0104334	0
	Higher (with BB/GV)	51.27	0.0094287	0.0104566	0
	Lower (no BB/GV)	31.31	0.0057569	0.0062601	0
	Lower (with BB/GV)	31.48	0.0057896	0.0062740	0

[1]*BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.*

9.3.26. Table 9.11 below presents a summary of the key PVA outputs for puffin (CPS and CGR), taken from the PVA report; Table 3.15 (CPS) and Table 3.16 (CGR). As 35 years is the anticipated operational lifetime of the Proposed Development, these are the PVA outputs brought forward for consideration. The supporting rationale for each conclusion is presented after the table.

Table 9.11 Puffin in-combination PVA outputs

SPA Population	Scenario	PVA output at 35 years[1]		Conclusions
		CPS[2]	CGR[3]	
Coquet Island **Table B.20**	Higher (no BB/GV[4])	0.987 *0.950 - 1.025*	1.000 *0.999 - 1.001*	No AEoSI.
	Higher (with BB/GV)	0.981 *0.944 - 1.019*	0.999 *0.998 - 1.000*	
	Lower (no BB/GV)	0.992 *0.954 - 1.029*	1.000 *0.999 - 1.001*	
	Lower (with BB/GV)	0.988 *0.951 - 1.026*	1.000 *0.999 - 1.001*	
Farne Islands **Table B.22**	Higher (no BB/GV)	0.979 *0.940 - 1.021*	0.999 *0.998 - 1.001*	No AEoSI.
	Higher (with BB/GV)	0.967 *0.927 - 1.007*	0.999 *0.998 - 1.000*	
	Lower (no BB/GV)	0.987 *0.947 - 1.027*	1.000 *0.998 - 1.001*	

SPA Population	Scenario	PVA output at 35 years[1]		Conclusions
		CPS[2]	CGR[3]	
	Lower (with BB/GV)	0.979 *0.939 - 1.020*	0.999 *0.998 - 1.001*	
Forth Islands **Table B.23**	Higher (no BB/GV)	0.879 *0.853 - 0.904*	0.996 *0.996 - 0.997*	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (10.20 puffin mortalities).
	Higher (with BB/GV)	0.864 *0.839 - 0.887*	0.996 *0.995 - 0.997*	
	Lower (no BB/GV)	0.924 *0.898 - 0.949*	0.998 *0.997 - 0.999*	
	Lower (with BB/GV)	0.914 *0.889 - 0.940*	0.998 *0.997 - 0.998*	
North Caithness Cliffs **Table B.24**	Higher (no BB/GV)	0.661 *0.583 - 0.745*	0.989 *0.985 - 0.992*	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.39 puffin mortalities).
	Higher (with BB/GV)	0.660 *0.581 - 0.742*	0.989 *0.985 - 0.992*	
	Lower (no BB/GV)	0.778 *0.690 - 0.877*	0.993 *0.990 - 0.996*	
	Lower (with BB/GV)	0.778 *0.688 - 0.871*	0.993 *0.990 - 0.996*	

[1]Values are median values with 95% confidence intervals in italics below.
[2]CPS refers to counterfactual population sizes.
[3]CGR refers to counterfactual growth rates.
[4]BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.

9.3.27. For puffin at Coquet Island SPA, the population trend modelled under PVA is decreasing for impacted and baseline scenarios (Figure F.27 of Annex F, in Appendix 11.5, the PVA report). However, this does not reflect the available SPA count data which demonstrates an increase from the citation population of 31,686 breeding adults to the most recent *Seabirds Count* of 50,058 breeding adults (Burnell *et al.*, 2023). From the PVA, predicted differences in CGR and CPS are minimal; CGR <0.1% and CPS up to 1.9%. As these figures are so low, it is not considered likely that there would be any significant population consequence, and therefore it is judged that there is **no risk of AEOSI.**

9.3.28. The puffin population at Farne Islands SPA has been decreasing, with a 21% reduction observed between the counts in 2003 and 2019 (Burnell *et al*., 2023), and this is reflected by the modelled trend (Figure F.28 of Annex F, in Appendix 11.5, the PVA report). However, there is minimal difference in CGR and CPS from modelled impacts as compared to baseline: CGR <0.1% and CPS up to 3.3%. As these figures are so low, it is not considered likely that there would be any significant population consequence, and therefore it is judged that there is no risk of AEOSI.

9.3.29. The population of puffin at Forth Islands SPA (Isle of May) has fluctuated over time but is currently much larger than it was at designation; 87,504 breeding adults recorded during the *Seabirds Count* compared to the 28,000 breeding adults on the SPA citation (Burnell *et al.,* 2023). While the PVA modelling results in a declining trend (Figure F.29 of Annex F, in Appendix 11.5, the PVA report), the ratio metrics can still be informative. The decrease in CGR for the highest impact scenario (which includes Berwick Bank and Green Volt) is up to 0.4% compared to baseline with an associated reduction in end population size (CPS) of 13.6% for the highest impacted scenario. This may constitute **risk of AEoSI** from the in-combination impacts, however, it is judged that the Proposed Development does not make a

material contribution in this regard (10.2 adult mortalities from the 291.13 in-combination total, representing 3.5%).

9.3.30. For puffin at North Caithness Cliffs SPA, PVA modelling predicts a declining baseline population trend (Figure F.30 in Annex F of Appendix 11.5), corresponding to the actual trends from SPA count data (Burnell *et al.* 2023). PVA model outputs predict that the decrease in CGR between baseline and impacted populations would be 1.1%, however, the difference in CPS appears more significant (22.2 – 34%). While this might indicate**risk of AEoSI** from in-combination impacts, the Proposed Development's contribution is judged to be non-material as it is only 0.39 annual mortalities.

