



Bellrock Offshore Wind Farm

Wind Farm Development Area

Report to Inform Appropriate Assessment - Volume VI

Part 2: Special Area of Conservation Assessments: Marine Mammals

Date: April 2026

Document Number: RHDV_BEL_CST_REP_0020

Revision Number: 1

Classification: Public

nadara

Revision History

Rev.	Prepared By	Checked By	Approved By	Date
1	Haskoning	SA	BMcG	01/04/2026

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Glossary of Terminology

Term	Definition
Applicant	Bellrock Offshore Wind Farm Limited, the legal entity submitting Section 36 Consent and Marine Licence applications for Bellrock Wind Farm Development Area.
Bellrock Offshore Wind Farm (or the Bellrock Project)	<p>An offshore wind farm capable of exporting up to 1.8 GW of renewable energy to the National Electricity Transmission System.</p> <p>The Wind Farm Development Area is located 120 km east of Stonehaven, and will connect to the National Electricity Transmission System at the SSEN Transmission proposed Hurlie substation, west of Stonehaven in Aberdeenshire. The Bellrock Offshore Wind Farm comprises of the following Development Areas:</p> <ul style="list-style-type: none"> ▪ Wind Farm Development Area; ▪ Offshore Transmission Development Area; and ▪ Onshore Transmission Development Area.
Commencement of construction	<p>Commencement of construction to install the Wind Farm Infrastructure as authorised by the Wind Farm Development Area Section 36 consent and Marine Licence (excluding site preparation works), being the earlier of:</p> <ul style="list-style-type: none"> ▪ Intrusive pre-installation surveys; ▪ Placement on or installation in the seabed of anchors and associated scour protection, and mooring lines; ▪ Trench excavation for inter-array cables; or ▪ Trenching for, or laying of inter-array cables on or in the seabed.
Connector	Joint between a dynamic inter-array cable and a static inter-array cable.
Construction works	<p>Works to install the Wind Farm Infrastructure as authorised by the Wind Farm Development Area Section 36 Consent/Marine Licence, such as:</p> <ul style="list-style-type: none"> ▪ Site preparation works undertaken after commencement of construction; ▪ Pre-installation surveys (intrusive and/or non-intrusive); ▪ Placement on or installation in the seabed of anchors and associated scour protection, and mooring lines, and associated scour protection; ▪ Towing or transportation of the floating offshore unit to the Wind Farm Development Area from a port or wet storage facility; ▪ Floating offshore unit installation and commissioning, including hooking-up to the pre-installed mooring system; ▪ Trench excavation for inter-array cables; ▪ Laying of inter-array cables in or on the seabed and, associated cable protection; ▪ Installation of subsea cable hubs, including placing of associated foundation; ▪ Final commissioning following cable connections and snagging; and ▪ Post installation surveys.

Term	Definition
Development Area	<p>For consenting purposes, the area for which separate consents and/or Marine Licences will be sought by the Applicant, comprising:</p> <ul style="list-style-type: none"> ▪ Wind Farm Development Area; ▪ Offshore Transmission Development Area; and ▪ Onshore Transmission Development Area.
Floating offshore unit	The combined wind turbine generator and floating substructure.
Project design envelope	Includes all relevant technical, spatial and temporal elements of the Wind Farm Infrastructure, and the proposed methodology to be employed for construction, operations and maintenance, and decommissioning.
Safety Zone	An area of water around or adjacent to a floating offshore unit which is to be constructed, extended, operated or decommissioned, from which certain or all classes of vessels are excluded and within which activities can be regulated for the purpose of securing safety of the floating offshore unit or vessel in that vicinity, and individuals on the floating offshore unit and vessel, in line with Section 95 of the Energy Act 2004.
Scour protection	Protective material positioned around anchors to avoid sediment being eroded as a result of the flow of water.
Site preparation works	<p>Preparatory activities undertaken within the Wind Farm Development Area prior to the commencement of construction of the Wind Farm Infrastructure, which may comprise (and which may require separate consents):</p> <ul style="list-style-type: none"> ▪ Geophysical surveys, geotechnical surveys, and non-archaeological/archaeological diver/ remotely operated vehicle surveys; ▪ Seabed preparation including sand wave levelling, slope levelling for gravity based anchors (if selected), boulder clearance, and pre-lay grapnel runs; ▪ Unexploded ordnance survey and/or clearance; ▪ Debris clearance; and ▪ Out of service cable/pipeline removal.
Static inter-array cable	The section of inter-array cable that is not designed to move.
Station keeping system	The system (including mooring lines and anchors) used to hold a floating offshore unit within its excursion limit and maintain the intended orientation of the floating offshore unit.
Subsea cable hub	A subsea device, with a gravel pad foundation, which allows the connection of multiple inter-array cables.
Wind Farm Development Area	The boundary within which the Wind Farm Infrastructure will be constructed, operated and maintained, and decommissioned.
Wind Farm Infrastructure	Infrastructure located within the Wind Farm Development Area including wind turbine generators; floating substructures, station keeping systems and associated scour protection; inter-array cables and associated cable protection; and subsea cable hubs; and ancillary infrastructure including buoys (including activities associated with the Wind Farm Infrastructure construction, operation and maintenance, and decommissioning).

Term	Definition
Wind turbine generator	A wind turbine generator converts wind energy into electrical energy. The main components include rotor assembly (composed of three blades and a hub); nacelle (containing the generator, shaft and gearbox, power electronic converter and transformer); and a tower (containing lifting equipment and switchgear).

Glossary of Abbreviations

Term	Definition
ADD	Acoustic deterrent devices
AIS	Automatic identification system
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
BNNC	The Berwickshire and North Northumberland Coast
CEA	Cumulative Effects Assessment
CI	Confidence Interval
CPOD	Cetacean Porpoise Detectors
CTV	Crew transfer vessel
CV	Coefficient of Variation
DAERA	Department of Agriculture, Environment and Rural Affairs
Defra	Department for Environment, Food and Rural Affairs
DRC	Dose-Response Curve
E	Eastern
EDRs	Effective deterrent ranges
EIA	Environmental impact assessment
EMP	Environmental Management Plan
EPS	European Protected Species
FCS	Favourable Conservation Status
FOU	Floating offshore unit
FSS	Floating substructure
HLV	Heavy lift vessels
HRA	Habitats Regulations Appraisal
IAC	Inter-array cable
IAMMWG	Inter-agency Marine Mammal Working Group
iPCoD	Interims population consequences of disturbance
JNCC	Joint Nature Conservation Committee
LSE	Likely significant effect

Term	Definition
MBES	Multi-beam echo sounder
MD-LOT	Marine Directorate – Licensing Operations Team
MMMP	Marine Mammal Mitigation Protocol
MMMUs	Marine Mammal Management Units
MU	Management Unit
NEQ	Net Explosive Quantity
NRW	Natural Resources Wales
NS	North Sea
NW	Northwestern
O&M	Operation and Maintenance
OWF	Offshore wind farm
PDE	Project Design Envelope
PLGR	Pre-lay Grapnel Run
PNMP	Piling Noise Mitigation Plan
PTS	Permanent threshold shift
RIAA	Report to Inform Appropriate Assessment
RoC	Review of Consents
ROV	Remotely operated vehicle
SAC	Special Area of Conservation
SBES	Single-beam echo sounder
SBP	Sub-bottom profiler
SNCBs	Statutory nature conservation bodies
SNS	Southern North Sea
SOV	Service operation vessel
SPL	Sound pressure level
SSC	Suspended sediment concentrations
SSS	Side scan sonar
SW	Southwestern

Term	Definition
UK	United Kingdom
USBL	Ultra-Short Baseline
USV	Uncrewed surface vessel
UXO	Unexploded ordnance
VHF	Very High Frequency
VMNSP	Vessel Management and Navigational Safety Plan
WFDA	Wind Farm Development Area
WTG	Wind turbine generator

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1 Introduction

1. This Report forms Part 2 of the Report to Inform Appropriate Assessment (RIAA) for the Bellrock Wind Farm Infrastructure located within the Bellrock Wind Farm Development Area (WFDA), and presents the information required to inform the Appropriate Assessment (AA) of Special Area of Conservation (SAC), limited to sites designated for marine mammal qualifying features.
2. Upfront sections, providing the background to the Bellrock WFDA, the legislative and policy context for Habitat Regulations Assessment (HRA), a description of the HRA process, a description of the Bellrock Wind Farm Infrastructure (and associated activities), as well as an overview of consultation undertaken are presented in **RIAA Part 1: Introductory Chapters**.
3. Special Protection Areas (SPA) and Ramsar Assessment, presenting the information required to inform the AA of SPAs and Ramsar sites designated for ornithological qualifying features is presented in **RIAA Part 3: Special Protection Areas and Ramsar Assessments: Ornithology**.

2 Consultation

4. Consultation undertaken to date to inform the Bellrock WFDA RIAA: Part 2, has been in line with the general process described in **Section 2: RIAA Part 1: Introductory Chapters**. Key consultation pertinent to this RIAA: Part 2 for marine mammals is provided in **Table 2.1** below.

Table 2.1: Consultation Relevant to Marine Mammals Habitats Regulations Appraisal

Consultee	Date/Document	Comment	How/Where Comment is Addressed
Marine Directorate – Licensing Operations Team (MD-LOT)	Bellrock WFDA Scoping Opinion (2024), Paragraph 5.5.9	<p>In regard to the HRA Screening Report, the Scottish Ministers refer to the representation from NatureScot regarding Moray Firth SAC; Berwickshire & North Northumberland Coast and Isle of May SAC; and Firth of Tay and Eden Estuary SAC and advise that these comments are fully addressed in the Bellrock WFDA EIA Report.</p> <p>The Scottish Ministers also refer the Developer to the representation from Natural England who confirm that they do not expect to provide further comments or advice on marine mammal receptors unless the project changes substantially. The Developer should also note the standing advice provided by Natural England.</p>	Noted.
NatureScot	Scoping Opinion: Bellrock Offshore Wind Farm August 2024 Appendix 1: Consultation Responses and Advice: NatureScot: Appendix D: Marine Mammals	<p>NatureScot note that as described in Section 6.1 and summarised in Table 6.3, of the Scoping Report the initial screening stage has screened out all sites with marine mammal features other than the six closest sites.</p> <p>NatureScot is content with this and the conclusions presented. Table 6.2 presents a likely significant effect (LSE) matrix for sites screened in for further assessment in the Report to Inform Appropriate Assessment (RIAA). NatureScot do not agree with the conclusions presented in Table 6.2 and provided further advice (see below).</p>	Acknowledged, a summary of the HRA Screening is available in Section 3.1 . Further commentary on NatureScot’s advice is provided below.
NatureScot	Scoping Opinion: Bellrock Offshore Wind Farm August 2024 Appendix 1: Consultation Responses and Advice: NatureScot: Appendix D: Marine Mammals	<p><i>Moray Firth SAC</i></p> <p>NatureScot advise that bottlenose dolphins from this site are known to travel along the east coast of Scotland, as far south as the north of England. However, they generally stay close to the coast (mainly within the 20 m depth contour, which in this region is between 2-20 km from the coast) and are therefore unlikely to encounter any impacts from activities within the Bellrock WFDA as the export cable is not included in this scoping report Appendix 1.1: Bellrock WFDA Scoping Report, Volume IV. As such, NatureScot advise no LSE for this feature of the Moray Firth SAC.</p>	<p>Noted. Bottlenose dolphins of the Moray Firth SAC have not been carried forward for further assessment for the Bellrock WFDA.</p> <p>Further consideration to potential effects on the Moray Firth SAC will be considered in the Bellrock OFTDA RIAA due to its closer proximity to the SAC.</p>

Consultee	Date/Document	Comment	How/Where Comment is Addressed
NatureScot	Scoping Opinion: Bellrock Offshore Wind Farm August 2024 Appendix 1: Consultation Responses and Advice: NatureScot: Appendix D: Marine Mammals	<p><i>Berwickshire & North Northumberland Coast and Isle of May SAC</i></p> <p>For grey seals, NatureScot recommend using a connectivity distance of 20 km. Although grey seals can and do forage considerable distances, the Conservation Objectives for grey seal SACs in Scotland relate to the protection of the breeding colony. During the sensitive breeding time, grey seals (particularly females) do not generally travel further than 20 km from the breeding site. Outside the breeding season the number of grey seals at the site can dramatically decrease. There is evidence to show that grey seals may not forage close to the SAC outside the breeding season and instead can travel to different management units when foraging (Carter et al. 2022). Given the distance of the development location from these SACs, NatureScot advise no LSE on the grey seal feature of these sites. As Berwickshire & North Northumberland Coast SAC is a cross-border site, Natural England should also be approached for advice.</p>	Noted. Natural England has advised that an assessment of the Berwickshire & North Northumberland Coast SAC should be undertaken, therefore this site is considered in Section 4.3 . Further information on the Isle of May SAC is given in Section 3.1.2 .
NatureScot	Scoping Opinion: Bellrock Offshore Wind Farm August 2024 Appendix 1: Consultation Responses and Advice: NatureScot: Appendix D: Marine Mammals	<p><i>Firth of Tay and Eden Estuary SAC</i></p> <p>For harbour seals, NatureScot recommend using a connectivity distance of 50 km, as this species does not generally travel further than this from their haul out sites. Given the distance of the Bellrock WFDA from this site, NatureScot advise no LSE on the harbour seal feature of this site.</p>	<p>Noted. Harbour seals of the Firth of Tay and Eden Estuary SAC have not been carried forward for further assessment.</p> <p>Additionally, vessels transiting to and from the Bellrock WFDA are anticipated to follow an established shipping route to the relevant ports to minimise vessel volume in the area.</p> <p>Further consideration to potential effects on the Firth of Tay and Eden Estuary SAC will be considered in the Bellrock OfTDA RIAA.</p>
NatureScot	Scoping Opinion: Bellrock Offshore Wind Farm August 2024 Appendix 1: Consultation Responses and Advice: NatureScot: Appendix D: Marine Mammals	<p><i>Southern North Sea and Humber Estuary SAC</i></p> <p>NatureScot advise that as both of these sites are entirely within English waters and Natural England should be approached for advice on LSE determination for these sites.</p>	Acknowledged, Natural England have been consulted on these sites, and the Southern North Sea SAC has been screened in for further assessment, further information on the Humber Estuary SAC has been given in Section 3.1 .

Consultee	Date/Document	Comment	How/Where Comment is Addressed
Natural England	Scoping Opinion: Bellrock Offshore Wind Farm August 2024 Appendix 1: Consultation Responses and Advice: Natural England	<p>Natural England advised that if the proposal outlined within the scoping document has the potential to significantly affect features of the internationally designated sites and the activity is not directly connected to the management of any designated site it should be assessed under regulation 63 the Conservation of Species and Habitats Regulations (2017).</p> <p>Should a Likely Significant Effect on an Internationally designated site be identified or be uncertain, the competent authority (e.g. the Marine Management Organisation or Local Planning Authority or Government Department) may need to prepare an Appropriate Assessment, in addition to consideration of impacts through the EIA process.</p>	Noted. A full assessment of the Southern North Sea SAC and Berwickshire & North Northumberland Coast SAC is presented in Section 4 and Section 5 .
Natural England	Scoping Opinion: Bellrock Offshore Wind Farm August 2024 Appendix 1: Consultation Responses and Advice: Natural England	<p>Natural England advise that if during the EIA process the potential for a Likely Significant Effect on the conservation objectives of the sites cannot be ruled out the competent authority for the Marine Licence should undertake an Appropriate Assessment of the implications for the site in view of its conservation objectives. Noting recent case law (People Over Wind ¹) measures intended to avoid and/or reduce the likely harmful effects on a European Site cannot be taken into account when determining whether or not a plan or project is likely to have a significant effect on a site, therefore consideration is required at Appropriate Assessment.</p> <p>Natural England request to be consulted on the scope of the Habitats Regulations Assessment and the information that will be produced to support it and should be formally consulted on any Appropriate Assessment provided for the proposal (Regulation 63).</p>	Noted. Natural England made a representation on the Bellrock WFDA HRA Screening Report (Appendix 1.2: Bellrock WFDA Scoping Opinion (Volume IV)) and will be consulted by MD-LOT on this RIAA as part of the determination process.
Natural England	Email, 30/10/2024	<p>For Scottish offshore wind farms, Natural England advise designated sites are screened in, based on the Management Unit they fall within, for either seals or harbour porpoise (Northeast England SMU and North Sea Management Unit respectively).</p> <p>With the large distance between Scottish wind farms and English designated sites, Natural England recommend screening in English designated sites that are within foraging range of the Scottish wind farm array/cable. This is based on survey/telemetry data from the Applicant, modelling and current research to determine the proportion</p>	Both the Southern North Sea SAC and the Berwickshire and North Northumberland Coast SAC have been screened in for further assessment (see Sections 4.2 and 4.3).

Consultee	Date/Document	Comment	How/Where Comment is Addressed
		<p>of marine mammals from English designated sites in the vicinity of the project and their interaction within the Rochdale Envelope of the application. This typically involves screening in harbour porpoise of the Southern North Sea SAC and grey seal of the Berwickshire and North Northumberland Coast SAC.</p> <p>Natural England also advise, based on impacts scoped into the assessment, to consider whether they would have LSE on a significant proportion of the population of the designated site based on their conservation objectives. Impacts of concern are usually: underwater noise from piling and unexploded ordnance (UXO) clearance and in-combination effects of this on prey species that they would forage in the area. Secondary entanglement and electromagnetic fields are also of concern for floating wind.</p> <p>Natural England would then advise that there is an AEoI of the site if there is not appropriate mitigation to reduce the significance of effect on the population of the designated site.</p> <p>So far, Natural England note that it has not had any Scottish wind farm application where they have advised adverse effect on integrity for English SACs and have not yet been consulted on European Protected Species (EPS) licences.</p>	
<p>Department of Agriculture, Environment and Rural Affairs (DAERA)</p>	<p>Scoping Opinion: Bellrock Offshore Wind Farm August 2024 Appendix 1: Consultation Responses and Advice: DAERA</p>	<p>DAERA Marine and Fisheries Division Advise that as the location of the wind farm is in excess of 500 km from the nearest Marine Protected Area within the Northern Ireland inshore area, they are content that sites designated for marine mammals will not be impacted and therefore do not need to be screened into any assessment.</p>	<p>Acknowledged.</p>
<p>Natural Resources Wales (NRW)</p>	<p>Scoping Opinion: Bellrock Offshore Wind Farm August 2024 Appendix 1: Consultation Responses and Advice: NRW</p>	<p>NRW note that no Welsh Marine Mammal Management Units (MMUs) cross to the east coast of Scotland, so do not expect any population level effects to be linked to Welsh populations and Special Areas of Conservation (SACs). NRW advise that they have no further comments to make at this stage.</p>	<p>Acknowledged.</p>
<p>Notes: ¹ People Over Wind and Sweetman vs Coillte Teoranta (ref: C 323/17).</p>			

3 Summary of Habitats Regulations Appraisal Screening Conclusions

3.1 Sites Designated for Annex II Marine Mammals

3.1.1 Sites and Features to be Considered in the Report to Inform Appropriate Assessment

5. A summary of the Annex II Marine Mammals and their relevant European Sites considered in this RIAA are provided in **Table 3.1** and shown in Figure A 1 (**Appendix A**). These sites are screened in due to the potential connectivity between the European Site and the Bellrock WFDA relating to the Annex II species designated for each site and following consultation with stakeholders (see **Table 2.1**).

Table 3.1: Summary of Annex II Marine Mammals European Sites and Species Screened in for the Bellrock Wind Farm Development Area Report to Inform Appropriate Assessment

European Site	Distance to Bellrock WFDA (Nearest km)	Designated Feature Screened In	Country of Designation
Southern North Sea (SNS) SAC (site code: UK0030395)	154	Harbour porpoise	England
Berwickshire and North Northumberland Coast (BNNC) SAC (site code: UK0017072)	152	Grey seal	England

3.1.2 Sites and Features Screened Out in the Habitats Regulations Appraisal Screening Report

6. Due to potential connectivity, several designated sites were considered in the HRA Screening Report (**Appendix B** of the **Bellrock RIAA Part 1: Introductory Chapters**), the full list of designated sites screened out of the HRA is presented in **Table 6.3** in the **HRA Screening Report (Appendix B** of the **Bellrock WFDA RIAA Part 1: Introductory Chapters**). Upon receiving consultation feedback (see **Table 2.1**), a number of sites and features were subsequently screened out, see **Table 3.2**.