KITTIWAKE

9.3.31. As for the Project alone impacts, cumulative mortality estimates for kittiwake distributional responses need to be considered alongside those arising from collision risk. Currently the figures for each impact pathway are added together to give the combined impacts for comparison against the NatureScot advised thresholds. Please see the section below on collision risk, where this quantitative assessment is set out.

GANNET

9.3.32. As for the Project alone impacts, cumulative mortality estimates for gannet distributional responses need to be considered alongside those arising from collision risk. Currently the figures for each impact pathway are added together to give an estimated of total combined impacts which is then compared against the NatureScot advised thresholds. Please see the section below on collision risk, where this quantitative assessment is set out.

COLLISION

SEABIRDS

KITTIWAKE

9.3.33. This section sets out the kittiwake SPA populations for which in-combination PVA has been run to explore the population consequences of such impacts.

9.3.34. Table 9.12 summarises the input parameters and estimated impacts on demographic parameters for each SPA (extracted from Table 2.9 of the Population Viability Analysis Report (Volume 3, Appendix 11.5)). The table numbers (B.1 - B.10) provided in the SPA column reference Annex B of the PVA Report, as this is where the in-combination impact scenarios are set out in detail, showing how the mortality estimates (numbers of birds) have been derived across all the projects included for assessment, and then how the impacts on survival rates and productivity (where relevant) have been calculated.

Table 9.12 Kittiwake in-combination PVA inputs

SPA Population	Scenario	Adult mortality estimates	Predicted reduction in		
			Adult survival rate	Immature survival rate	Productivity rate
Buchan Ness to Collieston Coast **Table B.1**	Higher (no BB/GV[1])	104.96	0.0038738	0.0014490	0.0009448
	Higher (with BB/GV)	112.74	0.0041609	0.0014576	0.0009448
	Lower (no BB/GV)	81.05	0.0029916	0.0011066	0.0009448

SPA Population	Scenario	Adult mortality estimates	Predicted reduction in		
			Adult survival rate	Immature survival rate	Productivity rate
	Lower (with BB/GV)	87.37	0.0032246	0.0011124	0.0009448
Cape Wrath **Table B.2**	Higher (no BB/GV)	5.21	0.0007186	0.0007026	0
	Higher (with BB/GV)	5.21	0.0007186	0.0007026	0
	Lower (no BB/GV)	3.83	0.0005282	0.0005012	0
	Lower (with BB/GV)	3.83	0.0005282	0.0005012	0
East Caithness Cliffs **Table B.3**	Higher (no BB/GV)	400.73	0.0081852	0.0022701	0.0002206
	Higher (with BB/GV)	402.01	0.0082114	0.0022716	0.0002206
	Lower (no BB/GV)	264.05	0.0053934	0.0015576	0.0002206
	Lower (with BB/GV)	265.12	0.0054153	0.0015581	0.0002206
Farne Islands **Table B.4**	Higher (no BB/GV)	22.18	0.0030947	0.0012159	0
	Higher (with BB/GV)	47.39	0.0066136	0.0013201	0
	Lower (no BB/GV)	15.37	0.0021450	0.0008435	0
	Lower (with BB/GV)	35.58	0.0049647	0.0009237	0
Forth Islands **Table B.5**	Higher (no BB/GV)	51.54	0.0038913	0.0008089	0.0001208
	Higher (with BB/GV)	83.43	0.0062997	0.0008793	0.0001208
	Lower (no BB/GV)	34.09	0.0025743	0.0005754	0.0001208
	Lower (with BB/GV)	59.68	0.0045060	0.0006326	0.0001208
Fowlsheugh **Table B.6**	Higher (no BB/GV)	149.03	0.0048128	0.0010911	0.0009042
	Higher (with BB/GV)	245.53	0.0079290	0.0011847	0.0009042
	Lower (no BB/GV)	108.58	0.0035064	0.0008203	0.0009042
	Lower (with BB/GV)	185.98	0.0060058	0.0008936	0.0009042

[1]BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.

9.3.35. Table 9.13 below presents a summary of the key PVA outputs for kittiwake (CPS and CGR), taken from the PVA report; Table 3.3 (CPS) and Table 9.4 (CGR). As 35 years is the anticipated operational lifetime of the Proposed Development, these are the PVA outputs brought forward for consideration.

9.3.36. The supporting rationale for each conclusion is presented after the table.

Table 9.13 Kittiwake in-combination PVA outputs.

SPA Population	Scenario	PVA outputs at 35 years[1]		Conclusion
		CPS[2]	CGR[3]	
Buchan Ness to Collieston Coast **Table B.1**	Higher (no BB/GV[4])	0.880 *0.857 - 0.905*	0.996 *0.996 - 0.997*	Potential risk of AEoSI from in-combination impacts and the Proposed Development may make a material contribution (13.91 kittiwake mortalities).
	Higher (with BB/GV)	0.875 *0.850 - 0.898*	0.996 *0.996 - 0.997*	
	Lower (no BB/GV)	0.905 *0.881 - 0.930*	0.997 *0.997 - 0.998*	
	Lower (with BB/GV)	0.900 *0.875 - 0.924*	0.997 *0.996 - 0.998*	
Cape Wrath **Table B.2**	Higher	0.971 *0.918 - 1.024*	0.999 *0.998 - 1.000*	No AEOSI
	Lower	0.978 *0.928 - 1.033*	0.999 *0.998 - 1.001*	
East Caithness Cliffs **Table B.3**	Higher (no BB/GV)	0.789 *0.771 - 0.806*	0.993 *0.993 - 0.994*	Potential risk of AEoSI from in-combination impacts and the Proposed Development may make a material contribution (7.22 kittiwake mortalities)
	Higher (with BB/GV)	0.788 *0.771 - 0.806*	0.993 *0.993 - 0.994*	
	Lower (no BB/GV)	0.854 *0.835 - 0.872*	0.996 *0.995 - 0.996*	
	Lower (with BB/GV)	0.853 *0.835 - 0.871*	0.996 *0.995 - 0.996*	
Farne Islands **Table B.4**	Higher (no BB/GV)	0.908 *0.862 - 0.960*	0.997 *0.996 - 0.999*	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.60 kittiwake mortalities)
	Higher (with BB/GV)	0.835 *0.792 - 0.881*	0.995 *0.994 - 0.996*	
	Lower (no BB/GV)	0.936 *0.888 - 0.988*	0.998 *0.997 - 0.999*	
	Lower (with BB/GV)	0.874 *0.829 - 0.922*	0.996 *0.995 - 0.998*	
Forth Islands **Table B.5**	Higher (no BB/GV)	0.898 *0.863 - 0.934*	0.997 *0.996 - 0.998*	Potential risk of AEoSI from in-combination impacts but the Proposed Development may make a material contribution (1.81 kittiwake mortalities)
	Higher (with BB/GV)	0.848 *0.814 - 0.882*	0.995 *0.994 - 0.996*	
	Lower (no BB/GV)	0.931 *0.894 - 0.968*	0.998 *0.997 - 0.999*	
	Lower	0.888	0.997	

SPA Population	Scenario	PVA outputs at 35 years[1]		Conclusion
		CPS[2]	CGR[3]	
	(with BB/GV)	*0.853 - 0.924*	*0.996 - 0.998*	
Fowlsheugh **Table B.6**	Higher (no BB/GV)	0.868 *0.845 - 0.890*	0.996 *0.995 - 0.997*	Potential risk of AEoSI from in-combination impacts and the Proposed Development may make a material contribution (4.95 kittiwake mortalities)
	Higher (with BB/GV)	0.805 *0.783 - 0.827*	0.994 *0.993 - 0.995*	
	Lower (no BB/GV)	0.899 *0.876 - 0.923*	0.997 *0.996 - 0.998*	
	Lower (with BB/GV)	0.847 *0.825 - 0.869*	0.995 *0.995 - 0.996*	
North Caithness Cliffs **Table B.7**	Higher (no BB/GV)	0.818 *0.784 - 0.855*	0.994 *0.993 - 0.995*	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.82 kittiwake mortalities)
	Higher (with BB/GV)	0.817 *0.782 - 0.855*	0.994 *0.993 - 0.995*	
	Lower (no BB/GV)	0.867 *0.830 - 0.906*	0.996 *0.995 - 0.997*	
	Lower (with BB/GV)	0.867 *0.828 - 0.906*	0.996 *0.995 - 0.997*	
St Abb's Head to Fast Castle **Table B.8**	Higher (no BB/GV)	0.885 *0.845 - 0.926*	0.997 *0.995 - 0.998*	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.62 kittiwake mortalities)
	Higher (with BB/GV)	0.414 *0.388 - 0.439*	0.976 *0.974 - 0.977*	
	Lower (no BB/GV)	0.920 *0.881 - 0.965*	0.998 *0.997 - 0.999*	
	Lower (with BB/GV)	0.501 *0.471 - 0.529*	0.981 *0.979 - 0.982*	
Troup, Pennan and Lion's Heads **Table B.9**	Higher (no BB/GV)	0.878 *0.854 - 0.902*	0.996 *0.996 - 0.997*	Potential risk of AEoSI from in-combination impacts and the Proposed Development may make a material contribution (9.35 kittiwake mortalities)
	Higher (with BB/GV)	0.875 *0.851 - 0.899*	0.996 *0.996 - 0.997*	
	Lower (no BB/GV)	0.911 *0.887 - 0.936*	0.997 *0.997 - 0.998*	
	Lower (with BB/GV)	0.909 *0.884 - 0.933*	0.997 *0.997 - 0.998*	
West Westray **Table B.10**	Higher	0.644 *0.602 - 0.689*	0.988 *0.986 - 0.989*	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.50 kittiwake mortalities)
	Lower	0.740 *0.691 - 0.789*	0.992 *0.990 - 0.993*	

[1]Values are median values with 95% confidence intervals in italics below.
[2]CPS refers to counterfactual population sizes.
[3]CGR refers to counterfactual growth rates.
[4]BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.

9.3.37. Scottish Ministers have already determined there to **be risk of AEoSI** from in-combination offshore wind impacts on the kittiwake population at Buchan Ness to Collieston Coast SPA. PVA outputs from the in-combination assessment (as presented in Table 9.13), show a minimal difference in the CGR of 0.4% for the high scenario with Berwick Bank and Gren Volt. The predicted CPS, however, ranges from 9.5 – 12.5%, which could potentially be considered significant. Census data evidence that the population has been declining, although the most recent 2023 count is higher than the Seabird Census count of 2019 (Burnell *et al.* 2023). Nevertheless, there are insufficient data to conclude a recovering trend and the Project contribution (13.91 breeding adults) to in-combination totals may be considered material at this SPA

9.3.38. For kittiwake at Cape Wrath SPA, modelled population trend (for impacted and baseline scenarios) is decreasing, however, the predicted difference in CGR compared to baseline is minimal for all scenarios and maximum predicted difference in CPS is 2.9%. It is therefore determined that this may not constitute a significant population consequence and thus there is **no AEoSI**.

9.3.39. Scottish Ministers have already determined there to be **risk of AEoSI** from in-combination offshore wind impacts on the kittiwake population at East Caithness Cliffs SPA. While the modelled trend from PVA is increasing (Figure F.10 of Annex F, in Appendix 11.5, the PVA report), seabird census data reveals a declining population (Brunell *et al*. 2023). Therefore, the predicted counterfactuals, CGR of 0.4-0.7% and CPS from 14.6 - 21.2% appear significant in relation to the already declining population. As a result, it is likely that the Project's contribution to in-combination totals will be deemed material (7.22 breeding adult mortalities).