Table 3.2: Summary of European Sites and Species Originally Screened In for the Bellrock Wind Farm Development Area Report to Inform Appropriate Assessment that were Screened Out Following Consultation Responses (see Responses in Table 2.1)

European Site	Distance to Bellrock WFDA (Nearest km)	Feature Screened Out	Reason for Screening Out	Country of Designation
Annex II Marine Mammals				
Moray Firth SAC (site code: UK0019808)	209	Bottlenose dolphin	<p>NatureScot Advice (Table 2.1):</p> <p>Bottlenose dolphins from this SAC are known to travel along the east coast of Scotland, as far south as the north of England. However, they generally stay close to the coast (mainly within the 20 m depth contour, which in this region is between 2-20 km from the coast) and are therefore unlikely to encounter any impacts from activities within the Bellrock WFDA.</p> <p>As such, NatureScot advises no LSE for this feature of the Moray Firth SAC.</p>	Scotland
Humber Estuary SAC (site code: UK0030170)	338	Grey seal	<p>Although the Bellrock WFDA is within foraging range of grey seal from both the BNNC and Humber Estuary SACs, and the grey seal populations of both SACs have connectivity with the same MUs, given the distance to the Humber Estuary SAC (338 km) it is most likely that the grey seal present are from the BNNC SAC.</p> <p>Therefore, given the lower densities of grey seal present, it has been deemed acceptable to screen out the Humber Estuary SAC.</p>	England
Isle of May SAC (site code: UK0030172)	160	Grey seal	<p>NatureScot Advice (Table 2.1):</p> <p>For grey seals, NatureScot recommends using a connectivity distance of 20 km. Although grey seals can and do forage considerable distances, the Conservation Objectives for grey seal SACs in Scotland relate to the protection of the breeding colony. During the sensitive breeding time, grey seals (particularly females) do not generally travel further than 20 km from the breeding site. Outside the breeding season the number of grey seals at the site can dramatically decrease. There is evidence to show that grey seals may not forage close to the SAC outside the breeding season and instead can travel to different management units when foraging (Carter et al. 2022).</p>	Scotland

European Site	Distance to Bellrock WFDA (Nearest km)	Feature Screened Out	Reason for Screening Out	Country of Designation
			Given the distance of the development location from these SACs, NatureScot advise no LSE on the grey seal feature of these sites.	
Firth of Tay & Eden Estuary SAC (site code: UK0030311)	158	Harbour seal	NatureScot Advice (Table 2.1): For harbour seals, we recommend using a connectivity distance of 50 km, as this species does not generally travel further than this from their haul out sites. Given the distance of the Bellrock WFDA from this site, NatureScot advises no LSE on the harbour seal feature of this site.	Scotland

3.1.3 Potential Effects Screening

7. The potential effects on Annex II Marine Mammal features during the construction, operation and maintenance (O&M) and decommissioning phases of the Bellrock WFDA are shown in **Table 3.3**. The screening results are based on the results from the HRA Screening Report (**Appendix B** of the **Bellrock WFDA RIAA: Part 1**) and subsequent consultations (**Table 2.1**).

Table 3.3: Summary of Potential Effects Identified for Annex II Marine Mammals

Potential Effect	C	O&M	D
Underwater noise (all potential sources during construction, O&M and decommissioning)	✓	✓	✓
Collision risk with vessels	✓	✓	✓
Secondary entanglement	x	✓	x
Disturbance at seal haul-out sites	✓	✓	✓
Changes to prey availability	✓	✓	✓
Changes in water quality	x	x	x
Notes: C = Construction. O&M = Operation and Maintenance. D = Decommissioning.			

4 Stage 2: Assessment of Adverse Effect – Marine Mammals

4.1 Approach to Assessment

8. For marine mammals, the approach to the RIAA primarily focuses on the potential for connectivity between individual marine mammals from designated populations and the Bellrock WFDA (i.e. demonstration of a clear source-pathway-receptor relationship). This is based on the distance of the Bellrock WFDA from a European site, the range of each effect, the potential for animals from a European Site to be within range of an effect, and the overall distribution and movement patterns of each marine mammal species.
9. Assessment of species-specific risk to potential effects of the Bellrock WFDA is informed by industry-standard advice and guidance, relevant scientific papers, and representations from both Applicants and stakeholders.

4.1.1 Realistic Worst-case Scenario

10. The final design of the Bellrock WFDA will be confirmed during detailed engineering studies post-consent. In order to undertake a robust and precautionary impact assessment, the realistic worst-case scenario has been defined. Realistic worst-case scenarios (i.e. those that have potential to cause the greatest impact) are derived from the Project Design Envelope (PDE) to ensure that all other design scenarios would have equal or less impact.
11. The realistic worst-case scenario used to assess impacts on marine mammals are defined in **Table 4.1**.

Table 4.1: Realistic Worst-case Scenario for Marine Mammals

Impact	Realistic Worst-case Scenario	Rationale
Construction		
Impact C1: Underwater noise during UXO clearance	<p>A worst-case UXO with a Net Explosive Quantity (NEQ) of 750 kg (based on the Natural England Guidance (Parker et al. 2025)) (Appendix 9.3: Marine Mammals Unexploded Ordnance Assessment of the Bellrock WFDA EIA Report (Volume IV)). The following has been considered:</p> <ul style="list-style-type: none"> ▪ Various possible types and sizes of UXO, ranging from 0.25 kg to 750 kg; ▪ Underwater modelling and assessments based high-order detonation of UXO with NEQ of 750 kg (including donor charge); ▪ Low-order clearance would be the default method for UXO that require clearance; ▪ Underwater modelling and assessments include low-order deflagration with shaped charge of 0.25 kg NEQ; and ▪ As a worst-case, assessments are based on contingency high-order detonation without mitigation. 	<p>The type, size and number of possible detonations and duration of UXO clearance operations is therefore not known at this stage .A detailed UXO survey would be completed prior to construction to inform an assessment to be completed later as part of the marine licence that will be associated with UXO clearance.</p> <p>An assessment to inform the worst-case scenario for Impacts of underwater noise during UXO clearance on Marine Mammals is presented in Appendix 9.3: Marine Mammals Unexploded Ordnance Assessment of the Bellrock WFDA EIA Report (Volume IV).</p>
Impact C2: Underwater noise during geophysical surveys	<p>Up to 18 round trips for geophysical survey vessels, for up to 504 days on site.</p> <p>Expected to include the following surveys:</p> <ul style="list-style-type: none"> ▪ Multi-beam echo sounder (MBES); ▪ Ultra-Short Baseline (USBL); ▪ Single-beam echo sounder (SBES); ▪ Side Scan Sonar (SSS); and ▪ Sub-bottom profiler (SBP). 	<p>An assessment based on the actual equipment used to be completed later as part of the marine licence associated with geophysical surveys.</p>
Impact C3: Underwater noise during piling	<p>Indicative construction duration: site preparation works¹ to commence 2030, construction to occur from 2031 – 2037 inclusive (8 years of activity for Bellrock Wind Farm Infrastructure). No piling works will be undertaken during site preparation works.</p>	<p>The spatial and temporal worst-case scenario is based on the largest hammer energy which is required for anchors for a FOU.</p>

Impact	Realistic Worst-case Scenario	Rationale
	<p>Number of piles for maximum 132 floating offshore units (FOUs) = 1,188 (9 anchors per FOU x 132).</p> <p>Maximum hammer energy = 3000 kJ.</p> <p>Maximum pile diameter = 6 m.</p> <p>Duration of anchor installation for single FOU = 3 days (3 piled anchors per 24 hours, for up to 9 anchors).</p> <p>Maximum total active piling time per FOU (including soft-start and ramp-up): = 2.99 hours per pile, up to 8.97 hours piling per day.</p> <p>Total piling time for 132 FOUs = 3,552.12 hours.</p>	<p>Full hammer energy is unlikely to be required on all piles but is assessed for all piles as a worst-case scenario.</p> <p>The assessment also considers concurrent piling at two WTG locations within the Bellrock WFDA. For the concurrent modelling scenario three sequentially installed FOU driven piles at the NW location and three piles sequentially installed at E-midpoint location within a 24-hour period (equating to a maximum of six piles installed over both locations in a 24-hour period) have been considered (see details in Appendix 9.2 Underwater Noise modelling of the Bellrock WFDA EIA Report (Volume IV)).</p>
<p>Impact C4: Underwater noise from non-piling construction activities</p>	<p>The construction phase is expected to take place between: 2031 to 2037 (total construction duration of up to seven years, in addition to one year of site preparation works). Site preparation works will take place prior to commencement of construction.</p> <p>Boulder clearance may be required as part of site preparation works.</p> <p>Cable and cable protection installation methods considered include:</p> <ul style="list-style-type: none"> ▪ Ploughing; ▪ Trenching; ▪ Jetting; and ▪ Rock placement. <p>Subsea cable hubs will also be installed by placement on the seabed.</p> <p>Installation of gravity, drag embedment or suction piles.</p> <p>Number of anchors for max. 132 FOUs = 1,188 (9 anchors per FOU * 132)).</p>	<p>Underwater noise during the placement of subsea cable hubs is expected to be minimal and far less than that of the other activities, therefore, other activities are used as a worst-case for it in the assessments.</p> <p>Underwater noise during non-piled anchor installation is anticipated to be comparable or less than modelled impact ranges for cable trenching/cutting. Therefore, modelled impact ranges for cable trenching/cutting are considered worst-case.</p> <p>The duration of the mooring installation within construction period will be depended on anchor type but will be within the worst-case scenario.</p>

Impact	Realistic Worst-case Scenario	Rationale
Impact C5: Underwater noise and presence of vessels	<p>A range of vessel types will be required across site preparation and construction, please see Chapter 4: Project Description of the Bellrock WFDA EIA Report (Volume II) for further details.</p> <p>Maximum total number of construction vessels on site at any one time = up to 34 vessels.</p> <p>Maximum total number of round trips² over construction period = 1,615</p>	<p>Due to construction sequencing, not all vessel types will be on site at the same time. The number of vessels would vary depending on activities taking place within the Bellrock WFDA.</p> <p>Assessments are based on the worst-case scenario for the maximum number of vessels on site at any one time during the construction period.</p> <ul style="list-style-type: none"> ▪ Construction port(s) will be confirmed post consent.
Impact C6: Collision risk with vessels		
Impact C7: Changes to prey availability	<p>Total Area of Disturbance = 3.64 km² (3,635,158 m²).</p> <p>Total SSC released due to construction activities (including site preparation) = 0.0014 km³ (1,394,530 m³).</p>	<p>The worst-case scenario for changes to prey availability for marine mammals is based on the worst-case scenario table (Table 8.3) and conclusions of the assessments presented in Chapter 8: Fish and Shellfish Ecology of the Bellrock WFDA EIA Report (Volume II):</p> <ul style="list-style-type: none"> ▪ Physical disturbance and temporary habitat loss; ▪ Increased suspended sediment concentrations (SSCs) and sediment re-deposition; ▪ Underwater noise and vibration; and ▪ Changes in fishing activity.

Impact	Realistic Worst-case Scenario	Rationale
<p>Impact C8: Disturbance at seal haul-out sites</p>	<ul style="list-style-type: none"> ▪ The number of vessel trips are as outlined above for Impact C5 which details information on construction vessel presence. 	<p>Construction port(s) would be confirmed prior to the start of construction. However, the assessment considers the potential for in-transit vessels in proximity to the seal haul-out sites in the marine mammal study area.</p> <p>Movements of construction vessels could occur throughout the year.</p> <p>See Appendix 9.1: Marine Mammals Technical Report of the Bellrock WFDA EIA Report (Volume IV) for details on seal haul-out sites.</p>
<p>Operation and Maintenance</p>		
<p>Impact O1: Underwater noise during geophysical surveys</p>	<p>Expected to include the following surveys:</p> <ul style="list-style-type: none"> ▪ MBES; ▪ USBL; ▪ SBES; ▪ SSS; and ▪ SBP. 	<p>Indicative only.</p>
<p>Impact O2: Underwater noise from O&M activities</p>	<p>Cable repair and replacement activities during the O&M phase could include:</p> <ul style="list-style-type: none"> ▪ Trenching; ▪ Ploughing; ▪ Cable laying; and ▪ Rock placement. <p>Operational life = 35 years.</p>	<p>Indicative only.</p>

Impact	Realistic Worst-case Scenario	Rationale
<p>Impact O3: Underwater noise and presence of vessels</p>	<p>A range of vessel types will be required across O&M, please see Chapter 4: Project Description of the Bellrock WFDA EIA Report (Volume II) for further details.</p> <p>Maximum number of O&M vessels at site at any one time: 21</p> <p>Maximum total number of round trips per year = 211</p>	<p>Assessments are based on the worst-case scenario for the maximum number of vessels within the Bellrock WFDA at any one time during O&M.</p> <p>Due to O&M requirements, not all vessel types will be within the Bellrock WFDA at the same time. The number of vessels would vary depending on activities taking place within the Bellrock WFDA.</p>
<p>Impact O4: Underwater noise from operational wind turbine generator (WTGs) and moorings on the seabed</p>	<p>Up to 132 FOU's.</p> <p>132 SKSs, with up to 1,188 mooring lines.</p> <p>Please see underwater noise modelling parameters as provided in Appendix 9.2: Underwater Noise Modelling Report of the Bellrock WFDA EIA Report (Volume IV).</p> <p>Operational life of the Wind Farm Infrastructure = 35 years.</p>	<p>Assessment (and underwater noise modelling) based on the largest number of FOU's and capacity per WTG.</p>
<p>Impact O5: Collision risk with vessels</p>	<p>Maximum of O&M vessels at site at any one time: 21.</p> <p>Maximum total number of round trips per year = 211</p> <p>Vessel types are as per Impact O3 above.</p>	<p>Assessments are based on the worst-case scenario for the maximum number of vessels within the WFDA at any one time during O&M.</p> <p>Due to O&M requirements, not all vessel types will be within the WFDA at the same time. The number of vessels would vary depending on activities taking place within the Bellrock WFDA.</p> <p>O&M port(s) will be confirmed post consent.</p>

Impact	Realistic Worst-case Scenario	Rationale
<p>Impact O6: Secondary entanglement</p>	<p>Mooring lines:</p> <ul style="list-style-type: none"> ▪ Maximum number of mooring lines = 1,188 for 132 FOU's (up to 9 mooring lines per FOU); ▪ Maximum mooring touchdown distance from FOU = 1,300 m; ▪ Maximum length of each mooring line in water column during normal operation = 920 m; ▪ Maximum length of each mooring line on the seabed during normal operation = 770 m; and ▪ Mooring line material: Chain, nylon, polyester, high modulus polyethylene. <p>IACs:</p> <ul style="list-style-type: none"> ▪ Maximum external cable diameter = 270 mm; ▪ Maximum length of dynamic cable in the water column (free hanging, lazy s wave, steep wave) per IAC connection to each FSS = 350 m; and ▪ Total maximum length of dynamic cable in the water column for all FSS (1 – 2 connection points per FSS) = 92.4 km. 	<p>The maximum length of mooring line and dynamic IACs in the water column is assessed as the worst-case.</p>
<p>Impact O7: Changes to prey availability</p>	<p><u>Total O&M Disturbance Footprint for the Bellrock WFDA = 47.46 km² (47,461,080 m²)</u></p> <ul style="list-style-type: none"> ▪ Maximum catenary drag seabed footprint (swept area) of all mooring lines = 46,200,000 m² (350,000 m² per FOU); ▪ IAC repair due to failure: Maximum seabed disturbance footprint (per year) = 27,720 m² (970,200 m² over lifetime (35 yrs)); ▪ Remedial IAC burial due to exposure: Maximum seabed disturbance footprint (per year) = 2,880 m² per year (100,800 m² overtime lifetime (35 years)); and ▪ Maximum jack-up vessel seabed footprint (for all jack-up positions) = 190,080 m² (1,440 m² x 132). ▪ Total SSC released due to O&M activities = 0.0255 km³ (25,525,500 m³) ▪ Total Area of permanent habitat loss = 2.93 km² (2,926,659 m²) 	<p>The worst-case scenario for marine mammals is based on the conclusions of the assessments presented in Chapter 8: Fish and Shellfish Ecology of the Bellrock WFDA EIA Report (Volume II) for all possible effects on prey:</p> <ul style="list-style-type: none"> ▪ Physical disturbance and temporary habitat loss; ▪ Increased SSCs and sediment re-deposition; ▪ Underwater noise and vibration; ▪ EMFs; ▪ Permanent habitat loss; ▪ Introduction of hard substrate; and ▪ Changes in fishing activity.

Impact	Realistic Worst-case Scenario	Rationale
Impact O8: Disturbance at seal haul-out sites	Maximum of O&M vessels at site at any one time: 21, Maximum total number of round trips per year = 211. Vessel types are as per Impact O3 above.	O&M port(s) will be confirmed post consent.
Decommissioning		
Impact D1: Underwater noise during geophysical surveys	The sequence of decommissioning is likely to be the reverse of the construction sequence, taking around seven years, with similar types and numbers of vessels and equipment expected to be involved.	The detail and scope of the decommissioning works would be determined by the relevant legislation and guidance at the time.
Impact D2: Underwater noise from decommissioning activities	It is expected that the Bellrock Wind Farm Infrastructure will be fully removed at the end of its operational life.	The impacts of decommissioning are primarily linked to the removal of infrastructure from the seabed, such as anchors, IACs, subsea cable hubs, and scour and cable protection. These activities may cause temporary disturbances to the seabed and surrounding marine environment. However, it is anticipated that the overall environmental impacts associated with decommissioning will be equal to, or potentially less than, those experienced during the construction phase. This is due to the fact that much of the infrastructure will have already settled into place, and the removal process will likely be more controlled and less intrusive. Additionally, any disturbance will be short-term and localised, with appropriate mitigation employed to minimise harm to marine habitats and ecosystems.
Impact D3: Underwater noise and presence of vessels	The removal and dismantling of the FOU's will largely be a reversal of the installation process. Generally, the FOU's will be towed from the Bellrock WFDA to a suitable port for decommissioning.	
Impact D4: Collision risk with vessels	Mooring lines and anchors will be recovered and removed from the WFDA. For FOU driven pile anchors, these are expected to be either fully removed or cut off below seabed level with a proportion remaining in-situ (due to anticipated excessive cost in their complete removal) following good practice and consideration of environmental conditions and sensitivities.	
Impact D5: Disturbance at seal haul-out sites	Subsea cable hubs are expected to be fully removed from the seabed.	
Impact D6: Changes to prey availability	The dynamic sections of the IACs within the water column will be cut at the connector with the static IAC and fully removed. The approach for decommissioning the static IACs on the seabed is yet to be determined, however, this will be reviewed throughout the lifetime of the Bellrock WFDA and good practice guidance at time of decommissioning will be followed. Subject to the material used and environmental sensitivities, it may be preferable to leave scour protection in-situ to preserve the marine habitat that may have developed over the life of the Bellrock WFDA. The approach for decommissioning cable protection will be similar to scour protection. Relevant stakeholders and regulators will be consulted to establish the best approach. Good practice guidance at time of decommissioning will be followed.	