9.3.40. Kittiwake at Farne Islands SPA have also declined, by 14% between 2000 – 2019 based on the available SPA count data (Burnell *et al.* 2023) which the modelled trend does not reflect (Figure F.11 of Annex F, in Appendix 11.5, the PVA report). The maximum predicted difference in CGR compared to baseline is minimal (<1%) for all scenarios, however, the maximum predicted difference in CPS is 16.5% (for the high scenario including Berwick Bank and Green Volt). While these in-combination impacts may likely be judged as significant, giving rise to a risk of AEoSI, the Proposed Development does not itself make a material contribution (< 1 bird).

9.3.41. The Forth Islands SPA kittiwake population has decreased between its citation level of 16,800 breeding adults and recent counts (2018-2021) of 9,084 breeding adults (Burnell *et al*., 2023). Whilst the modelled predicted difference in CGR compared to baseline is minimal (<1%) for all scenarios, the maximum predicted difference in CPS is 15.2%. which could be considered significant in relation to the already declining population and thus may lead to **risk of AEoSI**. The Proposed Development's contribution to the in-combination mortality total may therefore potentially be considered material (1.18 breeding adult mortalities).

9.3.42. Scottish Ministers have already determined there to be **risk of AEoSI** from in-combination offshore wind impacts on the kittiwake population at Fowlsheugh SPA. This population had been declining since the time of SPA designation (Burnell *et al.* 2023), albeit the modelled trend from PVA does not reflect this (Figure F.13 of Annex F, in Appendix 11.5, the PVA report). The model outputs predict declines in CGR of <1%, however, CPS ranges from 10.1 - 19.5%. It is likely therefore that the Proposed Development's contribution to in-combination totals will be considered material (4.95 breeding adult mortalities).

9.3.43. The modelled population trend (for impacted and baseline scenarios) for kittiwake at North Caithness Cliffs SPA is increasing (Figure F.14 of Annex F, in Appendix 11.5, the PVA report). This is contrary to population trend discerned from the SPA census counts which show a 45% population decline between 1999/2000 - 2015/16 (Burnell *et al.* 2023). The predicted difference in CGR compared to baseline is <1% for all scenarios, however, the maximum

predicted difference in CPS is 18.3%. While these in-combination impacts may likely be judged as significant, giving rise to a risk of AEoSI, the Proposed Development does not itself make a material contribution (< 1 bird).

9.3.44. The modelled population trend (for impacted and baseline scenarios) for kittiwake at St Abbs to Fast Castle SPA is increasing (Figure F.15 of Annex F, in Appendix 11.5, the PVA report).. This is contrary to the population trend discerned from census counts which show a 68% population decline between 2000 - 2016/21 (Burnell *et al.* 2023). In this context, any further impact on this population is likely to be significant. The maximum predicted difference in CGR compared to baseline is 2.4% and the maximum predicted difference in CPS is 58.6%. While these in-combination impacts may likely be judged as significant, giving rise to a risk of AEoSI, the Proposed Development does not itself make a material contribution (< 1 bird).

9.3.45. Scottish Ministers have already determined there to be **risk of AEoSI** from in-combination offshore wind impacts on the kittiwake population at Troup, Pennan and Lion's Heads SPA. This population has been declining since the time of SPA designation (Burnell *et al.* 2023), albeit the modelled trend from PVA does not reflect this (Figure F.16 of Annex F, in Appendix 11.5, the PVA report). Predicted differences in CGR compared to baseline are less than <0.5% for all scenarios, however, CPS ranges from 8.9-12.2%. It is likely therefore that the Proposed Development's contribution to in-combination totals will be considered material (9.35 breeding adult mortalities).

9.3.46. The West Westray kittiwake population has suffered severe declines since 1999, with a reduction in the 2017 count of 92% (Burnell *et al.* 2023). In this context, any additional impact on this population will be significant. The maximum predicted difference in CGR compared to baseline is 1.2% with a CPS of up to 35.6%. While these in-combination impacts may likely be judged as significant, giving rise to a risk of AEoSI, the Propos**ed Development** does not itself make a material contribution (< 1 bird).

GANNET

9.3.47. This section sets out the gannet SPA populations for which in-combination PVA has been run to explore the population consequences of such impacts.

9.3.48. Table 9.14 summarises the input parameters and estimated impacts on demographic parameters for each SPA (extracted from Table 2.9 of the Population Viability Analysis Report (Volume 3, Appendix 11.5)). The table numbers (B.26 - B.33) provided in the SPA column reference Annex B of the PVA Report, as this is where the in-combination impact scenarios are set out in detail, showing how the mortality estimates (numbers of birds) have been derived across all the projects included for assessment, and then how the impacts on survival rates and productivity (where relevant) have been calculated.

Table 9.14 Gannet in-combination PVA inputs

SPA Population	Scenario	Adult mortality estimates	Predicted reduction in	
			Adult survival rate	Immature survival rate
Fair Isle **Table B.26**	Higher (no BB/GV[1])	13.94	0.0014437	0.0013841
	Higher (with BB/GV)	15.42	0.0015974	0.0014475
	Lower (no BB/GV)	8.43	0.0008731	0.0008368
	Lower	9.39	0.0009727	0.0008705

SPA Population	Scenario	Adult mortality estimates	Predicted reduction in	
			Adult survival rate	Immature survival rate
	(with BB/GV)			
Flamborough and Filey Coast **Table B.27**	Higher (no BB/GV)	415.52	0.0136389	0.0014490
	Higher (with BB/GV)	419.66	0.0137748	0.0014868
	Lower (no BB/GV)	265.17	0.0087037	0.0008617
	Lower (with BB/GV)	267.96	0.0087952	0.0008821

[1]BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.