Impact	Realistic Worst-case Scenario	Rationale
<p>Notes:</p> <p>¹ Site preparation works will commence up to one year before commencement of construction (year 0), at which point they may continue albeit as construction works (rather than site preparation works) these activities have been considered in this assessment, for completeness.</p> <p>² One round trip comprises two movements (i.e. one to and one from the Bellrock WFDA).</p>		

4.1.2 Definition of Significance

12. The potential effects have been assessed for each of the marine mammal designated sites during the construction, O&M and decommissioning of the Bellrock Wind Farm Infrastructure.
13. Assessments of the potential for adverse effects, at the population level, have been based on the Joint Nature Conservation Committee (JNCC et al. 2010) draft guidance for effects on EPS, Marine Scotland advice (Marine Scotland, 2020), and the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) agreement.
14. The JNCC et al. (2010) draft guidance provides some indication on how many animals may be removed from a population without causing detrimental effects to the population at Favourable Conservation Status (FCS). The JNCC et al. (2010) draft guidance also provides limited consideration of temporary effects, with guidance reflecting consideration of permanent displacement. JNCC et al (2010) draft guidance considered 4% as the maximum potential growth rate in harbour porpoise, and the 'default' rate for cetaceans. Therefore, beyond natural mortality, up to 4% of the population could theoretically be permanently removed before population growth could be halted. In assigning 5% to a temporary effect, consideration is given to uncertainty of the individual consequences of temporary disturbance.
15. For permanent effects, further assessment may be required if there was an effect to 1% or more of the population, based on ASCOBANS (ASCOBANS, 2015) and Defra advice (Defra, 2003) relating to impacts from fisheries by-catch on harbour porpoise. A threshold of 1.7% of the relevant harbour porpoise population above which a population decline is inevitable has been agreed with Parties to ASCOBANS, with an intermediate precautionary objective of reducing the impact to less than 1% of the population (Defra, 2003), (ASCOBANS, 2015).
16. The above information on the potential for population level effects has been used to inform the approach to defining potential for adverse effect for harbour porpoise and grey seal populations of the SNS SAC and BNNC SAC respectively. The approach to define the potential for adverse effect on site integrity (AEoSI) of the SACs, based on the potential effect to the overall populations, is therefore as follows:
 - For temporary effects, if there is an effect to 5% or more of the population; and
 - For permanent effects, if there is an effect to 1% of more of the population.
17. The potential effect should be considered in the context of the seasonal components of the SAC area, rather than the SAC area as a whole.
18. The assessments are based on the current recommended effective deterrent ranges (EDRs) for assessing the disturbance of harbour porpoise in the SAC from different noise generating activities (JNCC, 2025b). As a worst-case approach this methodology has also been applied to grey seals.

4.2 Southern North Sea Special Area of Conservation

4.2.1 Site Description

19. The SNS SAC has been recognised as an area with persistent high densities of harbour porpoise (JNCC, 2017), (JNCC) and (Natural England, 2019) and is the largest designated site for harbour porpoise in UK and European waters at the time of designation (see **Figure A 1, Appendix A**).
20. The SNS SAC covers an area of 36,951 km², with both winter and summer habitats of importance to harbour porpoise (JNCC, 2017). Approximately 27,028 km² of the SNS SAC is important in the summer period (183 days from April to September inclusive) and 12,696 km² of the SNS SAC is important in the winter period (182 days from October to March inclusive) (JNCC et al. 2020). The majority of the SNS SAC is less than 40 m in depth, reaching up to 75 m in the northern most areas.
21. The closest point of the SNS SAC to the Bellrock WFDA is 154 km from the summer area and approximately 307 km from the winter area.

4.2.2 Harbour Porpoise Population and Density

22. Within the SNS SAC, harbour porpoise is the most common marine mammal species (Gilles et al. 2023). Heinänen and Skov (2015) identified that within the North Sea, water depth and hydrodynamic variables are the most important factors in harbour porpoise densities in species areas, in both winter and summer seasons. The seabed sediments also play an important role in determining areas of high harbour porpoise density, as well as the number of vessels present in the area.
23. The Bellrock WFDA is in the SCANS-IV (Small Cetaceans in the European Atlantic and North Sea) survey block NS-D (Gilles et al. 2023) and (Ramirez-Martinez et al. 2025) where:
 - Abundance estimate = 38,577 harbour porpoise (95% Confidence Interval (CI) = 18,017 – 76,361);
 - Summer density estimate = 0.5985 harbour porpoise/km² (Coefficient of Variation (CV) = 0.367); and
 - Winter density estimate = 0.2569 (CV = 0.265).
24. The Inter-Agency Marine Mammal Working Group (IAMMWG, 2023) define three Management Units (MUs) for harbour porpoise. The Bellrock WFDA is located in the North Sea (NS) MU. The most recent abundance estimates for the NS MU was published in the SCANS-IV survey, indicating that there are 346,601 harbour porpoise individuals (IAMMWG, 2023).
25. Site-specific survey data from the Bellrock WFDA plus a 4 km buffer has also been used to generate abundance and density estimates for harbour porpoise. The average of the winter months, summer months, and annual density has then been calculated based on the maximum

calculated for each month. **Table 4.2** shows the densities for harbour porpoise, based on all individuals that have the potential to be harbour porpoise (for further details see **Appendix 9.1: Marine Mammals Technical Report** of the Bellrock WFDA EIA Report (**Volume IV**)).

Table 4.2: Maximum Summer, Winter and Annual Density Estimates for Harbour Porpoise from the Bellrock Wind Farm Development Area Site-specific Surveys

Season	Maximum Density Estimate (Corrected) for Whole Survey Area (Bellrock WFDA + 4 km buffer) (Animals/km ²)
Average Winter	0.165
Average Summer	1.273
Average Annual	0.719

26. The site-specific surveys indicate the average maximum densities for the summer or winter seasons over the two years differ quite drastically between both the seasons and years (**Appendix 9.1: Marine Mammals Technical Report (Volume IV)** in the Bellrock WFDA EIA Report). Therefore, there is an evident pattern of harbour porpoise density being higher in the summer season. It is thought that the summer season in the North Sea brings higher concentrations of small shoaling fish like herring, sprat and sandeel, which are key prey species for harbour porpoise, which also typically breed between May and August (Evans et al. 2008).
27. The assessment of likely effects for impacts relating to the Bellrock WFDA (as also noted in **Appendix 9.1: Marine Mammals Technical Report** of the Bellrock WFDA EIA Report (**Volume IV**)) uses the worst-case density which is the average summer density estimate of harbour porpoise from the site-specific surveys (1.273 harbour porpoise/km²).
28. The SNS SAC Site Selection Report (JNCC, 2017) identifies that the SNS SAC site supports approximately 18,500 individuals (95% CI = 11,864 - 28,889) for at least part of the year. However, JNCC and Natural England (2019) state that because this estimate is from a one-month survey in a single year (the SCANS-II survey in July 2005) it cannot be considered as an estimated population for the site. It is therefore not appropriate to use site population estimates in any assessments of effects of plans or projects on the site (i.e. HRA), as they need to take into consideration population estimates at the MU level, to account for daily and seasonal movements of the animals (JNCC and Natural England, 2019).

4.2.3 Conservation Objectives

29. The Conservation Objectives for the SNS SAC are designed to help ensure that the obligations of the Habitats Directive can be met. Article 6(2) of the Habitats Directive requires that there should be no deterioration or significant disturbance of the qualifying species or to the habitats upon which they rely.
30. The Conservation Objectives (JNCC and Natural England, 2019) for the SNS SAC are:

“To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for Harbour Porpoise in UK waters.

In the context of natural change, this will be achieved by ensuring that:

1. *Harbour porpoise is a viable component of the site;*
2. *There is no significant disturbance of the species; and*
3. *The condition of supporting habitats and processes, and the availability of prey is maintained”.*

31. These Conservation Objectives are: *“a set of specified objectives that must be met to ensure that the site contributes in the best possible way to achieving FCS of the designated site feature(s) at the national and biogeographic level”* (JNCC) and (Natural England, 2019”).

4.2.3.1 Conservation Objective 1: The Species is a Viable Component of the Site

32. This Conservation Objective is designed to minimise the risk of injury and killing or other factors that could restrict the survivability and reproductive potential of harbour porpoise using the SNS SAC. Specifically, this objective is primarily concerned with operations that would result in unacceptable levels of those impacts on harbour porpoise using the SNS SAC. Unacceptable levels can be defined as those having an impact on the FCS of the population of the species in their natural range.
33. Harbour porpoise are considered to be a viable component of the SNS SAC if they are able to live successfully within it. The SNS SAC has been selected primarily based on the long term, relatively higher densities of porpoise in contrast to other areas of the North Sea. The implication is that the SNS SAC provides relatively good foraging habitat and may also be used for breeding and calving. However, because the number of harbour porpoise using the SNS SAC naturally varies there is no exact value for the number of animals expected within the SAC (JNCC and Natural England, 2019).
34. The Conservation Objectives for the SNS SAC (JNCC and Natural England, 2019) state that, with regard to assessing impacts, *‘the reference population for assessments against this objective is the MU population in which the SAC is situated’*.
35. Harbour porpoise are listed as EPS under Annex IV of the Habitats Directive and are therefore protected from the deliberate killing (or injury), capture and disturbance throughout their range. Under the Habitats Regulations, it is an offence if harbour porpoise are deliberately disturbed in such a way as to:
- Impair their ability to survive, to breed or reproduce, or to rear or nurture their young; or
 - To affect significantly the local distribution or abundance of that species.
36. The term deliberate is defined as any action that is shown to be *“by a person who knows, in the light of the relevant legislation that applies to the species involved, and the general information delivered to the public, that his action will most likely lead to an offence against a species, but intends this offence or, if not, consciously accepts the foreseeable results of his action”* (JNCC, Natural England and Countryside Council for Wales, 2010).

37. In addition, Article 12(4) of the Habitats Directive is concerned with incidental capture and killing. It states that Member States “*shall establish a system to monitor the incidental capture and killing of the species listed on Annex IV (all cetaceans). In light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned*”.

4.2.3.2 Conservation Objective 2: There is No Significant Disturbance of the Species

38. The disturbance of harbour porpoise typically, but not exclusively, originates from operations that cause underwater noise, including activities such as seismic surveys, pile driving and sonar.

39. Disturbance is considered to be significant if it leads to the exclusion of harbour porpoise from a significant portion of the site for a significant period of time. The current statutory nature conservation bodies (SNCBs) guidance for the assessment of significant noise disturbance on harbour porpoise in SACs (JNCC et al. 2020) is that:

“...noise disturbance within an SAC from a plan/project, individually or in-combination, is considered to be significant if it excludes harbour porpoises from more than:

1. *20% of the relevant area of the site in any given day, or*
2. *An average of 10% of the relevant area of the site over a season.”*

40. Note that percentages of effect listed in the above objective relates to disturbance within the SNS SAC and is therefore the area and seasonal effect are not relevant to this assessment but consideration of disturbance in the wider population has been undertaken.

4.2.3.3 Conservation Objective 3: The Condition of Supporting Habitats and Processes, and The Availability of Their Prey Is Maintained

41. Supporting habitats, in this context, means the characteristics of the seabed and water column. Supporting processes encompass the movements and physical properties of the habitat. The maintenance of these supporting habitats and processes contributes to ensuring prey is maintained within the site and is available to harbour porpoise using the SAC. Harbour porpoise are strongly reliant on the availability of prey species year round due to their high energy demands, and their distribution and condition may strongly reflect the availability and energy density of prey.

42. This Conservation Objective is designed to ensure that harbour porpoise are able to access food resources year round, and that activities occurring in the SNS SAC will not affect this. Therefore, the area of effect is not relevant to this assessment but consideration of disturbance in the wider population has been undertaken.

4.2.4 Assessment of Potential Effects of the Bellrock Wind Farm Infrastructure-Alone

43. The Bellrock WFDA is located 154 km at its nearest point from the SNS SAC. Although the Bellrock WFDA is not near the SNS SAC, there is still the potential for LSE on its designated feature connected with the SAC, harbour porpoise, in the wider management unit during the construction, O&M or decommissioning phases of the Bellrock Wind Farm Infrastructure.
44. For the purposes of the assessment, the potential effects are considered in relation to the SNS SAC Conservation Objectives are outlined in **Table 4.3**. Due to the distance of the Bellrock WFDA from the SNS SAC, conservation objective three will not be affected due to it being focused on the supporting habitat and processes, with there being no pathway of effect being present for this objective.

Table 4.3: Potential Effects of the Bellrock Wind Farm Development Area in Relation to the Conservation Objectives of the Southern North Sea Special Area of Conservation for Harbour Porpoise

Conservation Objective for Harbour Porpoise	Potential Effect
Conservation Objective 1: Harbour porpoise is a viable component of the site	Physical and permanent auditory injury (Permanent Threshold Shift (PTS)) from underwater noise will be mitigated, but in line with current advice this is considered further in Sections 4.2.4.1.1 - 4.2.4.1.5 and 4.2.4.2.1 - 4.2.4.2.4 .
	Significant disturbance and displacement as a result of increased underwater noise levels has the potential to have an adverse effect on harbour porpoise from the SNS SAC and is considered further in Sections 4.2.4.1.1 - 4.2.4.1.5 and 4.2.4.2.1 - 4.2.4.2.4 .
	Any potential increased collision risk with vessels could cause a potential LSE which is considered further in Sections 4.2.4.1.6 and 4.2.4.2.5 .
Conservation Objective 2: There is no significant disturbance of the species	Significant disturbance and displacement as a result of increased underwater noise levels has the potential to have an effect on harbour porpoise population supported by the SNS SAC and is considered further in Sections 4.2.4.1.1 - 4.2.4.1.5 and 4.2.4.2.1 - 4.2.4.2.4 .

45. The potential effects of the Bellrock WFDA that are assessed to determine any potential for an adverse effect on the integrity of the SNS SAC in relation to the Conservation Objectives for harbour porpoise are outlined in **Section 3.1.3**. In order to reduce potential effects during construction, an **Outline Marine Mammal Mitigation Protocol (MMMP) (Volume V)** has been prepared. The MMMP recommends measures for mitigating the potential impact of auditory injury (permanent threshold shift (PTS)) on marine mammals.

4.2.4.1 Potential Effects During Construction

4.2.4.1.1 Impact C1: Underwater Noise During Unexploded Ordnance Clearance

46. Prior to construction (during the site preparation period), there is the potential for UXO clearance to be required. While any identified UXO will either be avoided or removed and disposed of in a designated place, there is the potential that underwater detonation could be required where it is necessary and unsafe to remove the UXO. Underwater noise from the clearance of UXO could cause injury (PTS) or disturbance.
47. In order to undertake any UXO clearance work (during the site preparation works or during the construction period), a Marine Licence is required under the Marine and Coastal Access Act 2009 (for activities more than 12 nm offshore). In addition, the clearance of UXO by detonation will require an EPS Licence under the Conservation of Offshore Marine Habitats and Species Regulations 2017. A separate Marine Licence application will be submitted by the Applicant prior to construction supported by a detailed risk assessment based on the latest available information has been undertaken.
48. The number of possible UXO that may require to be cleared and the duration of UXO clearance operations are currently unknown. It is important to note therefore, that the assessments for UXO clearance here are preliminary, based on the realistic worst-case scenario and further assessment will be undertaken as part of the future Marine Licence application for UXO clearance. Further information relating to the UXO assessment is provided in **Appendix 9.3: Unexploded Ordnance Assessment** of the Bellrock WFDA EIA Report (**Volume IV**). The potential worst-case effects for harbour porpoise from the SNS SAC, utilising the assessments undertaken in the above appendix are summarised in **Table 4.4** below.
49. As discussed further in **Appendix 9.3: UXO Assessment** of the Bellrock WFDA EIA Report (**Volume IV**), the assessments for temporary threshold shift (TTS)/fleeing response have been used for assessing the potential disturbance ranges for UXO high-order clearance without noise mitigation, UXO low-order clearance, and acoustic deterrent devices (ADDs). Therefore, the potential ranges and areas for TTS presented in **Table 4.4**, with the estimated number and percentage of the harbour porpoise reference population that could be affected provides an indication of possible fleeing response.

Table 4.4: Maximum Number of Harbour Porpoise Potentially at Risk of Permanent Threshold Shift and Disturbance During High and Low-order Unexploded Ordnance Clearance Without Noise Mitigation, and Acoustic Deterrent Devices

Criteria	Maximum Impact Range (and Area)	Maximum Number of Individuals	% of Reference Population	Potential Adverse Effect on Site Integrity
PTS SPL _{peak} Unweighted (impulsive criteria)	High-order clearance (750 kg + donor) 14 km (615.8 km²)	784	0.23% of NS MU	No (under 1% of population affected)
	Low-order clearance (0.25 kg NEQ) 990 m (3.08 km²)	4	0.001% of NS MU	No (under 1% of population affected)

Criteria	Maximum Impact Range (and Area)	Maximum Number of Individuals	% of Reference Population	Potential Adverse Effect on Site Integrity
TTS SPL _{peak} Unweighted (impulsive criteria)	High-order clearance (750 kg + donor) 26 km (2,124 km²)	2,703	0.78% of NS MU	No (under 1% of population affected)
	Low-order clearance (0.25 kg NEQ) 1.8 km (10.2 km²)	13	0.004% of NS MU	No (under 1% of population affected)
Acoustic Deterrent Device (ADD) Activation for UXO clearance				
	Low-order clearance up to 12 minutes	4	0.001% of NS MU	No (under 1% of population affected)
	High order (without noise mitigation) clearance up to 80 minutes (see Appendix 9.3: UXO Assessment of the Bellrock WFDA EIA Report (Volume IV) for further information)	172	0.05% of NS MU	No (under 1% of population affected)

50. The current advice from the UK SNCBs is that an EDR of 20 km (with an area of 1,256.64 km²) for high-order UXO (<263 kg and without noise abatement) and 5 km for low-order UXO is used to determine the area from which harbour porpoise may be disturbed within a SAC (JNCC, 2025a). Although the Bellrock WFDA is located 154 km from the SNS SAC, this approach has also been used to consider disturbance. The approach is considered precautionary as not all harbour porpoise within an EDR will be disturbed, however, as a worst-case scenario 100% disturbance of harbour porpoise in the area has been assumed.
51. The estimated number of harbour porpoise and percentage of the NS MU reference population that could be disturbed as a result of underwater noise during high-order and low-order UXO clearance for the Bellrock WFDA is presented in **Table 4.5**.

Table 4.5: Assessment of the Potential for Disturbance to Harbour Porpoise Based on the Effective Deterrent Ranges Approach for Unexploded Ordnance

EDR	Maximum Number of Individuals	% of Reference Population	Potential Adverse Effect on Site Integrity
20 km for high-order UXO (1,256.64 km ²)	1,600	0.46% of NS MU	No (under 5% of population affected)
5 km for low order UXO (78.54 km ²)	100	0.03% of NS MU	No (under 5% of population affected)

4.2.4.1.1.1 Summary

52. Given the small number of individuals affected (<1% of the population), there would be **no adverse effect on the integrity of the SNS SAC** as a result of PTS or disturbance (TTS) on harbour porpoise from underwater noise during UXO clearance.

53. Although there is no adverse effect on the integrity of the SNS SAC as a result of underwater noise during UXO clearance, the MMMP includes mitigation measures for UXO that will further reduce the potential for effect. Mitigation measures and further details are provided in the **Outline MMMP (Volume V)**.

4.2.4.1.2 Impact C2: Underwater Noise During Geophysical Surveys

4.2.4.1.2.1 Auditory Injury

54. As detailed in **Section 9.8.1.2 in Chapter 9: Marine Mammals** of the Bellrock WFDA EIA Report (**Volume II**), injury ranges for geophysical survey sources (SBP, MBES, SBES, USBL system, and SSS) are compared against the non-impulsive thresholds (see Section 9.4.4 in **Chapter 9: Marine Mammals** of the Bellrock WFDA EIA Report (**Volume II**)).

55. The maximum injury (PTS) range across all geophysical surveys was estimated as 330 m for harbour porpoise due to SBP activity, which is the source used for the assessment as a worst-case (**Table 4.6**). However, it should be noted that as sonar-like sources have very strong directivity, there is only potential for injury when an animal is directly underneath the noise source. Once the animal moves outside of the main beam, there is no potential for injury.

56. The number of harbour porpoise potentially injured within the modelled PTS ranges (**Table 4.6**) were estimated using species-specific density estimates. Given that the potential PTS ranges are relatively low, no more than one individual harbour porpoise is at risk of experiencing PTS across all types of geophysical surveys (**Table 4.7**).