9.3.49. Table 9.15 below presents a summary of the key PVA outputs for gannet (CPS and CGR), taken from the PVA report; Table 3.17 (CPS) and Table 9.18 (CGR). As 35 years is the anticipated operational lifetime of the Proposed Development, these are the PVA outputs brought forward for consideration.

9.3.50. The supporting rationale for each conclusion is presented after the table.

Table 9.15 Gannet in-combination PVA outputs.

SPA Population	Scenario	PVA outputs at 35 years[1]		Conclusion
		CPS[2]	CGR[3]	
Fair Isle **Table B.26**	Higher (no BB/GV[4])	0.941 *0.894 - 0.989*	0.998 *0.997 - 1.000*	No AEoSI
	Higher (with BB/GV)	0.936 *0.892 - 0.985*	0.998 *0.997 - 0.999*	
	Lower (no BB/GV)	0.964 *0.915 - 1.013*	0.999 *0.998 - 1.000*	
	Lower (with BB/GV)	0.961 *0.914 - 1.010*	0.999 *0.998 - 1.000*	
Flamborough and Filey Coast **Table B.27**	Higher (no BB/GV)	0.676 *0.657 - 0.697*	0.989 *0.988 - 0.990*	No AEoSI as the assessment did not take account of gannet macro-avoidance, and the Proposed Development contribution is not material anyway (1.19 gannet mortalities).
	Higher (with BB/GV)	0.673 *0.654 - 0.694*	0.989 *0.988 - 0.990*	
	Lower (no BB/GV)	0.780 *0.758 - 0.803*	0.993 *0.992 - 0.994*	
	Lower (with BB/GV)	0.778 *0.756 - 0.801*	0.993 *0.992 - 0.994*	
Forth Islands **Table B.28**	Higher (no BB/GV)	0.841 *0.829 - 0.853*	0.995 *0.995 - 0.996*	There is potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (10.6 gannet mortalities).
	Higher (with BB/GV)	0.807 *0.796 - 0.818*	0.994 *0.994 - 0.994*	
	Lower	0.886	0.997	

SPA Population	Scenario	PVA outputs at 35 years[1]		Conclusion
		CPS[2]	CGR[3]	
	(no BB/GV)	*0.873 - 0.898*	*0.996 - 0.997*	Furthermore, assessment did not take account of gannet macro-avoidance.
	Lower (with BB/GV)	0.861 *0.849 - 0.873*	0.996 *0.996 - 0.996*	
Hermaness, Saxa Vord and Valla Field **Table B.29**	Higher (no BB/GV)	0.936 *0.916 - 0.955*	0.998 *0.998 - 0.999*	No AEoSI.
	Higher (with BB/GV)	0.932 *0.914 - 0.952*	0.998 *0.998 - 0.999*	
	Lower (no BB/GV)	0.961 *0.942 - 0.980*	0.999 *0.998 - 0.999*	
	Lower (with BB/GV)	0.958 *0.939 - 0.978*	0.999 *0.998 - 0.999*	
North Rona and Sula Sgeir **Table B.30**	Higher (no BB/GV)	0.985 *0.952 - 1.021*	1.000 *0.999 - 1.000*	No AEoSI.
	Higher (with BB/GV)	0.984 *0.949 - 1.020*	1.000 *0.999 - 1.000*	
	Lower (no BB/GV)	0.991 *0.959 - 1.027*	1.000 *0.999 - 1.001*	
	Lower (with BB/GV)	0.991 *0.957 - 1.025*	1.000 *0.999 - 1.001*	
Noss **Table B.31**	Higher (no BB/GV)	0.927 *0.898 - 0.957*	0.998 *0.997 - 0.999*	No AEoSI.
	Higher (with BB/GV)	0.922 *0.893 - 0.950*	0.998 *0.997 - 0.999*	
	Lower (no BB/GV)	0.956 *0.926 - 0.985*	0.999 *0.998 - 1.000*	
	Lower (with BB/GV)	0.953 *0.924 - 0.982*	0.999 *0.998 - 0.999*	
Sule Skerry and Sule Stack **Table B.33**	Higher (no BB/GV)	0.910 *0.875 - 0.945*	0.997 *0.996 - 0.998*	No AEoSI.
	Higher (with BB/GV)	0.909 *0.875 - 0.945*	0.997 *0.996 - 0.998*	
	Lower (no BB/GV)	0.936 *0.900 - 0.974*	0.998 *0.997 - 0.999*	
	Lower (with BB/GV)	0.935 *0.900 - 0.971*	0.998 *0.997 - 0.999*	

[1]Values are median values with 95% confidence intervals in italics below.
[2]CPS refers to counterfactual population sizes.
[3]CGR refers to counterfactual growth rates.
[4]BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.

9.3.51. Excluding Flamborough and Filey coast SPA and Forth Islands SPA, it is considered that there is **no AEoSI** arising from in-combination impacts for any other SPA gannet populations assessed. For these other SPAs, modelling predicts a maximum reduction in CGR of 0.5% and changes in CPS are all less than 10%. The modelled population trends (baseline and impacted) are all increasing, which reflects empirical census data which shows colony increases and population growth (Burnell *et al*. 2023).

9.3.52. The gannet population at Flamborough and Filey Coast SPA has also increased considerably; between 2004-2017, the count increased by 240% (Burnell *et al.*, 2023). This population trend is reflected in the modelled outputs, with predicted increases in both baseline and impacted populations over the 35-year lifespan of the Proposed Development. The in-combination impacts on this gannet population are predicted to give rise to 0.7-1.1% change in CGR and between 22.2- 32.7% change in CPS for the range of modelled scenarios.