Table 4.6: Summary of Potential Impact Ranges for Sub-bottom Profiler

Equipment	Species	Potential Effect	Threshold	Reported Range of Effect	Reference
SBP (202 dB re 1 µPa @ 1 m peak)	Harbour porpoise	PTS	155 SEL _{cum} dB re 1 µPa	23 m	BEIS (2020)
		Disturbance	140 SPL _{RMS} dB re 1 µPa unweighted	3.77 km	
SBP (220 dB re 1 µPa @ 1 m peak)	Harbour porpoise	PTS	Not reported	32 m	Nearth na Gaiithe Offshore Wind (2019)
	Cetaceans	Disturbance	Not reported	1.5 km	
SBP (215 dB re 1 µPa @ 1 m SPL _{peak})	Harbour porpoise	PTS	202 dB peak/155 dB SEL _{cum}	<3 m	Wieting (2019)
SBP (247 dB re 1 µPa @ 1 m (rms))	Harbour porpoise	PTS	247 dB re 1 µPa @ 1 m (rms)	330 m	Green Volt (2023)
	All marine mammals	Disturbance	247 dB re 1 µPa @ 1 m (rms)	1.425 km	

Table 4.7: Permanent Threshold Shift Assessment for Harbour Porpoise for the Worst-case Geophysical Survey Equipment (a Sub-bottom Profiler in Table 4.6)

Maximum Number of Individuals (% of Reference Population) – One SBP	Maximum Number of Individuals (% of Reference Population) – Two SBPs	Potential Adverse Effect on Site Integrity
0.4 (0.00013% of the NS MU)	<1 (0.0003% of the NS MU)	No (under 1% of population affected)

4.2.4.1.2.2 Behavioural Disturbance

57. The disturbance maximum impact range as a worst-case is used in the assessments (see **Table 4.8**). This is based on underwater noise modelling that was undertaken for the Green Volt Offshore Wind Farm (2023) for an SBP, with a maximum source noise level of 247 dB re 1 μ Pa-m. As a worst-case, the maximum number of harbour porpoise (percentage of reference population) that could be at risk of disturbance from one vessel deploying the geophysical equipment is presented in **Table 4.8**. See the **Chapter 9: Marine Mammals** of the Bellrock WFDA EIA Report (**Volume II**) for more information on disturbance effects from geophysical surveys.

Table 4.8: Disturbance Assessment for Harbour Porpoise for Worst-case Geophysical Survey Equipment (a Sub-bottom Profiler in Table 4.6)

Maximum Number of Individuals (% of Reference Population) – One SBP	Maximum Number of Individuals (% of Reference Population) – Two SBPs	Potential Adverse Effect on Site Integrity
57 (0.04% of the NS MU)	114 (0.07% of the NS MU)	No (under 5% of population affected)

58. The current advice from the UK SNCBs is that an EDR of 3 km (with an area of 28.3 km²) for SBPs (all types) is used to determine the area from which harbour porpoise may be disturbed within a SAC (JNCC, 2025b). Although the Bellrock WFDA is located 154 km from the SNS SAC, this approach has also been used to consider disturbance. The Approach is considered precautionary as not all harbour porpoise within an EDR will be disturbed, however, as a worst-case scenario 100% disturbance of harbour porpoise in the areas has been assumed.
59. The estimated number of harbour porpoise and percentage of the NS MU reference population that could be disturbed as a result of underwater noise during geophysical surveys (SBPs) for the Bellrock WFDA is presented in **Table 4.9**.

Table 4.9: Assessment of the Potential for Disturbance to Harbour Porpoise Based on the Effective Deterrent Ranges (EDR) Approach for Sub-bottom Profiler (SBP)

EDR	Assessment of Effect	Potential Adverse Effect on Site Integrity
3 km for SBPs (28.3 km ²)	36 (0.0104% of NS MU)	No (under 5% of population affected)

4.2.4.1.2.3 Summary

60. The auditory injury (PTS) and disturbance ranges will not overlap with the SNS SAC.
61. Given the small number of individuals potentially affected (<1% of the population for auditory injury and <5% for disturbance), there would be **no adverse effect** of auditory injury or disturbance in harbour porpoise as a result of geophysical survey activities in the Bellrock WFDA during the construction (and site preparation) phase. Therefore, there is **no adverse effect on the site integrity of the SNS SAC** as a result of the underwater noise during geophysical surveys in the Bellrock WFDA.
62. Although there is no adverse effect on the integrity of the SNS SAC as a result of underwater noise during geophysical surveys, the MMMP includes mitigation measures for geophysical surveys that will further reduce the potential for effect. Mitigation measures and further details are provided in the **Outline MMMP (Volume V)**.

4.2.4.1.3 Impact C3: Underwater Noise During Piling

4.2.4.1.3.1 Overview of Underwater Noise Modelling Conducted

63. Pile driving during the construction phase of the Bellrock Wind Farm Infrastructure could result in auditory injury (PTS) and/or potential behavioural effects on harbour porpoise of the SNS SAC (**Section 4.2.2**). A detailed underwater noise modelling assessment was carried out to investigate the potential for such effects to occur, using the latest assessment criteria (see **Appendix 9.2: Underwater Noise Modelling Report** of the Bellrock WFDA EIA Report (**Volume IV**) and **Appendix 9.5: Information and Modelling Methods for Disturbance** of the Bellrock WFDA EIA Report (**Volume IV**)).
64. The scenarios modelled were based on the maximum hammer energies (3,000 kJ) over the longest possible duration, noting that piling is unlikely to reach and maintain the absolute maximum hammer energy at all locations. The assessment of potential effects on harbour porpoise from piling considered a maximum spatial and maximum temporal scenario (**Table 4.10**).
65. Maximum spatial scenarios assume concurrent piling of FOU driven piles at three representative locations, leading to the largest area of effect at any one time.
66. Underwater noise modelling considered concurrent piling of anchors for FOUs with a maximum hammer energy of 3,000 kJ where the modelled locations were chosen in areas likely to generate noise contours with the highest potential to overlap with sensitive areas for a given species (e.g. designated areas). The modelling scenarios were as follows:
- A point at the northwestern (NW) corner of the WFDA (single piling) as well as at the Eastern boundary midpoint (E-midpoint) of the WFDA (concurrent piling);
 - A point at the southwestern (SW) corner of the WFDA (single piling) as well as the E-midpoint of the WFDA (concurrent piling); and
 - A point at the E-midpoint of the WFDA (single piling) as well as at the NW corner of the WFDA (concurrent piling).

67. Maximum temporal scenarios, leading to the greatest number of days of piling, is based on piling at a single location (**Table 4.11**). The longest duration of piling per pile for anchors for FOU is 2.99 hours per pile. Therefore, conservatively, the assessment assumes that piling activities can take place over a maximum of 3,552.12 hours over six years¹.

4.2.4.1.3.2 Auditory Injury

68. The maximum spatial effect was estimated using two different concurrent piling scenarios (**Section 4.1.1**). The potential injury range for the concurrent scenarios based on the SPL_{peak} metric remains the same as the injury ranges for the single installation scenario (**Table 4.11**). Considering cumulative exposure using the SEL_{cum} metric, the risk of PTS was estimated to occur out to a maximum range of 3,700 m for harbour porpoise during concurrent pile installation, which is the worst-case for harbour porpoise (**Table 4.10**).

Table 4.10: Predicted Permanent Threshold Shift Impact Ranges (and Areas) at the Bellrock Wind Farm Development Area from a Single Strike and from Cumulative Exposure for Maximum Hammer Energy (3,000 kJ) (3x Piles at E-midpoint)

Species (Hearing Group)	Metric	Threshold	Potential PTS Range (m) and Area (km ²)
Harbour porpoise (VHF)	SPL _{peak}	202 dB re 1 µPa	770 (1.9 km ²)
	SEL _{cum}	155 dB re 1 µPa ² s	3,700 (37 km ²)

Table 4.11: Summary of Predicted Permanent Threshold Shift Area for Concurrent Pile at the Worst-case Locations within the Bellrock Wind Farm Development Area (3x Piles at Northwestern Corner and 3x Piles at E-midpoint)

Species (Hearing Group)	Metric	Threshold	Potential PTS Area (km ²)
Harbour porpoise (very high frequency (VHF))	SEL _{cum}	155 dB re 1 µPa ² s	600

69. An assessment of the maximum number of harbour porpoise that could be at risk of instantaneous PTS from a single strike of a pile (at the maximum hammer energy) is presented in **Table 4.12**, based on the PTS ranges presented in **Table 4.10** and **Table 4.11**. This assessment assumed the maximum hammer energy without any mitigation, based on the worst-case E-midpoint location, whereby less than 0.001% of the reference populations are exposed to a permanent effect.
70. An assessment of the maximum number of individuals that could be at risk of PTS from cumulative exposure during sequential installation of three piles is presented in **Table 4.12**. This assessment assumes a maximum hammer energy of 3,000 kJ, without any additional mitigation, and is based on the worst-case E-midpoint location for the maximum impact area (as set out in **Table 4.10**).

¹ Whilst construction will take place over a seven-year period, piling will be undertaken over a six year period.

71. It is important to note that the assessment for PTS from cumulative exposure is highly precautionary (see Section 9.8.1.3.1.3.2 in **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)**). There is some variation in the potential impact ranges for SEL_{cum} at each location and between locations, therefore in many cases less individuals would be at risk of exposure than presented here (as the assessments are based on the worst-case location). It is also unlikely that the maximum hammer energy would be required at all piling locations for the entire duration of the piling activity.

Table 4.12: Maximum Number of Individuals (and % of Reference Population) that Could be at Risk of Permanent Threshold Shift Piling, Based on the Worst-case Location at the Bellrock Wind Farm Development Area

Criteria and Threshold	Maximum Number of Individuals (% of Reference Population)	Potential Adverse Effect on Site Integrity
Single Strike of a Pile at the Maximum Hammer Energy (3,000 kJ) Without Mitigation		
SPL _{peak} Unweighted (202 dB re 1 µPa) Impulsive	<3 (0.0009% of the NS MU)	No (under 1% of population affected)
Cumulative SEL of Sequential Installation of three Piles at the Maximum Hammer Energy (3,000 kJ) - 3x Piles at E-midpoint		
SEL _{cum} Weighted (155 dB re 1 µPa ² s) Impulsive	<48 (0.01% of NS MU)	No (under 1% of population affected)
Cumulative SEL of Sequential Installation of three Piles at the Maximum Hammer Energy (3,000 kJ) - 3x Piles at NW corner and 3x piles at E-midpoint		
SEL _{cum} Weighted (155 dB re 1 µPa ² s) Impulsive	<764 (0.22% of NS MU)	No (under 1% of population affected)

4.2.4.1.3.3 Behavioural Disturbance

72. The range of possible behavioural reactions that may occur as a result of exposure to noise include orientation or attraction to a noise source, increased alertness, modification of characteristics of their own sounds, cessation of feeding or social interaction, alteration of movement/diving behaviour, temporary or permanent habitat abandonment and, in severe cases, panic, or stranding, sometimes resulting in injury or death (Southall et al. 2007).

73. There are currently no agreed thresholds or criteria for the behavioural response and disturbance of marine mammals, therefore it is not possible to conduct underwater noise modelling to predict impact ranges for harbour porpoise. Potential disturbance of harbour porpoise from underwater noise during piling has been assessed using the following methods for harbour porpoise:

- Dose-Response Curve (DRC);
- EDR; and
- Interim population consequences of disturbance (iPCoD) modelling.

4.2.4.1.3.3.1 Dose-Response Curve

74. The modelled number of harbour porpoise and percentage of the NS MU reference population that could be disturbed as a result of underwater noise during piling for the Bellrock Wind Farm Infrastructure utilising the dose-response curve method is presented in **Table 4.13**. The maximum number of individuals impacted by piles associated with FOU is expected to be 8,554, which is 2.5% of the NS MU population. For further information on the methodology of the DRC assessment used, see **Section 9.8.1.3.2.2.1** in **Chapter 9: Marine Mammals** of the Bellrock WFDA EIA Report (**Volume II**) and **Appendix 9.5: Marine Mammals Information and Modelling Methods for Disturbance** of the Bellrock WFDA EIA Report (**Volume IV**). The results of the assessment are shown in **Table 4.13**.
75. It is important to note that recent research from Thompson et al. (2025), suggests that even dose-response modelling is likely to be overly conservative, based on new data collected from Moray West’s installation of larger monopiles. However, comparisons of the predictions from the alternative Beatrice response functions provides evidence that distance from source is a better predictor of porpoise responses to piling. For comparison purposes for piling in the Bellrock WFDA, the deterrence function was applied for harbour porpoise, resulting in a drastically lower disturbance estimate (733 harbour porpoise disturbed or 0.2% NS MU) when compared to the dose response function. Further information and the comparison between the dose response and distance-based deterrence function is provided in **Appendix 9.5: Marine Mammals Information and Modelling Methods for Disturbance** of the Bellrock WFDA EIA Report (**Volume IV**). As a worst-case scenario, the dose-response assessment will still be utilised and noted.

Table 4.13: Number of Individuals (and % of Reference Population) that Could be Disturbed During Piling Based on the Dose-Response Approach

Maximum Number of Individuals Impacted (% of Reference Population) for FOU Piles	Potential Adverse Effect on Site Integrity
8,554 (2.5% of NS MU)	No (under 5% of population affected)

4.2.4.1.3.3.2 Effective Deterrent Ranges

76. The current advice from the UK SNCBs is that an EDR of 20 km (with an area of 1,256.64 km²) for pin piles is used to determine the area from which harbour porpoise may be disturbed within a SAC (JNCC, 2025b). Although the Bellrock WFDA is located 154 km from the SNS SAC, this approach has also been used to consider disturbance. The Approach is considered precautionary as not all harbour porpoise within an EDR will be disturbed, however, as a worst-case scenario 100% disturbance of harbour porpoise in the areas has been assumed. The estimated number of harbour porpoise and percentage of the NS MU reference population that could be disturbed as a result of underwater noise during piling for the Bellrock Wind Farm Infrastructure is presented in **Table 4.14**. Note that this does not assume any overlap between disturbance areas from the piling events and is therefore precautionary.

Table 4.14: Assessment of the Potential for Disturbance to Harbour Porpoise Based on the Effective Deterrent Ranges Approach for Pin Piles, for Both a Single and Two Simultaneous Piling Events

EDR	Assessment of Effect	Potential Adverse Effect on Site Integrity
For a single piling event		
20 km for one vessel (1,256.64 km ²)	1,600 (0.46% of NS MU)	No (under 5% of population affected)
For two simultaneous piling events		
20 km for two vessels (2,513.28 km ²)	3,200 (0.92% of NS MU)	No (under 5% of population affected)

4.2.4.1.3.3.3 Modelled Population Level Consequences due to Disturbance

77. The potential population level consequences due to disturbance of harbour porpoise from the SNS SAC were modelled using the iPCoD model. Considering the North Sea population is being used for the SNS SAC, the modelling undertaken for the **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)** will be the same here. However, it is important to note that this modelling is overly conservative (see **Appendix 9.5: Marine Mammals Information and Modelling Methods for Disturbance** of the **Bellrock WFDA EIA Report (Volume IV)**).
78. Assuming a precautionary worst-case of 8,554 harbour porpoises disturbed (**Table 4.13**) on every piling day, the iPCoD model estimated there to be a negligible impact to the harbour porpoise population (**Plate 4.1** and **Table 4.15**).
79. The results from the effects of piling at the Bellrock WFDA has been presented as mean and median ratios of impacted: unimpacted population sizes (Table 9.32 in **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)**). The results show no significant effect across all time points and a less than 1% average annual decline over the first six and 25-year period for both the mean and median, with a resultant effect significance of **negligible adverse**.

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Plate 4.1: Simulated Worst-case Harbour Porpoise Population Sizes for Both the Un-impacted and the Impacted Population

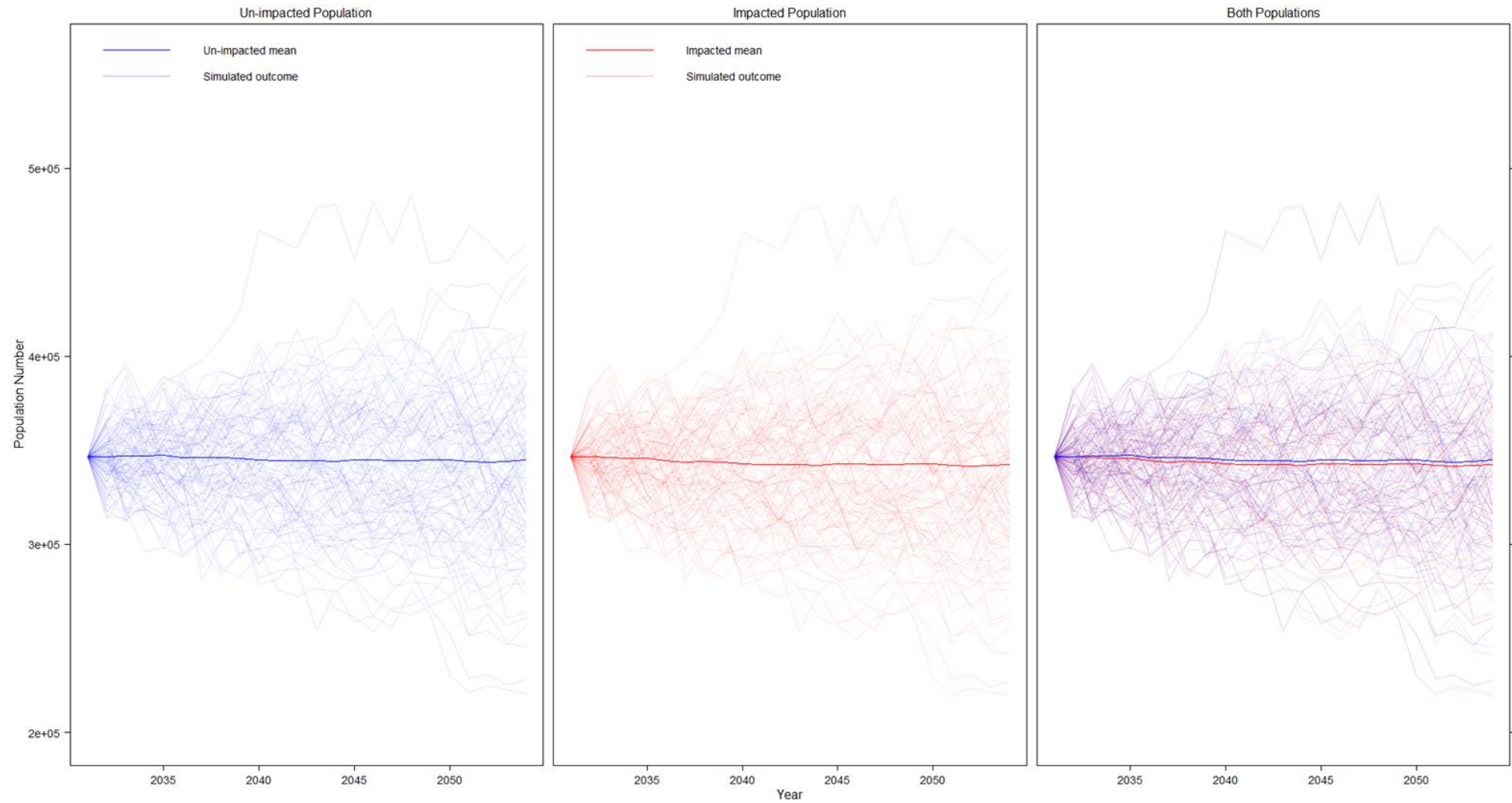


Table 4.15: Results of the iPCoD Modelling for the Bellrock Wind Farm Development Area, Giving the Mean Population Size for the Harbour Porpoise Population (North Sea Management Unit) for Years up to 2056 for Both Impacted and Un-impacted Populations, in Addition to the Mean and Median Ratio Between their Population Sizes

Time Point	Year	Mean			Median			95% Confidence Intervals	
		Un-impacted Population	Impacted Population	Impacted As % of Un-impacted	Un-impacted Population	Impacted Population	Impacted As % of Un-impacted	Un-impacted Population	Impacted Population
1	2031	346,600	346,600	100%	346,600	346,600	100%	346,600 – 346,600	346,600 – 346,600
2	2032	346,768	346,565	99.94%	347,459	347,303	99.99%	317,472 – 373,334	317,460 – 373,334
3	2033	347,005	346,235	99.77%	347,484	346,883	99.92%	309,505 – 378,525	309,049 – 377,295
7	2037	345,985	343,810	99.37%	344,885	342,562	99.77%	294,740 – 401,634	291,339 – 398,592
13	2043	344,590	342,480	99.39%	342,566	340,634	99.79%	276,089 – 426,221	274,814 – 422,312
19	2049	345,053	342,944	99.39%	342,740	340,885	99.79%	262,047 – 438,426	258,108 – 438,426
26	2056	344,697	342,591	99.39%	341,803	340,072	99.79%	247,217 – 454,710	244,833 – 451,394

4.2.4.1.3.4 Behavioural Disturbance due to Acoustic Deterrent Devices Activation

80. Mitigation to reduce the risk of PTS from piling could include activation of ADDs prior to the soft start commencing. The period of time that an ADD is required to be activated for is dependent on the potential PTS ranges for each species (other species considered in **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)**), and their known swim speeds, as used within the underwater noise modelling.
81. The assessments of the potential disturbance during any ADD activation is indicative only, as the requirements for mitigation will be defined in the MMMP and will be determined prior to construction.
82. During 30 minutes of ADD activation, harbour porpoise would move at least 2.52 km from the ADD location (based on a precautionary harbour porpoise swimming speed of 1.4 m/s; SNH, 2016), resulting in a potential disturbance area of 20 km². This is further than the maximum instantaneous PTS range for pin piles predicted for harbour porpoise. The ADD activation required for a single pile installation would be 9.17 minutes to cover the maximum PTS range of 0.77 km, resulting in a potential disturbance area of 1.86 km².
83. As a worst-case, based on an ADD activation time of 30 minutes, up to 26 harbour porpoise (0.008% of the NS MU population) may be disturbed (Table 9.33 in **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)**).
84. The ADD activation would ensure harbour porpoise are beyond the maximum impact range for instantaneous PTS due to a single strike of the maximum hammer energy pin piles. This disturbance area would be within the disturbance area due to piling (as assessed above) and therefore would not be an additive effect to harbour porpoise.
85. The current advice from the UK SNCBs is that an EDR of 11 km (with an area of 28.3 km²) for ADD (> 15 min) is used to determine the area from which harbour porpoise may be disturbed within a SAC (JNCC, 2025b). Although the Bellrock WFDA is located 154 km from the SNS SAC, this approach has also been used to consider disturbance. The Approach is considered precautionary as not all harbour porpoise within an EDR will be disturbed, however, as a worst-case scenario 100% disturbance of harbour porpoise in the areas has been assumed.
86. The estimated number of harbour porpoise and percentage of the NS MU reference population that could be disturbed as a result of underwater noise during ADD activation using EDRs for the Bellrock WFDA is presented in **Table 4.16**.

Table 4.16: Assessment of the Potential for Disturbance to Harbour Porpoise Based on the Effective Deterrent Ranges Approach for Acoustic Deterrent Devices

EDR	Assessment of Effect	Potential Adverse Effect on Site Integrity
11 km for ADDs (1027.88 km ²)	1,308 (0.38% of NS MU)	No (under 5% of population affected)

4.2.4.1.3.5 Summary

87. Noting the information in **Sections 4.2.4.1.3.1 to 4.2.4.1.3.4** above, the small number of individuals potentially affected (<1% of the population for auditory injury and <5% for disturbance), there would be no significant effect of auditory injury or disturbance in harbour porpoise as a result of piling activities in the Bellrock WFDA during the construction phase. Therefore, there is **no adverse effect on the site integrity** of the SNS SAC as a result of the underwater noise on harbour porpoise during piling in the Bellrock WFDA.
88. Although there is no adverse effect on the integrity of the SNS SAC as a result of underwater noise during piling, the Piling Noise Mitigation Plan (PNMP) will provide mitigation or management measures to further reduce the potential for any auditory injury or disturbance to harbour porpoise from underwater noise and inform the MMMP for piling activity that will further reduce the potential for effect. Mitigation measures and further details are provided in the **Outline MMMP (Volume V)**.

4.2.4.1.4 Impact C4: Underwater Noise from Non-piling Construction Activities

89. Potential sources of underwater noise during construction activities, other than piling and substructure installation, include:
- Boulder clearance;
 - Cable and cable protection installation methods:
 - Ploughing;
 - Trenching;
 - Jetting; and
 - Rock placement.
 - Subsea cable hubs; and
 - Other substructure installation activities:
 - Gravity based anchors;
 - FOU driven piles Drive-Drill-Drive process;
 - Suction piles; and
 - Drag embedment anchors.

4.2.4.1.4.1 Auditory Injury

90. Underwater noise modelling was undertaken for non-piling related construction activities such as cable laying, cable trenching, drilling and rock placement. The modelling indicated the worst-case potential for auditory injury would occur during rock placement for a stationary harbour porpoise. The predicted impact range for PTS from 24- hour cumulative exposure from rock placement is 1.1 km (3.801 km²). This impact range has no potential overlap with the SNS SAC.
91. For the other construction activities modelled for harbour porpoise, impact ranges were all less than 100 m. The results of the underwater noise modelling do not define effect ranges of less than 100 m, therefore, it is possible that the actual effect ranges are considerably lower. An assessment

of the maximum number of individuals that could be at risk of PTS, due to other construction activities, is presented in **Table 4.17**, based on the worst-case impact area of 3.801 km².

Table 4.17: Assessment of the Potential for Permanent Threshold Shift Due to Other Construction Activities, Including Cable Laying, Cable Trenching, and Rock Placement, for One Activity Taking Place at Any One Time

Impact Range (Area)	Assessment of Effect	Potential Adverse Effect on Site Integrity
1.1 km (3.801 km ²)	5 (0.0014% of NS MU)	No (under 1% of population affected)

92. There is the potential that more than one of these non-piling construction activities could be underway at the Bellrock WFDA at the same time. As a worst-case and unlikely scenario, an assessment for all four activities being undertaken simultaneously has also been considered. **Table 4.18** presents the potential areas of PTS for four other construction activities taking place at the same time.
93. An assessment of the maximum number of individuals that could be at risk of PTS, due to all non-piling construction activities undertaken at the same time is presented in **Table 4.18**, based on the impact areas as presented for the Bellrock WFDA.

Table 4.18: Assessment of the Potential for Permanent Threshold Shift Due to All Other Construction Activities Taking Place at the Same Time

Impact Area	Assessment of Effect	Potential Adverse Effect on Site Integrity
15.204 km ²	19 (0.006% of NS MU)	No (under 1% of population affected)

4.2.4.1.4.2 Behavioural Disturbance

94. There is limited data on the potential for a behavioural response or disturbance from non-piling construction activities (or other continuous noise sources). Harbour porpoise within the potential disturbance area are considered to have limited capacity to avoid such effects. If the response is displacement from the area, it is predicted that harbour porpoise will return once the activity has been completed and therefore any impacts from underwater noise as a result of non-piling construction activities will be both localised and temporary. Therefore, there is unlikely to be the potential for any significant disturbance impact on harbour porpoise.
95. Studies undertaken during the construction of two Scottish OWFs (Beatrice OWF and Moray East OWF) and (Benhemma-Le Gall et al. 2021), found that there was a reduction in harbour porpoise presence detected at up to 12 km from pile driving, and up to 4 km from construction activities. With construction activities 2 km from CPOD locations, harbour porpoise activity decreased by up to 35.2%; with construction activities 3 km from the CPODs, there was a decrease of up to 24%. At 4 km from construction activities, there was an increase of harbour porpoise detection by 7.2%. This implies that harbour porpoise activity decreases within a 4 km radius from the distance to the activity. At the time of the detections, there were multiple construction activities being undertaken

with a variety of support vessels present. Outside of the piling period, the study found that the presence of harbour porpoise decreased by 17%, with SPLs of 57 dB (above ambient noise). While the study did not define which activities were taking place to cause the disturbance, the study occurred whilst a number of construction vessels were on site (Benhemma-Le Gall et al. 2021).

- 96. An assessment of the maximum number of individuals that could be at risk of disturbance due to non-piling construction activities based on the 4 km potential disturbance range (with an impact area of 50.3 km²) is presented in **Table 4.18**.
- 97. As noted above, there is the potential that more than one of these non-piling construction activities could be underway at the Bellrock WFDA at the same time. As a worst-case and unlikely scenario, an assessment for up to four activities being undertaken simultaneously has also been undertaken.
- 98. Based on a 4 km potential disturbance range, and up to four non-piling construction activities taking place at the same time, there is the potential for a simultaneous disturbance impact area of 201.06 km². This assumes that the disturbance would only affect the area around the vessel at the time of the activity taking place, and that harbour porpoise would return to the disturbed area once the activity had either completed or transited to a new location.
- 99. An assessment of the maximum number of individuals that could be at risk of disturbance, due to four non-piling construction activities undertaken at the same time, is also presented in **Table 4.19**.

Table 4.19: Assessment of the Potential for Disturbance Due to Non-piling Construction Activities, Including Cable Laying, Cable Trenching, and Rock Placement

Impact Area	Assessment of Effect	Potential Adverse Effect on Site Integrity
One activity taking place at any one time		
4 km (50.3 km ²)	64 (0.018% of NS MU)	No (under 5% of population affected)
All other construction activities taking place at the same time		
201.06 km ²	256 (0.07% of NS MU)	No (under 5% of population affected)

4.2.4.1.4.3 Summary

- 100. Therefore, under the circumstances in **Sections 4.2.4.1.4.1** and **4.2.4.1.4.2**, there would be **no adverse effect** on the integrity of the SNS SAC due to auditory injury (PTS) or disturbance of harbour porpoise from non-piling construction activities taking place individually or simultaneously during construction, for the Bellrock Wind Farm Infrastructure.

4.2.4.1.5 Impact C5: Underwater Noise and Presence of Vessels

- 101. Site-specific underwater noise modelling was undertaken to determine the potential risk for PTS from underwater noise from the presence of vessels. The underwater noise propagation modelling was conducted using a simple modelling approach, using measurement data from Subacoustech Environmental’s own underwater noise measurement database. To account for the weightings

required for modelling using the Southall et al. (2019) criteria, reductions in source level were applied to the various noise sources (see **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)** for further information).

102. Predicted PTS impact ranges from vessel noise were estimated to be less than 100 m for harbour porpoise. The noise levels are low enough that harbour porpoise would only be exposed to minimal risk from auditory injury (PTS). Therefore, this section will not investigate the risk to auditory injury (PTS) any further.

4.2.4.1.5.1 *Behavioural Disturbance*

103. The distance at which animals may react to vessels is challenging to predict, as behavioural responses can vary widely depending on factors such as species, location, vessel type and size, speed, noise levels and frequency, ambient noise levels, and environmental conditions (see **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)** for more details).
104. In coastal waters of SW Wales, vessel type and speed, rather than mere presence, appeared to be critical factors in harbour porpoise reactions to vessel traffic (Oakley et al. 2017). A significant correlation was observed between vessel numbers and harbour porpoise sightings. Over 729 hours of survey (268 total surveys), there were 39 instances of neutral or negative harbour porpoise responses to vessels, with 75% of negative reactions triggered by high-speed, planning-hulled vessels.
105. Modelling by Heinänen and Skov (2015) indicated that ship traffic density plays a notable role in determining harbour porpoise density in the North Sea during summer. Specifically, higher traffic levels are linked to lower porpoise densities, with a threshold impact level of approximately 15,000 ships per year (around 50 vessels per day within a 5 km grid cell; or approximately two vessels/km²). For context, the maximum of 33 vessels expected on-site during construction would remain below this threshold (33 vessels over the 280 km² Bellrock WFDA would amount to approximately 0.1 vessels per km²).
106. Brandt et al (2018) found that harbour porpoise detections declined several hours before piling began at seven German OWFs due to increased construction-related activity and vessel presence within a 2 km vicinity of the construction sites. Similarly, studies in the Moray Firth during piling at the Beatrice OWF linked higher vessel activity within 1 km to a greater likelihood of harbour porpoise responses (Graham et al. 2019).
107. A precautionary approach to this impact has been adopted based on the studies by Brandt et al (2018) and Benhemma-Le Gall et al (2021). Consequently, the following disturbance from vessels assessment (see **Table 4.20**) utilises the 4 km disturbance range for harbour porpoise (with a disturbance area of 50.27 km²). This is considered very precautionary for the following reasons:
- As presented by Benhemma-Le Gall et al (2021), at 2 km from vessel activities, harbour porpoise activity decreased by up to 35.2%; with construction activities 3 km from the CPODs, there was a decrease of up to 24%, and at 4 km from construction activities, there was an increase of harbour porpoise detection by 7.2%. Therefore, assuming that all harbour porpoise will respond within a 4 km radius is over-precautionary, as it is likely that only a small proportion would respond at up to 4 km;

- Benhemma-Le Gall et al (2021) do not differentiate between vessels that are undertaking activities, and those that are transiting. Therefore, assuming the harbour porpoise response is the same in both cases may be overestimating the effect where vessels are transiting only;
- Other research has reported smaller disturbance ranges for vessels, either transiting or undertaking works (e.g. Diederichs et al (2010) found that trenching can disturb harbour porpoise up to 600 m, and Frankish et al (2023) found that harbour porpoise deterrence was mostly observed at close distance to vessels only (<300 m), while deterrence of 5-9% of individuals was still recorded for vessels at 2 km away); and
- The assessments are undertaken based on the maximum number of vessels being present at any one time within the Bellrock WFDA, which is only likely to occur occasionally.

108. The disturbance assessment based on one vessel in the Bellrock WFDA has been presented in **Table 4.20**. While the maximum number of vessels at any one time is 33, this scenario is precautionary and would not take into consideration any potential overlap of the 4 km disturbance ranges with other nearby vessels. Therefore, an alternative approach to determining the potential disturbance area for multiple vessels has been provided as discussed below.

109. Assuming the disturbance caused by 33 vessels within the Bellrock WFDA would not overlap with that of other vessels, the total disturbed area would be 1,609 km². This is significantly larger than the Bellrock WFDA itself, which has a total area of 280 km². Therefore, the actual maximum area of effect would be the Bellrock WFDA plus a 4 km buffer (equating to an area of 657.2 km²), as it is assumed vessels would be within the Bellrock WFDA and those transiting to and from site will use indicative vessels transit corridors to reduce potential disturbance.

Table 4.20: Maximum Number of Harbour Porpoise (and % of Reference Population) that Could be Disturbed as a Result of Underwater Noise Associated with Construction Vessels at the Bellrock Wind Farm Development Area

Maximum Number of Individuals (% of Reference Population) for One Vessel in the Bellrock WFDA at Any One Time	Maximum Number of Individuals (% of Reference Population) for the Bellrock WFDA, Including a 4 km Buffer (657.2 km ²)	Potential Adverse Effect on Site Integrity
64 (0.018% of NS MU)	837 (0.24% of NS MU)	No (under 5% of population affected)

4.2.4.1.5.2 Summary

110. Therefore, under the circumstances noted above in **Section 4.2.4.1.5.1**, there would be **no adverse effect** on the integrity of the SNS SAC due to disturbance of harbour porpoise from construction vessel presence in the Bellrock WFDA.

4.2.4.1.6 Impact C6: Collision Risk with Vessels

111. Construction of the Bellrock WFDA would increase the number of vessels in the current baseline due to the number of vessels transiting to and from the Bellrock WFDA (see **Section 4.2.4.1.5** for

further information on vessel numbers). However, given the existing levels of marine traffic, as outlined in **Chapter 12: Shipping and Navigation** of the **Bellrock WFDA EIA Report (Volume II)**, harbour porpoise in and around the Bellrock WFDA would typically be habituated to the presence of vessels and would be able to detect and avoid vessels.

112. Harbour porpoises, being small and highly mobile, are generally expected to avoid vessels due to their responses to vessel noise e.g. (Thomsen et al. 2006), (Polacheck and Thorpe, 1990). Predictive modelling indicates a negative relationship between the number of ships and the distribution of harbour porpoises in the Irish and Celtic Seas, and North Sea during summer. This suggests that harbour porpoises may exhibit avoidance behaviour (Heinänen and Skov, 2015), (Dyndo et al. 2015) and (Frankish et al. 2023), observed even at long ranges (2-9 km; Dyndo et al, 2015), (Benhemma-Le Gall et al. 2021) and (Pigeault et al. 2024), thereby reducing the risk of collisions with vessels. In a study by Robbins (2022), the relative collision risk was calculated using Automatic Identification System (AIS) vessel density data overlaid on the cetacean distribution maps by Waggitt et al. (2019). The study found that harbour porpoise in the southern North Sea are exposed to high shipping traffic year-round, exposing them to a significant risk of potential ship strikes.
113. Research shows that larger vessels, such as cruise ships and cargo vessels over 80 m in length, are more likely to cause severe or fatal injuries to marine mammals (Laist et al. 2001) and (Keen et al. 2023). High speeds are a key factor in collisions with cetaceans; for instance, the likelihood of a lethal injury to large whales, specifically the North Atlantic right whale in this study, increased from around 20% to 80% when vessel speeds increased from 8 to 15 knots (Vanderlaan and Taggart, 2007). Serious injuries have also been documented at lower speeds of 2 and 5.5 knots (Conn and Silber, 2013). Conversely, vessels traveling at speeds below 10 knots rarely cause serious injuries, making reduced speed one of the most effective mitigation strategies (Laist et al. 2001), (Conn and Silber, 2013), (Laist et al. 2014) and (Keen et al. 2023).
114. It is anticipated that vessels would follow an agreed indicative transit corridor to the relevant ports, where this retains compliance with the Convention on International Regulations for Preventing Collisions at Sea (COLREGS), to minimise vessel volume in the areas outside of the agreed indicative transit corridor (see the **Outline Vessel Management and Navigational Safety Plan (VMNSP)** provided in **Volume V**). Where possible, these will be incorporated within existing vessel routes and hence to areas where harbour porpoise are accustomed to vessels, in order to reduce any increased collision risk. In addition, vessel operators will use best practice to reduce any risk of collisions with harbour porpoise, such as reducing the speed of vessel transits wherever possible.

4.2.4.1.6.1 Summary

115. Harbour porpoise in the relevant study area(s) are likely to be accustomed to vessels or exhibit avoidance behaviours, therefore, increased collision risk due to vessels is unlikely. Additionally, vessel movements would be kept to the minimum number that is required to develop the Wind Farm Infrastructure and the risk will be further reduced with the implementation of the mitigation measures discussed. Additionally, vessel operators would use industry best practice to reduce any risk of collisions with marine mammals. The VMNSP and Environmental Management Plan (EMP) will provide a protocol for minimising collision risk of marine mammals with vessels. An **Outline VMNSP** and **Outline EMP** are provided in **Volume V**.

116. Therefore, there would be **no adverse effect** on the integrity of the SNS SAC from collision risk to harbour porpoise from vessel movement during the construction phase of the Bellrock Wind Farm Infrastructure.

4.2.4.1.7 *Impact C7: Changes to Prey Availability*

117. Harbour porpoise feed on schooling fish such as herring, whiting, sprat, sandeel, etc. They feed on a wide range of prey species and have relatively large foraging ranges (see **Appendix 9.1: Marine Mammals Technical Report** of the **Bellrock WFDA EIA Report (Volume IV)**).

118. Any impacts on prey species have the potential to indirectly affect harbour porpoise. As outlined in **Chapter 8: Fish and Shellfish** of the **Bellrock WFDA EIA Report (Volume II)**, the potential impacts on fish species during construction can result from:

- Physical disturbance and temporary habitat loss;
- Increased suspended sediment and sediment re-deposition;
- Underwater noise and vibration; and
- Changes in fishing activity.

119. Due to the interaction between prey and harbour porpoise, the assessment on fish receptors have been extracted from **Chapter 8: Fish and Shellfish Ecology** of the **Bellrock WFDA EIA Report (Volume II)** and forms the basis of this assessment on harbour porpoise and the SNS SAC.

120. During construction activities, the worst-case footprint for sea bed disturbance would be 3.64 km², which is outside of the SNS SAC area. Predominantly fine sand was the sediment type found (see **Chapter 6: Marine Geology, Oceanography and Physical Processes** of the **Bellrock WFDA EIA Report (Volume II)**). Increased suspended sediment and sediment re-deposition would only occur for a limited duration at specific locations (e.g. piling location), at any given time.