9.3.53. However, the Project contributes just over a single bird (1.19 gannet) and assessment is considered to be precautionary. CRM for the Proposed Development, and that of many of the other developments considered, does not account for gannet macro-avoidance. In this regard, Natural England now advise that a 65-85% macro-avoidance rate is applied to input densities for modelling gannet collision risk, in either breeding or non-breeding seasons (Parker *et al.,* 2022). NatureScot accept the same for the non-breeding season, however, their advice on this for ScotWind was issued after all modelling for the Proposed Development had already been completed.

9.3.54. If macro-avoidance had been taken into account in the Project alone CRM, then the annual mortality would be < 1 gannet. Given the minimal contribution that the Project makes to the in-combination mortality, and the precautionary nature of the assessment, we consider that the Proposed Development does not make a material contribution to in-combination impacts.

9.3.55. The Forth Islands SPA gannet colony has also been increasing, with a 57% increase in colony size between 2004 – 2014 to 75,259 AON/AOS (150,518 breeding adults). This SPA feature, centered at the Bass Rock colony, was heavily impacted by the HPAI outbreak in 2022 and the most recent count reported a reduction in this colony size to 51,844 AOS (103,688 breeding adults) (Harris *et al*. 2023i). Nevertheless, current colony counts are still considerably higher than the citation population of 43,200 breeding birds.

The PVA modelling predicts an increasing population and the decrease in CGR is less than 0.5%, however, the predicted range of CPS is between 11.4-15.9% across the in-combination scenarios. The Project alone mortality, however, is not judged to make a material contribution (10.6 adult mortalities from the highest 1,014 in-combination total, representing 1.0%). Additionally, both Project alone and in-combination impacts will be reduced to a currently unknown extent if gannet macro-avoidance is taken into account.

HERRING GULL

9.3.56. This section sets out the herring gull SPA populations for which in-combination PVA has been run to explore the population consequences of such impacts.

9.3.57. Table 9-16 summarises the input parameters and estimated impacts on demographic parameters for each SPA (extracted from Table 2.9 of the Population Viability Analysis Report (Volume 3, Appendix 11.5)). The table number (B.12) provided in the SPA column references Annex B of the PVA Report, as this is where the in-combination impact scenarios are set out in detail, with all the supporting calculations.

Table 9-16 Herring gull in-combination PVA inputs

SPA Population	Scenario[1]	Adult mortality estimates	Predicted reduction in	
			Adult survival rate	Immature survival rate
Buchan Ness to Collieston Coast **Table B.12**	No BB/GV[2]	5.00	0.0011015	0.0001823
	With BB/GV	5.08	0.0011191	0.0001823

[1]There are no 'higher' and 'lower' scenarios presented as these relate to distributional response.
[2]BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.

9.3.58. Table 9-17 below presents a summary of the key PVA outputs for herring gull (CPS and CGR), taken from the PVA report; Table 3.5 (CPS) and Table 3.6 (CGR). As 35 years is the anticipated operational lifetime of the Proposed Development, these are the PVA outputs brought forward for consideration.

9.3.59. The supporting rationale for the conclusion is presented after the table.

Table 9-17 Herring gull in-combination PVA outputs

SPA Population	Scenario[1]	PVA output at 35 years[2]		Conclusion
		CPS[3]	CGR[4]	
Buchan Ness to Collieston Coast **Table B.12**	No BB/GV[5]	0.972 *0.894 - 1.059*	0.999 *0.997 - 1.001*	No AEOSI
	With BB/GV	0.973 *0.892 - 1.058*	0.999 *0.997 - 1.001*	

[1]There are no 'higher' and 'lower' scenarios presented as these relate to distributional response.
[2]Values are median values with 95% confidence intervals in italics below.
[3]CPS refers to counterfactual population sizes.
[4]CGR refers to counterfactual growth rates.
[5]BB and GV abbreviations relate to Berwick Bank and Green Volt, respectively.

9.3.60. The model outputs for herring gull at Buchan Ness and Collieston SPA predict a stable baseline and impacted population over the 35-year lifespan of the Proposed Development. In-combination impacts on this population have a minimal effect on CGR with a median of 0.1% for the high scenario including Berwick Bank and Green Volt. The predicted difference in CPS is just 2.7% for the high scenario, which is unlikely to affect population viability. There is unlikely to be AEoSI in-combination collision risk for this SPA population of herring gull.

WATERBIRD SPECIES

9.3.61. The Project alone collision risk to SPA waterbirds on migration has been addressed in Section 8.2 above. Although this assessment is qualitative, it is considered that if such collision risk was to be quantified (once methods become available), then the annual mortalities would be less than 0.2 birds per year for all of these SPA waterbird species considered. Such levels of impact are below the NatureScot threshold of concern for in-combination assessment (this being 0.2 birds) and so the Proposed Development does not make any material contribution to in-combination collision risk to waterbird species.

10. TRANSBOUNDARY STATEMENT

10.1.1. There are 12 transboundary SPAs screened in for assessment (Table 7.2):

- Horn Head to Fanad Head SPA (fulmar)
- Tory Island SPA (fulmar)
- West Donegal Coast SPA (fulmar)
- Clare Island SPA (fulmar)
- High Island, Inishshark and Davillaun SPA (fulmar)
- Cruagh Island SPA (Manx shearwater)
- Kerry Head SPA (fulmar)
- Iveragh Peninsula SPA (fulmar)
- Lambay Island SPA (fulmar)
- Falaise du Bessin Occidental SPA (fulmar)
- Littoral seino-marin SPA (fulmar)
- Seevogelschutzgebiet Helgoland SPA (fulmar)

10.1.2. The potential for an AEoSI from the Project alone on these SPAs has been addressed in Section 8.3, and potential for AEoSI from the Project in-combination with other plans or projects (including transboundary projects) has been addressed in Section 9.3. For all transboundary SPAs, it was concluded that there is no potential for AEoSI from the Project alone, or in-combination other developments.