121. The data and analysis in **Chapter 6: Marine Geology, Oceanography and Physical Processes** of the **Bellrock WFDA EIA Report (Volume II)** indicates that levels of contaminants within the Bellrock WFDA are low and do not contain elevated levels to cause concern.

122. **Chapter 8: Fish and Shellfish Ecology** of the **Bellrock WFDA EIA Report (Volume II)** provides an assessment of the potential underwater noise impacts on fish and shellfish species and predicts that impacts would be of a temporary nature. Underwater noise and vibration generated during construction activities, including UXO clearance as part of site preparation works, piling for the FOU driven pile anchor option or foundation installation, and vessel operations across the construction period (including IAC installation), have the potential to affect fish and shellfish species. Of these, piling is considered to produce the highest levels of underwater noise and therefore has the greatest potential to result in adverse impacts on fish.

123. During piling, stationary fish with swim bladders involved in hearing could potentially die within a 2.8 km radius or sustain recoverable injuries up to 47 km away from the piling source (see Table 8.14 in **Chapter 8: Fish and Shellfish Ecology** of the **Bellrock WFDA EIA Report Volume II**). Fish species that sustain recoverable injuries, TTS or show behavioural responses would still be available as prey to marine mammals.

124. It is unlikely that there would be significant changes to prey over the entire Bellrock WFDA. It is more likely that effects would be restricted to an area around the working sites. Effects would be negligible in the context of the amount of similar available habitat in the wider area for prey species. There is unlikely to be any additional displacement of harbour porpoise as a result of any changes in prey availability during piling as they would potentially already be disturbed from the area (see **Section 4.2.4.1.3**).
125. It is also important to note, the Bellrock WFDA is 154 km away from the SNS SAC, therefore there are no direct effects on the supporting functions of the SAC.
126. **Chapter 11: Commercial Fisheries** of the **Bellrock WFDA EIA Report (Volume II)** provides an assessment of the potential changes of fishing activity by the presence of safety zones associated with the project during construction. The predicted impact has been assessed as having a negligible impact in the EIA given the short-term and temporary nature of the construction phase.

4.2.4.1.7.1 Summary

127. The footprint of the Bellrock WFDA is relatively small and not within the SNS SAC. Therefore, there would be **no adverse effect** on the integrity of the SNS SAC from effects of changes to prey of harbour porpoise arising during construction activities.

4.2.4.2 Potential Effects During Operation and Maintenance

4.2.4.2.1 Impact O1: Underwater Noise during Geophysical Surveys

128. Elevated underwater noise generated during site-investigation surveys may lead to injury and/or disturbance to harbour porpoise during the O&M phase. The worst-case scenario comprises of routine geophysical surveys (such as MBES and SBP) undertaken periodically during the O&M phase. Survey frequency is not fixed and will depend on site conditions. Monitoring is expected to be more frequent during the first five years to confirm cable burial and anchor point stability. Beyond this, the frequency and scope of surveys will be risk-based and informed by the outcomes of early-stage monitoring.
129. The potential impacts from auditory injury (PTS) due to underwater noise during site-investigation surveys will be the same as that assessed for the construction phase (see **Section 4.2.4.1.2**).
130. For injury, the impact is predicted to be relatively localised, short term duration, intermittent and the effect of PTS is permanent. However, since injury is assumed to be fully mitigated via designed in measures (detailed in the **Outline MMMP, Volume V**) there is considered to be no residual risk of injury and therefore no population-level effects.
131. For the behavioural disturbance, the impact is predicted to be the same as that of the construction phase where it is highly localised, of short term duration, intermittent and the effect of behavioural disturbance is reversible (see **Section 4.2.4.1.2**).

4.2.4.2.1.1 Summary

132. There would be **no adverse effect** on the integrity of the SNS SAC from the effects of geophysical surveys on harbour porpoise during O&M activities.

133. Although there is no adverse effect on the integrity of the SNS SAC as a result of underwater noise during geophysical surveys, the MMMP includes mitigation measures for geophysical surveys that will further reduce the potential for effect. Mitigation measures and further details are provided in the **Outline MMMP (Volume V)**.

4.2.4.2.2 Impact O2: Underwater Noise from Operation and Maintenance Activities

134. The requirements for any potential O&M work, such as additional rock placement or cable re-burial, are currently unknown. However, the work required, and associated effects to harbour porpoise from the SNS SAC would be less than those during construction.
135. The potential for PTS is only likely in very close proximity to cable laying or rock placement activities at the onset of the activity. Therefore, it is highly unlikely for there to be any PTS due to these activities. The effects from additional cable laying and protection are temporary in nature and will be limited to relatively short periods during the O&M phase.
136. Currently available data indicates that there is no lasting disturbance or exclusion of harbour porpoise around OWFs during the O&M phase (Lindeboom et al. 2011, (Marine Scotland, 2012, McConnell et al. 2012 and Scheidat et al. 2011). Data collected suggests that any behavioural responses for harbour porpoise may only occur up to a few hundred metres away (McConnell et al. 2012). Harbour porpoise have been shown to forage within operational wind farm sites (e.g. Lindeboom et al. 2011) and (Russell et al. 2014), indicating no restriction to movements in operational OWF sites. Potential disturbance would be temporary in nature, not consistent throughout the operational period and would be limited to only part of the overall Bellrock WFDA at any one time.

4.2.4.2.2.1 Summary

137. There would be **no adverse effect on the integrity** of the SNS SAC from the underwater noise effects of operational activities on harbour porpoise during O&M activities.

4.2.4.2.3 Impact O3: Underwater Noise and Presence of Vessels

138. The assessment for underwater noise impacts from the presence of vessels during the O&M phase is considered to be the same as that for the construction phase, although to a lesser degree. As per the underwater noise modelling (see **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)**), the noise levels are low enough that harbour porpoise would only be exposed to a minimal risk. This section will not investigate the risk to auditory injury (PTS) any further.

4.2.4.2.3.1 Behavioural Disturbance

139. During O&M, there is the potential for vessels transiting and conducting maintenance activities in the Bellrock WFDA. The number of vessels would be fewer than during construction (**Section 4.2.4.1.5**), with a maximum of 21 vessels on site at any one time. However, it is unlikely that all 21 vessels would be present simultaneously and engaging in noisy activities. The same rationale for disturbance assessment as outlined for construction vessels has been used, noting that this impact is assumed to have a long-term effect, as the vessels will be present throughout the lifetime of the Bellrock WFDA.

- 140. Vessel movements to and from the O&M port (to be decided post-consent) would be incorporated within existing vessel routes where possible. The vessels conducting the maintenance work would be slow moving or stationary at times.
- 141. The disturbance assessment based on one vessel and the whole of the Bellrock WFDA has been presented in **Table 4.21**.
- 142. As described in **Section 4.2.4.1.5**, assuming that all harbour porpoise within 4 km of a vessel, would be disturbed from the entire area, is very precautionary as marine mammals have been observed in and around OWFs during O&M activities (e.g. Lindeboom et al. 2011, Marine Scotland, 2012, McConnell et al. 2012 and Scheidat et al. 2011). In addition, It is unlikely all vessels would be present in the Bellrock WFDA at the same time and this has been assessed as a precautionary worst-case.
- 143. Less than 5% of the reference population is affected (**Table 4.21**), therefore, it is considered that there would be no significant effect.

Table 4.21: Maximum Number of Individuals (and % of Reference Population) that Could be Disturbed as a Result of Underwater Noise Associated with Operation and Maintenance Vessels at the Bellrock Wind Farm Development Area

Maximum Number of Individuals (% of Reference Population) for One Vessel in the Bellrock WFDA at Any One Time	Maximum Number of Individuals (% of Reference Population) for Bellrock WFDA, Including a 4 km buffer (657.2 km ²)	Potential Adverse Effect on Site Integrity
64 (0.018% of NS MU)	837 (0.24% of NS MU)	No (under 5% of population affected)

4.2.4.2.3.2 Summary

- 144. There would be **no adverse effect** on the integrity of the SNS SAC from the presence of vessels on harbour porpoise during O&M activities.

4.2.4.2.4 Impact O4: Underwater Noise from Operational WTGs and Moorings on the Seabed

4.2.4.2.4.1 Auditory Injury

- 145. There is a potential for FOU's as well as the mooring lines to generate underwater noise during the O&M phase of the Bellrock Wind Farm Infrastructure. It is noted that little empirical data exists for the operational noise produced by FOU's although the noise source is limited to the weighted and buoyant section that rests beneath the sea surface, which is a significantly smaller area than that of a fixed-bottom WTG substructure (see Section 5.2 in **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)**). Farr et al. (2021) conducted a systematic review to estimate potential effects of deepwater floating OWFs during operation, which included potential effects of underwater noise, and suggested noise effects on marine mammals were 'minimal'. Farr et al. (2021) also stated that empirical measurements are still needed for floating OWFs. Noise effects are unlikely to pose a risk to marine species as the

operation noise is low frequency (with dominant frequencies of ~1 kHz or less) and at low levels (Madsen et al. 2006 and Thomsen et al. 2015b).

146. Potential noise levels at the Bellrock WFDA have been assessed by comparing the proposed Bellrock Wind Farm Infrastructure design to worst-case examples from other OWFs. The assessment made in **Appendix 9.2: Underwater Noise Modelling Report of the Bellrock WFDA EIA Report (Volume IV)** indicates noise levels are below potential injurious thresholds (based on non-impulsive Southall et al. (2019) criteria) for harbour porpoise, even if the receptor was within 100 m of the floating WTG for an hour.
147. Operational noise levels that were measured from fixed-bottom WTG substructures were comparable to noise emissions from floating offshore FOUs at Kincardine and Hywind Scotland at comparable distances (Risch et al. 2023). Noise emissions were concentrated in the frequencies below 20 Hz and showed distinct tonal features, likely related to rotational speed, between 50 and 80 Hz at Kincardine and 25 and 75 Hz at Hywind Scotland.
148. Risch et al. (2023) further highlighted that the overall effect of the operational noise and the ability of marine mammals to perceive this noise would be largely dependent on ambient noise levels and wind speed. As opposed to fixed structures, the mooring structures generated noise too, particularly during higher wind speeds when impulsive ‘snaps’ were perceived more often than usual. Measurements of noise levels above the median (median = 100 dB noise contour) were recorded at distances up to 4 km from the wind turbine array (Risch et al. 2023).
149. Harbour porpoise click detection reduced at the sites closest to the wind turbine compared to the site furthest away, the report, however, indicated the preliminary nature of this particular result and highlighted that behavioural effects need to be studied in more detail whilst this industry is growing (Risch et al. 2023). Therefore, there is no risk of potential auditory injury from FOUs to harbour porpoise.
150. The periods of mooring line slackening and tensioning have the potential to produce transient ‘snapping’ noise during the O&M phase of the Bellrock WFDA. As described in **Appendix 9.2: Underwater Noise Modelling Report of the Bellrock WFDA EIA Report (Volume IV)**, the presence of snapping transient noise was identified during acoustic underwater noise measurements at the Hywind Demonstrator Project in Norway in 2011 (Martin et al. 2011). The data was subsequently analysed and Stephenson (2015) extrapolated results from a single WTG to a theoretical array, and it was found that with up to 115 snapping events per day, the resultant potential cumulative SEL over a 24-hour period was 156 dB re 1 $\mu\text{Pa}^2\text{s}$ at 150 m from the WTGs. This value is below the PTS onset acoustic thresholds detailed in **Sections 9.8.1.3.1.2 and 9.8.1.3.2.1 of Chapter 9: Marine Mammals of the Bellrock WFDA EIA Report (Volume II)** (Southall et al. 2019).
151. **Appendix 9.2: Underwater Noise Modelling Report of the Bellrock WFDA EIA Report (Volume IV)** details how analysis of the Hywind Demo data by Xodus (2015) for the Hywind Scotland Project predicted a potential $L_{E,p,24h}$ of up to 157 dB re 1 $\mu\text{Pa}^2\text{s}$ at 150 m caused by snapping chains from six WTGs. In theory, the equivalent snapping chains for ten WTGs would produce approximately 160 dB re 1 $\mu\text{Pa}^2\text{s}$. 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) and this level is below any PTS or injury criteria to harbour porpoise.

152. As discussed in **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)**, though existing empirical studies on operational noise from offshore floating wind farms of any foundation type are limited, there is a general consensus that the risk of injury to harbour porpoise from both structure-borne noise (regardless of foundation type) and additional noise such as those by moving mooring lines, is very low, and therefore, population level effects are highly unlikely to occur.

4.2.4.2.4.2 *Behavioural Disturbance*

153. Although the underwater noise study carried out at completed Hywind site makes no attempt to quantify the disturbance (Burns et al. 2022), the semi-qualitative assessment provided in **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)** concluded that the areas of disturbance are unlikely to extend further than those for fixed WTG substructures.
154. The underwater noise from operational floating wind turbines comes from vibration in the gear box and generator, which is transmitted down the tower and radiated from the tower wall. Given that there is a paucity of qualitative data on sound radiation from the floating wind turbines, a qualitative assessment is presented with respect to fixed wind turbines (considered as maximum design case when compared to floating). The desktop review carried out in **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)** suggests that although sound levels are likely to be audible within the hundreds of metres from the wind turbine, these will not be at levels sufficient to cause behavioural changes in harbour porpoise.
155. However, these findings are based on data collected for wind turbines with capacity between 2 MW to 5 MW and a hub height of up to 95 m. The FOU's for the Bellrock Wind Farm Infrastructure will be larger than those in the desktop review and it is likely that there will be an increase of a few dB compared to smaller FOU's. However, considering that the Bellrock WFDA is located in the North Sea with relatively high shipping traffic, the difference in ambient sounds is anticipated to be minimal.
156. The impact (elevated underwater noise from FOU's and mooring lines) is predicted to be of a local spatial extent in the context of the relevant geographic frame of reference (the North Sea), long term duration, continuous and the effect of behavioural disturbance is of high reversibility. It is predicted that the impact will affect the receptor directly. Although noise levels are likely to be audible to harbour porpoise, animals are unlikely to experience behavioural disturbance including displacement as a result of the increased underwater noise during the O&M phase.

4.2.4.2.4.3 *Summary*

157. Noting the information in **Sections 4.2.4.2.4.1** and **4.2.4.2.4.2** above, the effects of underwater noise on auditory injury (PTS) and disturbance from operational wind turbines on harbour porpoise would have **no adverse effect** on the integrity of the SNS SAC.

4.2.4.2.5 *Impact O5: Collision Risk with Vessels*

158. As noted in **Section 4.2.4.2.3**, it is estimated that the maximum number of vessels that could be required within the WFDA at any one-time during O&M could be up to 21.
159. The risk of marine mammal collision with O&M vessels would be the same or less than what was assessed for the construction period (**Section 4.2.4.1.6**), given the number of vessels required would be lower.
160. Given the existing levels of marine traffic, as outlined in **Chapter 12: Shipping and Navigation** of the **Bellrock WFDA EIA Report (Volume II)**, harbour porpoise in and around the Bellrock WFDA would typically be habituated to the presence of vessels and would be able to detect and avoid vessels.
161. It is anticipated that vessels would follow an agreed indicative transit corridor to the relevant ports, where this retains compliance with the COLREGS, to minimise vessel volume in the areas outside of the agreed indicative transit corridor (see the **Outline VMNSP** and **Outline EMP** provided in **Volume V**). Where possible, these will be incorporated within existing vessel routes and hence to areas where harbour porpoise are accustomed to vessels, in order to reduce any increased collision risk. In addition, vessel operators will use best practice to reduce any risk of collisions with harbour porpoise, such as reducing the speed of vessel transits wherever possible.

4.2.4.2.5.1 *Summary*

162. There would be **no adverse effect** on the integrity of the SNS SAC due to the potential collision risk with O&M vessels on harbour porpoise.

4.2.4.2.6 *Impact O6: Secondary Entanglement*

163. Secondary entanglement occurs when marine mammals become ensnared in marine debris, such as lost or abandoned fishing gear (ghost nets) that has accumulated on lines and cables associated with project-related infrastructure (see diagram in Plate 9.1 in **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)**). The presence of ghost fishing gear wrapped around offshore wind structures could extend the spatial impact range, as nets can span tens of metres.
164. The impacts of entanglement on harbour porpoise can include fatalities from drowning, as well as injuries such as infections and tissue damage if the animal manages to escape. Additionally, entanglement may lead to emaciation if it restricts the animal's ability to feed properly, or increased energy expenditure and drag if the animal remains mobile while entangled.
165. Key factors which could influence secondary entanglement risk include (Harris et al. 2025, and Benjamins et al. 2014, Farr et al. 2021):
- The type of marine debris (nets, lines, fishing gear, etc.);
 - The amount of fishing gear or debris;
 - The detectability of the moorings and debris;
 - The behaviour of animals in the Bellrock WFDA;
 - The range and movement of the mooring lines;

- The design, material, length and number of moorings within the Bellrock WFDA; and
- The layout and level of biofouling on the moorings and other subsea infrastructure.

166. Harbour porpoise have some ability to detect cables or mooring lines using echolocation, vision, and hearing. However, fishing gear made out of nylon or monofilament is less likely to be detected, posing a greater risk of entanglement compared to, e.g. mooring lines (Benjamins et al. 2014).

167. The prevalence of abandoned or lost fishing gear in the area of Bellrock WFDA is influenced by local oceanographic conditions, fishing gear losses and their drift rates once lost. These unknowns make secondary entanglement very difficult to quantify. It is generally acknowledged that there are significant knowledge gaps, such as the lack of in-situ observations of fishing gear stuck on infrastructure and insufficient information on species abundance and behaviour around floating OWF structures. It should be noted that large fishing nets would not be used within the Bellrock WFDA due to the presence of infrastructure. Instead, static fishing gear (e.g. fish traps, crab and prawn creels, and electronic jiggers) could be used, as it has been trialled at the Hywind Scotland floating OWF (Wright et al. 2023). The tests indicated the viability of deploying static gear under suitable sea and weather conditions. During the four trial trips, no gear was lost or snagged in the structures.

168. Mitigation measures to monitor the risk of entanglement will be implemented in the final O&M Plan:

- Monitoring for large strains on mooring lines:
 - It is expected that a similar method of monitoring would be undertaken as per Kincardine Offshore Windfarm. On Kincardine Offshore Windfarm this has to date been undertaken by load cells attached to the mooring devices and subsea cables, designed to alert if there is unexpected load on the devices which can then be examined. The monitoring method is in the process of changing to using position monitoring system, which will identify the associated drag function on the structures outside the normal operating range (Risch et al. 2023); and
- Surveys: SKSs would be regularly checked by ROV (during both planned and unplanned maintenance activities):
 - This would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement for marine mammals.

169. The potential risk of secondary entanglement for harbour porpoise is considered to be sufficiently reduced with the application of the designed in mitigation measures. This, combined with the consideration with the potential for avoidance behaviour, supports the conclusion that population-level effects on harbour porpoise are highly unlikely.

4.2.4.2.6.1 Summary

170. There would be **no adverse effect on the integrity** of the SNS SAC due to the effects of secondary entanglement on harbour porpoise.

4.2.4.2.7 *Impact O7: Changes to Prey Availability*

171. Any impacts on prey species have the potential to indirectly affect harbour porpoise. As outlined in **Chapter 8: Fish and Shellfish** of the **Bellrock WFDA EIA Report (Volume II)**, the potential impacts on fish species during O&M can result from:
- Physical disturbance and temporary habitat loss;
 - Increased suspended sediment and sediment re-deposition;
 - Underwater noise and vibration;
 - Changes in fishing activity;
 - EMF;
 - Permanent habitat loss;
 - Introduction of hard substrate; and
 - Changes in fishing activity.
172. **Chapter 8: Fish and Shellfish** of the **Bellrock WFDA EIA Report (Volume II)** provides an assessment of these impact pathways on the relevant fish and shellfish species and concludes impacts of negligible to minor adverse significance in EIA terms. Any impacts on prey species have the potential to indirectly affect harbour porpoise. Although given that the distance from the Bellrock WFDA and the SNS SAC is 154 km, there are no direct effects on the supporting functions of the SAC.
173. Habitat loss will occur during the lifetime of the Bellrock Wind Farm Infrastructure as a result of structures, scour and external cable protection installed on the seabed. The introduction of hard substrate would increase habitat heterogeneity through the introduction of hard structures in an area predominantly characterised by sediment habitats. During operation of the Bellrock WFDA, the estimated total permanent habitat loss would be up to 47.46 km² in total. In **Chapter 8: Fish and Shellfish** of the **Bellrock WFDA EIA Report (Volume II)**, this is considered minor to negligible in EIA terms, in the context of the amount of similar available habitat in the wider area for prey species.
174. Increases in SSC within the water column and subsequent deposition onto the seabed may occur as a result of O&M activities. However, the volumes of sediment disturbed from such activities, as well as the overall duration of the disturbance, would be significantly less than compared to construction.
175. While demersal fish such as cod, (blue) whiting, and sandeel lack electromagnetic receptors to detect EMF, migratory and pelagic species might experience navigation interference due to EMF from the operation of IACs, potentially affecting the speed and/or direction of their movements (refer to **Chapter 8: Fish and Shellfish** of the **Bellrock WFDA EIA Report (Volume II)** for further information).
176. Common practice is to bury the static IACs, and by doing so, the magnetic field at the seabed is reduced due to the distance between the cable and the seabed surface as a result of field decay with distance from the cable (CSA Ocean Sciences Inc. and Exponent, 2019). The target burial

depth for the IACs is between 0.5 and 2.5 m. For non-buried cables, rock protection will be used, with a rock berm height of 0.5 m. These embedded mitigation measures ensure that a minimum distance between fish and shellfish receptors and EMFs associated with seabed cables are maintained, thereby reducing the maximum field strengths that receptors are exposed to and minimising potential behavioural or physiological effects.

177. The introduction of various man-made structures in soft sediment areas increases and changes habitat availability and type, resulting in locally altered biodiversity as species are able to establish and thrive in previously hostile environments (Wilhelmsson et al. 2006; Birchenough and Degraer, 2020). Physical structures provide a foundation for settling invertebrates, which increase the organic matter surrounding the structure, and underpin artificial reef ecosystems through 'bottom-up' control of productivity. Increasing nutrient availability and biomass presents opportunities for all fish and shellfish species, from top predators to detritivores (Raoux et al. 2017). The benefit of this potential increase in prey availability to harbour porpoise has not yet been studied widely. However, the presence of an artificial reef does increase the abundance and biomass of species, and the increase in prey species availability increases the attractiveness of the area to predators (Devault et al. 2017; Paxton et al. 2022). Increasing habitat heterogeneity may benefit harbour porpoise, that have shown to prefer variations in seabed topography (Isojunno et al. 2012; Brookes et al. 2013; Stalder et al. 2020). The introduction of new hard substrate in areas that are predominantly sandy, or soft sediments may cause positive effects through potential habitat enhancement (Roach and Cohen, 2020). However, the area of any reef effect would be relatively limited and it not considered to be significant relative to the large foraging range of harbour porpoise.

4.2.4.2.7.1 Summary

178. The effects upon prey during the O&M phase of the Bellrock Wind Farm Infrastructure are likely to be the same or less than those assessed for construction. Therefore, there would be no adverse effect on the integrity of the SNS SAC due changes to harbour porpoise prey during to O&M.

4.2.4.3 Potential Effects During Decommissioning

179. The potential effects relating to the decommissioning phase are as follows:
- Impact D1: Underwater noise during geophysical surveys;
 - Impact D2: Underwater noise from other activities;
 - Impact D3: Underwater noise and presence of vessels;
 - Impact D4: Collision risk with vessels; and
 - Impact D5: Changes to prey availability.
180. The sequence of decommissioning is likely to be the reverse of the construction sequence, taking around seven years, with similar types and numbers of vessels and equipment expected to be involved. It is expected that the Bellrock Wind Farm Infrastructure will be fully removed at the end of its operational life. The removal and dismantling of the FOU's will largely be a reversal of the installation process. Generally, the FOU's will be towed from the Bellrock WFDA to a suitable port for decommissioning. Mooring lines and anchors will be recovered and removed from the WFDA. For FOU driven pile anchors, these are expected to be either fully removed or cut off below seabed level with a proportion remaining in-situ (due to anticipated excessive cost in their complete

removal) following good practice and consideration of environmental conditions and sensitivities. Subsea cable hubs are expected to be fully removed from the seabed. The dynamic sections of the IACs within the water column will be cut at the connector with the static IAC and fully removed. The approach for decommissioning the static IACs on the seabed is yet to be determined, however, this will be reviewed throughout the lifetime of the Bellrock Wind Farm Infrastructure and good practice guidance at time of decommissioning will be followed.

181. Subject to the material used and environmental sensitivities, it may be preferable to leave scour protection in-situ to preserve the marine habitat that may have developed over the life of the Bellrock Wind Farm Infrastructure. The approach for decommissioning cable protection will be similar to scour protection.
182. No decision has been made regarding the final decommissioning strategy for the offshore infrastructure at the Bellrock Wind Farm Infrastructure, as it is recognised that regulatory requirements and industry best practice change over time.
183. Whilst a detailed assessment of decommissioning impacts cannot be undertaken at this stage, for this assessment, it is assumed overall that decommissioning effects will be similar to those of construction (i.e. any activities are likely to occur within the temporary construction working areas and require no greater amount or duration of activity than assessed for construction) albeit some effects will be greatly reduced (such as those related to underwater noise) .

4.2.4.3.1 Summary

184. The potential effects on harbour porpoise during decommissioning are assumed to be the same or less than those assessed for construction, with key differences being the potential for underwater noise effects with the absence of piling or UXO clearance. Therefore, there would be **no adverse effect** on the integrity of the SNS SAC due to the effects of decommissioning activities on harbour porpoise.

4.2.4.4 Summary of Potential Effects on Site Integrity for Harbour Porpoise in the Southern North Sea Special Area of Conservation

185. There would be **no adverse effect** on integrity of the SNS SAC in relation any of the effects upon harbour porpoise considered above during construction, O&M or decommissioning.
186. Additionally, the **Outline MMMP (Volume V)** based on the information in PNMP will provide mitigation or management measures to further reduce the potential for any auditory injury or disturbance to harbour porpoise from underwater noise.
187. The **Outline VMNSP (Volume V)** details measures relating to vessel management and coordination which will be applied during the construction and O&M phases. These measures will further reduce potential collision risk and disturbance to seal haul-out site effects.
188. In order to further reduce the risk of any potential secondary entanglement the final O&M Plan also incorporates monitoring measures.

4.3 Berwickshire and North Northumberland Coast Special Area of Conservation

4.3.1 Site Description

189. The Berwickshire and North Northumberland Coast (BNNC) SAC is one of the most biologically diverse marine areas in Europe, with its range of intertidal and subtidal habitats along with the internationally significant population of grey seals (Defra and NE, 2019). The SAC lies in between England and Scotland (see **Figure A 1, Appendix A**).

190. The BNNC SAC is 152 km from the Bellrock WFDA at closest point. Therefore, there is no potential for direct effect on the SAC as a result of the construction, O&M or decommissioning of the Bellrock Wind Farm Infrastructure. However, due to the foraging range of grey seal and the movement of grey seal along the east coast of England and Scotland, there is the potential for effects on foraging grey seal from the BNNC SAC in the vicinity of the Bellrock WFDA.

4.3.2 Grey Seal Population and Density

191. Carter et al (2022) produced habitat-based predictions of at-sea distribution for grey seals in the British Isles. The resultant density of seals at-sea maps shows the relative density of seals in each 5 km by 5 km grid cell. As well as the total grey seals at-sea densities, Carter et al (2022) provide SAC specific densities. These SAC specific densities provide the relative density of grey seal that are associated with each SAC. These SAC specific density estimates have been used to calculate the density of grey seal, associated with the BNNC SAC, present within the Bellrock WFDA (see **Figure A.2, Appendix A**). This effectively limits the potential for impacts to only those seals that are both affected and associated with the SAC itself.

192. The highest mean at sea relative density estimates of grey seal for the Bellrock WFDA, calculated from Carter et al (2022) is 0.028 individuals per km².

193. The at-sea population number is 14,563, based on the total population of grey seal at the BNNC SAC (of 16,903, as provided in **Table 4.22**), and calculating against a correction factor of 0.2515 to take account of those individuals at sea only.

Table 4.22: Grey Seal Counts and Population Estimates

Population Area	Grey Seal Haul-out Count	Source of Haul-out Count Data	Correction Factor for Seals Not Available to Count	Grey Seal SAC Population
BNNC SAC	4,251	SCOS (2024)	0.2515	16,903

194. Assessments are undertaken against the SAC population estimate of 16,903 seals, for both the Bellrock Wind Farm Infrastructure-alone and in-combination.

4.3.3 Conservation Objectives

195. The Conservation Objectives (Natural England, 2023c) are:

“to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- *The structure and function (including typical species) of qualifying natural habitats;*
- *The structure and function of the habitats of qualifying species;*
- *The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;*
- *The populations of qualifying species, and,*
- *The distribution of qualifying species within the site.”*

4.3.4 Assessment of Potential Effects of the Bellrock Wind Farm Infrastructure-Alone

4.3.4.1 Potential Effects During Construction

4.3.4.1.1 Impact C1: Underwater Noise During Unexploded Ordnance Clearance

196. As noted in **Section 4.2.4.1.1**, prior to construction, there is the potential for UXO clearance to be required. While any identified UXO will either be avoided or removed and disposed of in a designated place, there is the potential that underwater detonation could be required where it is necessary and unsafe to remove the UXO.

197. The potential worst-case effects for grey seal from the BNNC SAC, utilising the assessments done in **Appendix 9.3: UXO Assessment (Volume IV)** are summarised in **Table 4.25** below.

198. As discussed in **Appendix 9.3: UXO Assessment** of the **Bellrock WFDA EIA Report (Volume IV)**, the assessments for TTS/fleeing response have been used for assessing the potential disturbance ranges for UXO high-order clearance without noise mitigation for those species where no further information is currently available. Therefore, the potential ranges and areas for TTS presented in **Table 4.23**, with the estimated number and percentage of reference populations that could be affected provides an indication of possible fleeing response.

Table 4.23: Maximum Number of Grey Seals Potentially at Risk of Permanent Threshold Shift and Disturbance During High and Low-order Unexploded Ordnance Clearance Without Noise Mitigation

Criteria	Maximum Impact Range (and Area)	Maximum Number of Individuals	% of Reference Population	Potential Adverse Effect on Site Integrity
PTS SPL _{peak} Unweighted (impulsive criteria)	High-order clearance (750 kg + donor) 2.8 km (24.6 km²)	0.7	0.004% of BNNC SAC	No (under 1% of population affected)
	Low-order clearance (0.25 kg NEQ) 190 m (0.11 km²)	0.003	<0.0001% of BNNC SAC	No (under 1% of population affected)
TTS SEL _{cum} , Unweighted (impulsive criteria)	High-order clearance (750 kg + donor) 22 km (1,521 km²)	43	0.3% of BNNC SAC	No (under 5% of population affected)
	Low-order clearance (0.25 kg NEQ) 570 m (1 km²)	0.03	0.0002% of BNNC SAC	No (under 5% of population affected)
Acoustic Deterrent Device (ADD) activation for UXO clearance				
Low-order clearance up to 12 minutes		0.14	0.0008% of BNNC SAC	No (under 5% of population affected)
High order (without noise mitigation) clearance up to 80 minutes (see Appendix 9.3: UXO Assessment of the Bellrock WFDA EIA Report (Volume IV) for further information).		<7	0.04% of BNNC SAC	No (under 5% of population affected)

199. The current advice from the UK SNCBs is that an EDR of 20 km (with an area of 1,256.64 km²) for high-order detonation (<263 kg without noise abatement) and 5 km for low-order detonation is used to determine the area that grey seal may be disturbed from in BNNC SAC (JNCC, 2025a). Although the Bellrock WFDA is located 152 km from the BNNC SAC, this approach has also been used to consider disturbance. The approach is considered precautionary as not all grey seals within an EDR will be disturbed, however, as a worst-case scenario 100% disturbance of grey seal in the areas has been assumed.
200. The estimated number of grey seal and percentage of the BNNC SAC reference population that could be disturbed as a result of underwater noise during high-order UXO removal for the Bellrock WFDA is presented in **Table 4.24**.

Table 4.24: Assessment of the Potential for Disturbance to Grey Seal Based on the Effective Deterrent Ranges Approach for Unexploded Ordnance

EDR	Assessment of Effect	Potential Adverse Effect on Site Integrity
20 km for high-order UXO (1,256.64 km ²)	<36 (0.2% of BNNC SAC)	No (under 5% of population affected)
5 km for low order UXO (78.54 km ²)	<3 (0.02% of BNNC SAC)	No (under 5% of population affected)

4.3.4.1.1.1 Summary

- 201. Given the small number of individuals affected there would be no significant effect on grey seal from underwater noise during UXO clearance and therefore **no adverse effect on the integrity** of the BNNC SAC.
- 202. Although there is no adverse effect on the integrity of the BNNC SAC as a result of underwater noise during UXO clearance, the MMMP includes mitigation measures for UXO that will further reduce the potential for effect. Mitigation measures and further details are provided in the **Outline MMMP (Volume V)**.

4.3.4.1.2 Impact C2: Underwater Noise During Geophysical Surveys

- 203. The maximum injury (PTS) range across all geophysical surveys was estimated as 120 m for grey seal (pinnipeds) due to SBP activity, which is the source used for the assessment as a worst-case (**Table 4.25**). However, it should be noted that as sonar-like sources have very strong directivity, there is only potential for injury when an animal is directly underneath the noise source. Once the animal moves outside of the main beam, there is no potential for injury.

Table 4.25: Summary of the Desk-based Review of Potential Impact Ranges for Sub-bottom Profiler

Equipment	Species	Potential Effect	Threshold	Reported Range of Effect	Reference
SBP (247 dB re 1 µPa @ 1 m (rms))	Pinnipeds	PTS	247 dB re 1 µPa @ 1 m (rms)	120 m	Green Volt (2023)
	All marine mammals	Disturbance	247 dB re 1 µPa @ 1 m (rms)	1.425 km	

- 204. The number of grey seals potentially injured within the modelled PTS ranges (**Table 4.25**) were estimated using species-specific density estimates. Given that the potential PTS ranges are relatively low, less than one individual is at risk of experiencing PTS across all types of geophysical and geotechnical surveys (**Table 4.26**).
- 205. The worst-case impact range for disturbance used in the assessments is shown in **Table 4.25**. This is based on underwater noise modelling undertaken for the Green Volt Offshore Wind Farm (2023) for an SBP, with a maximum source noise level of 247 dB re 1 µPa-m. The maximum

number of grey seals (percentage of reference population) that could be at risk of disturbance from one vessel deploying the geophysical equipment is presented in **Table 4.26**.

Table 4.26: Assessment for Grey Seal for a Sub-bottom Profiler

Maximum Number of Individuals (% of Reference Population) – One SBP	Maximum Number of Individuals (% of Reference Population) – Two SBP	Potential Adverse Effect on Site Integrity
PTS		
0.001 (>0.0001% of the BNNC SAC)	0.004 (>0.0001% of the BNNC SAC)	No (under 1% of population affected)
Disturbance		
0.15 (0.00091% of the BNNC SAC)	<1 (0.0059% of the BNNC SAC)	No (under 5% of population affected)

4.3.4.1.2.1 Summary

- 206. The auditory injury (PTS) and disturbance ranges will not overlap with the BNNC SAC.
- 207. Given the small number of individuals affected there would be no significant effect on grey seal from underwater noise during geophysical survey activities and therefore **no adverse effect on the integrity** of the BNNC SAC.
- 208. Although there is no adverse effect on the integrity of the BNNC SAC as a result of underwater noise during geophysical surveys, the MMMP includes mitigation measures for geophysical surveys that will further reduce the potential for effect. Mitigation measures and further details are provided in the **Outline MMMP (Volume V)**.

4.3.4.1.3 Impact C3: Underwater Noise during Piling

- 209. An overview of the underwater noise modelling that is used for this sections assessment is summarised in **Section 4.2.4.1.3.1**.

4.3.4.1.3.1 Auditory Injury

- 210. The maximum spatial effect was predicted for concurrent piling at FOU's with a hammer energy of 3,000 kJ. As shown in **Table 4.1**, piling will be intermittent over a seven-year construction piling phase and will occur up to a maximum of 148 days.
- 211. The maximum spatial effect was estimated using two different concurrent piling scenarios, with a hammer energy of 3,000 kJ. The risk of PTS was estimated to occur out to a maximum range of 70 m using the SPL_{peak} metric for grey seal from single strike piling (with no mitigation) at FOU's, which is the worst-case assessed (**Table 4.27**). Impact ranges were not able to be modelled for cumulative PTS exposure using the SEL_{cum} metric at one location (including soft-start and ramp-up procedures), due to the impact range being less than 100 m. The modelling processes are

unable to model to a sufficient level of accuracy due to complex acoustic effects present near the source (see **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)**). Therefore, no further assessment has been undertaken for this piling scenario.

212. The risk of PTS was estimated to occur out to a maximum impact area of 70 km² for grey seal during multiple location piling with concurrent pile installation at FOU's (**Table 4.28**).

Table 4.27: Predicted Permanent Threshold Shift Impact Ranges (and Areas) at the Bellrock Wind Farm Development Area from a Single Strike and from Cumulative Exposure for Maximum Hammer Energy (3,000 kJ) (3x Piles at E-midpoint)

Species (Hearing Groups)	Metric	Threshold	Potential PTS Range (m) and Area (km ²)
Grey seal (PCW)	SPL _{peak}	218 dB re 1 µPa	70 (0.01km ²)
	SEL _{cum}	185 dB re 1 µPa ² s	N/A

Table 4.28: Summary of Predicted Permanent Threshold Shift Ranges for Concurrent Pile at the Worst-case Locations Within the Bellrock Wind Farm Development Area (3x Piles at Northwestern Corner and 3x Piles at E-midpoint)

Species (Hearing Groups)	Metric	Threshold	Potential PTS Area (km ²)
Grey seal (PCW)	SEL _{cum}	185 dB re 1 µPa ² s	70

213. An assessment of the maximum number of grey seal that could be at risk of instantaneous PTS from a single strike of a pile for FOU mooring system (at the maximum hammer energy) is presented in **Table 4.29**. This assessment assumed the maximum hammer energy without any mitigation, based on the worst-case E-midpoint location, whereby less than 0.001% of the reference populations are exposed to a permanent effect.

214. An assessment of the maximum number of individuals that could be at risk of PTS from cumulative exposure during multiple location piling of three piles at each location is presented in **Table 4.29**. This assessment assumes a maximum hammer energy of 3,000 kJ for piles associated with FOU mooring system, without any additional mitigation, and is based on the worst-case E-midpoint and the NW corner location for the maximum impact area (as set out in **Table 4.29**).

Table 4.29: Maximum Number Of Grey Seal (and % of Reference Population) that Could be at Risk of Permanent Threshold Shift Piling, Based on the Worst-case Location at the Bellrock Wind Farm Development Area

Criteria and Threshold	Maximum Number of Individuals (% of Reference Population)	Potential Adverse Effect on Integrity
Single Strike of a Pile at the Maximum Hammer Energy (3,000 kJ) Without Mitigation		
SPL _{peak} Unweighted (218 dB re 1 µPa) Impulsive	0.00028 (0.0000017% of the BNNC SAC)	No (under 1% of population affected)
Cumulative SEL of Sequential Installation of three Piles at the Maximum Hammer Energy (3,000 kJ) - 3x piles at NW corner and 3x piles at E-midpoint		
SEL _{cum} Weighted (185 dB re 1 µPa ² s) Impulsive	2 (0.01% of the BNNC SAC)	No (under 1% of population affected)

4.3.4.1.3.2 Behavioural Disturbance

215. Disturbance As noted in **Section 4.2.4.1.3.3**, potential disturbance of grey seal from underwater noise during piling has been assessed using the following methods for grey seal:

- Dose-Response Curve (DRC);
- EDR;
- iPCoD modelling; and
- ADD.