11. CONCLUSIONS OF THE ASSESSMENT

11.1.1. A summary of the assessment is presented below in Table 11.1. This identifies the designated sites (together with the relevant feature(s)) screened in for effect in relation to the Proposed Development alone and in-combination. The assessment concludes that 5 designated sites have the potential for AEoSI; Kittiwake at Buchan Ness to Collieston Coast SPA, Kittiwake at Troup, Pennan and Lion's Head SPA, Kittiwake at Fowlsheugh SPA, Kittiwake at East Caithness Cliffs SPA and Kittiwake at Forth Islands SPA. Therefore, a derogation may be required.

Table 11.1 Conclusions of the assessment for AEoSI for all offshore receptor groups

Designated Site	Feature(s) screened in	Potential for Effect	Conclusion on adverse effect alone			Conclusion on Adverse effect in-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
Marine Mammals								
Moray Firth SAC	Bottlenose dolphin (*Tursiops truncatus*)	• Auditory injury from piling	No AEoSI	N/A	N/A	N/A	N/A	N/A
		• Disturbance from piling	No AEoSI	N/A	N/A	No AEoSI	N/A	N/A
		• Auditory injury from UXO clearance	No AEoSI	N/A	N/A	N/A	N/A	N/A
		• Disturbance from UXO clearance	No AEoSI	N/A	N/A	N/A	N/A	N/A
		• Auditory injury from geophysical surveys	No AEoSI	N/A	N/A	N/A	N/A	N/A
		• Disturbance from geophysical surveys	No AEoSI	N/A	N/A	No AEoSI	N/A	N/A
		• Auditory injury from other construction activities	No AEoSI	N/A	N/A	N/A	N/A	N/A
		• Disturbance from other construction activities	No AEoSI	N/A	N/A	N/A	N/A	N/A
		• Vessel disturbance	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
		• Vessel collision risk	No AEoSI	No AEoSI	No AEoSI	N/A	N/A	N/A
		• Changes in water quality	No AEoSI	No AEoSI	No AEoSI	N/A	N/A	N/A
		• Indirect effects on prey species	No AEoSI	No AEoSI	No AEoSI	N/A	N/A	N/A
		• Entanglement	N/A	No AEoSI	N/A	N/A	No AEoSI	N/A
		• Barrier effects	N/A	No AEoSI	N/A	N/A	N/A	N/A
		• Noise impacts from operational WTGs	N/A	No AEoSI	N/A	N/A	No AEoSI	N/A
Offshore and Intertidal Ornithology – SPA breeding seabird colonies								
Buchan Ness to Collieston Coast SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Shag	• Direct distributional responses (ECC only) • Changes to prey (ECC only) • Accidental pollution (ECC only)	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Guillemot	• Direct distributional responses • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI only for the highest distributional response scenario which is not considered to be realistic.	Potential risk of AEoSI only for the highest distributional response scenario which is not considered to be realistic.	Potential risk of AEoSI only for the highest distributional response scenario which is not considered to be realistic.
	Herring gull	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI and Proposed Development	No AEoSI

Designated Site	Feature(s) screened in	Potential for Effect	Conclusion on adverse effect alone			Conclusion on Adverse effect in-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
		• Changes to prey • Accidental pollution					contribution may be material (13.91 adult mortalities).	
Troup, Pennan and Lion's Heads SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Guillemot	• Direct distributional responses • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Razorbill	• Direct distributional responses • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.95 razorbill mortalities).	No AEoSI
	Herring gull	• Changes to prey (ECC only) • Accidental pollution (ECC only)	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI and Proposed Development contribution may be material (9.35 adult mortalities).	No AEoSI
Fowlsheugh SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Guillemot	• Changes to prey (ECC only) • Accidental pollution (ECC only) • Direct distributional responses (ECC only)	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Razorbill	• Direct distributional responses • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.91 razorbill mortalities).	No AEoSI
	Herring gull	• Changes to prey (ECC only) • Accidental pollution (ECC only)	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI and Proposed	No AEoSI

Designated Site	Feature(s) screened in	Potential for Effect	Conclusion on adverse effect alone			Conclusion on Adverse effect in-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
		• Collision • Changes to prey • Accidental pollution					Development contribution may be material (4.95 adult mortalities).	
East Caithness Cliffs SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI and Proposed Development contribution may be material (7.22 adult mortalities).	No AEoSI
Forth Islands SPA	Gannet	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI but the Proposed Development does not make a material contribution (10.6 adult mortalities). Furthermore, assessment did not take account of macro-avoidance.	No AEoSI
	Lesser black-backed gull	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Puffin	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI but the Proposed Development does not make a material contribution (10.2 adult mortalities)	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI and Proposed Development contribution may be material (1.81 adult mortalities)	No AEoSI
North Caithness Cliffs SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Puffin	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.39 puffin mortalities).	No AEoSI
	Kittiwake	• Direct distributional responses	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI from in-	No AEoSI

Designated Site	Feature(s) screened in	Potential for Effect	Conclusion on adverse effect alone			Conclusion on Adverse effect in-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
		• Collision • Changes to prey • Accidental pollution					combination impacts but the Proposed Development does not make a material contribution (0.82 kittiwake mortalities)	
Copinsay SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
St Abb's Head to Fast Castle SPA	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.62 kittiwake mortalities)	No AEoSI
Farne Islands SPA	Puffin	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.60 kittiwake mortalities)	No AEoSI
Auskerry SPA	European storm petrel	• Artificial lighting • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Hoy SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Great skua	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Puffin	• Direct distributional	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI

Designated Site	Feature(s) screened in	Potential for Effect	Conclusion on adverse effect alone			Conclusion on Adverse effect in-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
		responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution						
Calf of Eday SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Rousay SPA	Fulmar	• Accidental pollution • Changes to prey	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Fair Isle SPA	Fulmar	• Accidental pollution • Changes to prey	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Gannet	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Great skua	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Puffin	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Coquet Island SPA	Puffin	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI

Designated Site	Feature(s) screened in	Potential for Effect	Conclusion on adverse effect alone			Conclusion on Adverse effect in-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
		• Accidental pollution						
West Westray SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	Potential risk of AEoSI from in-combination impacts but the Proposed Development does not make a material contribution (0.50 kittiwake mortalities)	No AEoSI
Marwick Head SPA	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Sumburgh Head SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Sule Skerry and Sule Stack SPA	Gannet	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Leach's petrel	• Artificial lighting • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	European storm petrel	• Artificial lighting • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Mousa SPA	European Storm Petrel	• Artificial lighting • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Cape Wrath SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Noss SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI

Designated Site	Feature(s) screened in	Potential for Effect	Conclusion on adverse effect alone			Conclusion on Adverse effect in-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
	Gannet	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Great skua	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Foula SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Great skua	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Leach's petrel	• Artificial lighting • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Handa SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Great skua	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Fetlar SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Great skua	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Flamborough and Filey Coast SPA	Gannet	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI as the assessment did not take account of gannet macro-avoidance, and the Proposed Development contribution is not material anyway.	No AEoSI

Designated Site	Feature(s) screened in	Potential for Effect	Conclusion on adverse effect alone			Conclusion on Adverse effect in-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
Ramna Stacks and Grunei SPA	Leach's petrel	• Artificial lighting • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
North Rona and Sula Sgeir SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Gannet	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Leach's petrel, European storm petrel	• Artificial lighting • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Hermaness, Saxa Vord and Valla Field SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Gannet	• Direct distributional responses • Collision • Entanglement • Changes to prey	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Great skua	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Shiant Isles SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Flannan Isles SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Leach's petrel	• Artificial lighting • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Rum SPA	Manx shearwater	• Artificial lighting • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
St Kilda SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Gannet	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	European storm petrel,	• Artificial lighting	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI

Designated Site	Feature(s) screened in	Potential for Effect	Conclusion on adverse effect alone			Conclusion on Adverse effect in-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
	Leach's petrel, Manx shearwater	• Entanglement • Changes to prey • Accidental pollution						
	Great skua	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Mingulay and Berneray SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Seevogelschutzgebiet Helgoland SPA			No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Horn Head to Fanad Head SPA			No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Tory Island SPA			No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
West Donegal Coast SPA			No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Littoral seino-marin SPA			No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Clare Island SPA			No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Lambay Island SPA			No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
High Island, Inishshark and Davillaun SPA			No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Falaise du Bessin Occidental SPA			No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Cruagh Island SPA	Manx shearwater	• Artificial lighting • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA	Manx shearwater	• Artificial lighting • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Kerry Head SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Skomer, Skokholm and the Seas off Pembrokeshire SPA	Manx shearwater	• Artificial lighting • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Iveragh Peninsula SPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Offshore and Intertidal Ornithology – Marine SPAs								
Outer Firth of Forth and St Andrews Bay Complex mSPA	Gannet	• Direct distributional responses • Collision • Entanglement	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI

Designated Site	Feature(s) screened in	Potential for Effect	Conclusion on adverse effect alone			Conclusion on Adverse effect in-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
		• Changes to prey • Accidental pollution						
	Kittiwake	• Direct distributional responses • Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Manx shearwater	• Artificial lighting • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Puffin	• Direct distributional responses • Artificial lighting • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Seas off Foula mSPA	Great skua	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Seas off St Kilda mSPA	Fulmar	• Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Gannet	• Direct distributional responses • Collision • Entanglement • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Great skua	• Collision • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	European storm petrel	• Artificial lighting • Changes to prey • Accidental pollution	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Offshore and Intertidal Ornithology – Waterbird SPAs								
Loch of Strathbeg SPA and Ramsar	Sandwich tern	• Changes to prey (ECC only) • Accidental pollution (ECC only)	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
	Goldeneye, Greylag goose, Pink-footed goose, Svalbard barnacle goose, Teal, Whooper swan	• Collision	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI

Designated Site	Feature(s) screened in	Potential for Effect	Conclusion on adverse effect alone			Conclusion on Adverse effect in-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
Ythan Estuary and Meikle Loch SPA and Ramsar	Eider, pink footed goose, redshank.	• Collision	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Inner Firth of Forth SPA	Bar-tailed godwit, common scoter, cormorant, curlew, dunlin, eider, golden plover, goldeneye, great crested grebe, grey plover, knot, lapwing, long-tailed duck, mallard, oystercatcher, pink-footed goose, red-breasted merganser, red-throated diver, redshank, ringed plover, scaup, shelduck, Slavonian grebe, turnstone, velvet scoter, wigeon	• Collision	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Dornoch Firth and Loch Fleet SPA and Ramsar	Bar-tailed godwit, curlew, dunlin, greylag goose, oystercatcher, redshank, scaup, teal	• Collision	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Scapa Flow SPA	Black-throated diver, eider, great northern diver, long-tailed duck, red-breasted merganser, red-throated diver, slavonian grebe	• Collision	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Inner Moray Estuary SPA and Ramsar	Bar-tailed godwit, cormorant, curlew, goldeneye, goosander, greylag goose, oystercatcher, red-breasted merganser, redshank, scaup, teal	• Collision	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Cromarty Firth SPA and Ramsar	Bar-tailed godwit, curlew, dunlin, greylag goose, knot, oystercatcher, pintail, red-breasted merganser, redshank, scaup, whooper swan, wigeon	• Collision	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI	No AEoSI
Migratory Fish								
River Dee SAC	• Atlantic salmon (*Salmo salar*) • Freshwater pearl mussel (*Margaritifera margaritifera*)	Underwater noise	No impact on site or feature			Not screened in for in-combination assessment		

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