4.3.4.1.3.2.1 Dose-Response Curve

216. For further information on the methodology of the DRC assessment used, see **Appendix 9.5: Marine Mammals Information and Modelling Methods for Disturbance** of the **Bellrock WFDA EIA Report (Volume IV)**. The results of the assessment are shown in **Table 4.30**.

Table 4.30: Number of Grey Seal (and % of Reference Population) that could be Disturbed During Piling Based on the Dose-Response Approach

Maximum Number of Individuals Impacted (% of Reference Population) for Piles Associated with FOU Mooring System	Potential Adverse Effect on Integrity
153 (0.9% of BNNC SAC)	No (under 5% of population affected)

4.3.4.1.3.2.2 Effective Deterrent Ranges

- 217. The current advice from the UK SNCBs is that an EDR of 20 km (with an area of 1,256.64 km²) for pin piles is used to determine the area that grey seals may be disturbed from in relevant SAC (JNCC, 2025b). Although the Bellrock WFDA is located 152 km from the BNNC SAC, this approach has also been used to consider disturbance. The approach is considered precautionary as not all grey seal within an EDR will be disturbed, however, as a worst-case scenario 100% disturbance of grey seal in the areas has been assumed.
- 218. The estimated number of grey seal and percentage of the BNNC SAC reference population that could be disturbed as a result of underwater noise during piling for the Bellrock Wind Farm Infrastructure is presented in **Table 4.31**. For a single piling event the worst-case would be 0.21% of the BNNC SAC reference population to be at risk of disturbance (**Table 4.31**).
- 219. For two simultaneous piling events the worst-case would be 0.42% of the BNNC SAC reference population to be at risk of disturbance (**Table 4.31**). Note that this does not assume any overlap between disturbance areas from the piling events and is therefore precautionary.

Table 4.31: Assessment of the Potential for Disturbance to Grey Seal Based on the Effective Deterrent Ranges Approach for Pin Piles, for Both a Single and Two Simultaneous Piling Events

EDR	Assessment of Effect	Potential Adverse Effect on Site Integrity
For a single piling event		
20 km for pin piles (1,256.64 km ²)	36 (0.21% of BNNC SAC)	No (under 5% of population affected)
For two simultaneous piling events		
20 km for pin piles (2,513.28 km ²)	71 (0.42% of BNNC SAC)	No (under 5% of population affected)

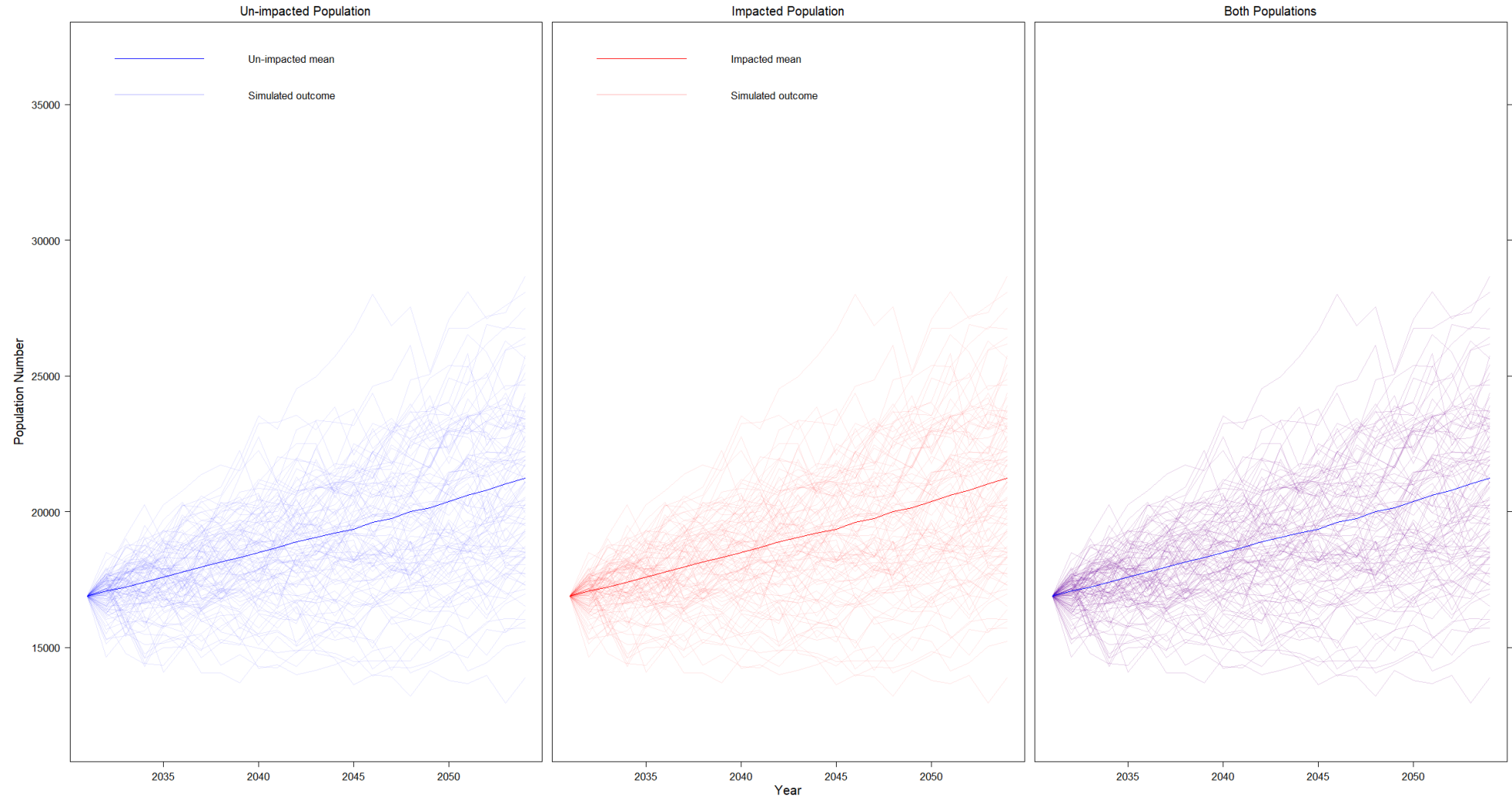
4.3.4.1.3.2.3 Modelled Population Level Consequences due to Disturbance

- 220. Assuming a worst-case of 153 disturbed grey seal (**Table 4.30**) on every piling day, the iPCoD model estimated there to be only the slightest discernible impact on grey seal of the Combined MU population (**Plate 4.2** and **Table 4.32**).
- 221. The results from the effects of piling at the Bellrock WFDA has been presented as mean and median ratios of impacted: unimpacted population sizes (**Table 4.32**). The results show no significant effect across all time points and there is no annual decline over the first six years and the 25-year period for both the population mean and median, the effects of disturbance from underwater noise during piling would have **no adverse effect** on the integrity of the BNNC SAC.

Table 4.32 : Results of the iPCoD Modelling for the Bellrock Wind Farm Development Area, Giving the Mean Population Size for the Grey Seal Population (The Berwickshire And North Northumberland Coast Special Area of Conservation) for Years up to 2056 for Both Impacted and Un-impacted Populations, in Addition to the Mean and Median Ratio Between their Population Sizes

Time Period	Year	Mean			Median			95% Confidence Intervals	
		Un-impacted Population	Impacted Population	Impacted as % of Un-impacted	Un-impacted Population	Impacted Population	Impacted As % of Un-impacted	Un-impacted Population	Impacted Population
1	2031	16,902	16,902	100%	16,902	16,902	100%	16,902 – 16,902	16,902 – 16,902
2	2032	17,083	17,083	100%	17,132	17,132	100%	15,666 – 18,162	15,666 – 18,162
3	2033	17,221	17,221	100%	17,272	17,272	100%	15,434 – 18,668	15,434 – 18,668
7	2037	17,962	17,962	100%	18,019	18,019	100%	14,998 – 20,720	14,998 – 20,720
13	2043	19,062	19,062	100%	19,079	19,079	100%	15,056 – 23,211	15,056 – 23,211
19	2049	20,148	20,148	100%	19,974	19,974	100%	15,270 – 25,599	15,270 – 25,599
26	2056	21,688	21,688	100%	21,287	21,287	100%	15,852 – 29,223	15,852 – 29,223

Plate 4.2 : Simulated Worst-case Grey Seal (BNNC SAC) Population Sizes for Both the Un-impacted and the Impacted Population



4.3.4.1.3.2.4 Behavioural Disturbance Due to Acoustic Deterrent Devices Activation

- 222. Mitigation to reduce the risk of PTS could include activation of ADDs prior to the soft start commencing. The period of time that an ADD is required to be activated for is dependent on the potential PTS ranges for each species, and their known swim speeds, as used within the underwater noise modelling.
- 223. The assessments of the potential disturbance during any ADD activation is indicative only, as the final requirements for mitigation in the MMMP will be determined prior to construction.
- 224. During 30 minutes of ADD activation, grey seals would move at least 3.24 km from the ADD location (based on a precautionary grey seal swimming speed of 1.8 m/s; SNH, 2016), resulting in a potential disturbance area of 20 km². This is further than the maximum instantaneous PTS range for pin piles predicted for grey seals. For pin piles the ADD activation required would be <1 minute to cover the maximum PTS range of 0.07 km.
- 225. As a worst-case, based on an ADD activation time of 30 minutes, up to <1 grey seals (0.0059% of the BNNC SAC population) may be disturbed.
- 226. The ADD activation would ensure grey seals are beyond the maximum impact range for instantaneous PTS due to a single strike of the maximum hammer energy pin piles, as well as from cumulative exposure. This disturbance area would be within the disturbance area due to piling (as assessed above) and therefore would not be an additive effect to grey seals.
- 227. The current advice from the SNCBs is that an EDR of 11 km (with an area of 28.3 km²) for ADD (> 15 min) is used to determine the area that grey seals may be disturbed from in relevant SAC (JNCC, 2025b). Although the Bellrock WFDA is located 154 km from the BNNC SAC, this approach has also been used to consider disturbance. The Approach is considered precautionary as not all grey seal within an EDR will be disturbed, however, as a worst-case scenario 100% disturbance of grey seal in the areas has been assumed.
- 228. The estimated number of grey seals and percentage of the BNNC SAC reference population that could be disturbed as a result of underwater noise during ADD activation using EDRs for the Bellrock WFDA is presented in **Table 4.33**.

Table 4.33: Assessment of the Potential for Disturbance to Grey Seal Based on the Effective Deterrent Ranges Approach for Acoustic Deterrent Devices

EDR	Assessment of Effect	Potential Adverse Effect on Site Integrity
11 km for ADDs (1027.88 km ²)	29 (0.17% of BNNC SAC)	No (under 5% of population affected)

4.3.4.1.3.3 Summary

- 229. Given the small number of individuals affected there would be no significant effect on grey seal from underwater noise during piling and therefore **no adverse effect on the integrity** of the BNNC SAC.

230. Although there is no adverse effect on the integrity of the BNNC SAC as a result of underwater noise during piling, the PNMP will provide mitigation or management measures to further reduce the potential for any auditory injury or disturbance to grey seal from underwater noise and inform the MMMP for piling activity that will further reduce the potential for effect. Mitigation measures and further details are provided in the **Outline MMMP (Volume V)**.

4.3.4.1.4 Impact C4: Underwater Noise from Non-piling Construction Activities

231. The underwater modelling in **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)** provided no PTS impact ranges from non-piling activities for grey seal. This is due to PTS ranges being less than 100 m, indicating grey seal would have to be within very close range at the start of the activity to have any potential exposure to induce PTS. Therefore, PTS for grey seals has not been assessed further.

4.3.4.1.4.1 Behavioural Disturbance

232. Underwater noise as a result of cable laying, cable trenching, and rock placement has the potential to disturb marine mammals (Pirota et al. 2014). Therefore, there is the potential for short, perhaps medium-term behavioural reactions and disturbance to grey seal in the area during trenching/cable installation activity. Grey seals may exhibit varying behavioural reactions intensities as a result of exposure to noise (Southall et al. 2008).
233. As discussed in **Section 4.2.4.1.4.2**, Benhemma-Le Gall et al. (2021), reported a 4 km (50.3 km²) reduction in harbour porpoise presence for other construction activities, including vessels. As harbour porpoise are the most sensitive marine mammal species, this 4 km potential disturbance range has been used for grey seal as a worst-case, in the absence of any other data to inform an assessment.
234. An assessment of the maximum number of individuals that could be at risk of disturbance due to non-piling construction activities is presented in **Table 4.34** for one activity occurring or four non-piling construction activities happening at the same time.

Table 4.34: Assessment of the Potential for Disturbance Due to Other Construction Activities, Including Trenching, Cable Laying, Drilling, and Rock Placement, for One Activity Taking Place at Any One Time for the Bellrock Wind Farm Development Area or Four Activities at the Same Time

Potential Impact	Maximum Number of Individuals (% of Reference Population)	Potential Adverse Effect on Site Integrity
Disturbance for each individual activity		
Cumulative SEL for: <ul style="list-style-type: none"> ▪ Trenching; ▪ Cable laying; ▪ Drilling; and ▪ Rock placement. 	2 (0.012% of the BNNC SAC)	No (under 5% of population affected)
Disturbance for four activities at the same time at the Bellrock WFDA		
Cumulative SEL for: <ul style="list-style-type: none"> ▪ Trenching; ▪ Cable laying; ▪ Drilling; and ▪ Rock placement. 	6 (0.04% of the BNNC SAC)	No (under 5% of population affected)

4.3.4.1.4.2 Summary

235. The population disturbed during other construction activities from underwater noise at the Bellrock WFDA is less than 5% of the BNNC SAC population. Therefore, given the small number of individuals affected there would be **no adverse effect on the integrity** of the BNNC SAC.

4.3.4.1.5 Impact C5: Underwater Noise and Presence from Vessels

236. Site-specific underwater noise modelling was undertaken to determine the potential risk for PTS from underwater noise from the presence of vessels (see **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)** for further information).

237. Predicted PTS impact ranges from vessel noise were estimated to be less than 100 m for grey seal. The noise levels are low enough that grey seal would only be exposed to minimal risk from auditory injury (PTS). Therefore, the assessment will not consider the risk to auditory injury (PTS) any further.

4.3.4.1.5.1 Behavioural Disturbance

238. The assessment on disturbance effects due to construction vessels has been based on the methods described in **Section 4.2.4.1.5**.

239. The assessments are undertaken based on the maximum number of vessels being present at any one time, which is only likely to occur occasionally.

240. The disturbance assessment based on one vessel in the Bellrock WFDA has been presented in **Table 4.35**. Assuming the disturbance caused by 33 vessels within the Bellrock WFDA would not overlap with that of other vessels, the total disturbed area would be 1,609 km². This is significantly larger than the Bellrock WFDA itself, which has a total area of 280 km². Therefore, the actual maximum area of effect would be the Bellrock WFDA plus a 4 km buffer (equating to an area of 657.2 km²), as all vessels would be within the Bellrock WFDA.

Table 4.35: Maximum Number of Grey Seal (and % of Reference Population) that Could be Disturbed as a Result of Underwater Noise Associated with Construction Vessels at the Bellrock Wind Farm Development Area

Maximum Number of Individuals (% of Reference Population) for One Vessel in the Bellrock WFDA at Any One Time	Maximum Number of Individuals (% of Reference Population) for WFDA, Including a 4 km Buffer (657.2 km ²)	Potential Adverse Effect on Site Integrity
2 (0.012% of BNNC SAC)	19 (0.11% of BNNC SAC)	No (under 5% of population affected)

241. Whilst short to medium term behavioural responses have been recorded from disturbance from vessels, there are no long-term or population level effects recorded to date. Less than 5% of the reference population is affected (**Table 4.35**), therefore, it is considered that there would be no significant effect.

4.3.4.1.5.2 Summary

242. The population disturbed by vessel noise during construction activities at the Bellrock WFDA is less than 5% of the BNNC SAC population. Therefore, given the small number of individuals affected there would be **no adverse effect on the integrity** of the BNNC SAC .

4.3.4.1.6 Impact C6: Collision Risk with Vessels

243. During offshore construction, there will be an increase in vessel traffic within the Bellrock WFDA (see **Section 4.2.4.1.5** for further information on vessel numbers). However, seals in and around the Bellrock WFDA and in the wider area would typically be habituated to the presence of vessels. Seals are able to detect and avoid vessels. However, vessel strikes are known to occur, possibly due to distraction whilst foraging and socially interacting, or due to the marine mammals' inquisitive nature (Wilson et al. 2007). Therefore, increased vessel movements, especially those outside recognised vessel routes, can pose an increased risk of vessel collision to marine mammals. Studies have shown that larger vessels are more likely to cause the most severe or lethal injuries, with vessels over 80 m in length causing the most damage to marine mammals (Laist et al. 2001, Keen et al. 2023).

244. The predictability of vessel movements by marine mammals is crucial in minimising the risks posed by vessel traffic (Nowacek et al. 2001) and (Lusseau, 2003; 2006). Reducing vessel speed not only allows more time for marine mammals to move away, but also significantly reduces emitted vessel noise. This reduction in noise enables marine mammals to hear approaching ships and prevents interference with intra-species communication (Leaper, 2019).

245. For grey seals a recent UK telemetry study showed there was no evidence of reduced seal presence as a result of vessel traffic. This was despite distributional overlaps (overlaps were most frequently found within 50 km of the coast) between seal and vessel presence and high cumulative sound levels (Jones et al. 2017). A study of grey seal pupping beaches around Ramsey Island in Pembrokeshire found that disturbance occurred when vessels were closer than 150 m to seal locations (Strong and Morris, 2010).
246. It is anticipated that vessels would follow an agreed indicative transit corridor to the relevant ports, where this retains compliance with the Convention on International Regulations for Preventing Collisions at Sea (COLREGS), to minimise vessel volume in the areas outside of the agreed indicative transit corridor (see the **Outline VMNSP** provided in **Volume V**). Where possible, these will be incorporated within existing vessel routes and hence to areas where harbour porpoise are accustomed to vessels, in order to reduce any increased collision risk. In addition, vessel operators will use best practice to reduce any risk of collisions with harbour porpoise, such as reducing the speed of vessel transits wherever possible.

4.3.4.1.6.1 Summary

247. Grey seal in the relevant study area(s) are likely to be accustomed to vessels or exhibit avoidance behaviours, therefore, increased collision risk due to vessels is unlikely. Additionally, vessel movements would be kept to the minimum number that is required to develop the Wind Farm Infrastructure and the risk will be further reduced with the implementation of the mitigation measures discussed. The VMNSP and EMP will provide a protocol for minimising collision risk of marine mammals with vessels. An **Outline VMNSP** and **Outline EMP** are both provided in **Volume V**.
248. Therefore, there would be minimal increase to collision risk of grey seal and therefore **no adverse effect** on the integrity of the BNNC SAC.

4.3.4.1.7 Impact C7: Changes to Prey Availability

249. Grey seal feed on a variety of prey species and are considered to be opportunistic feeders, feeding on a wide range of prey species and they have relatively large foraging ranges (see **Appendix 9.1: Marine Mammals Technical Report** of the **Bellrock WFDA EIA Report (Volume IV)**).
250. The potential effects on prey species during construction can result from:
- Physical disturbance and temporary habitat loss;
 - Increased suspended sediment and sediment re-deposition;
 - Remobilisation of existing contaminated sediments;
 - Underwater noise and vibration); and
 - Changes in fishing activity.
251. As discussed in the SNS SAC section (**Section 4.2.4.1.7**), **Chapter 8: Fish and Shellfish Ecology** of the **Bellrock WFDA EIA Report (Volume II)** provides an assessment of these impact pathways on the relevant fish and shellfish species and concludes impacts of negligible to minor adverse significance in EIA terms. Any reductions in prey availability would be small scale, localised and

temporary. Effects would be minimal in the context of the amount of similar available habitat in the wider area for prey species.

252. It is also important to note, the Bellrock WFDA is 152 km away from the BNNC SAC, therefore there therefore there are no direct effects on the supporting functions of the SAC.
253. Given the minimal effects on prey resource it is considered highly unlikely that activities in the Bellrock WFDA would result in detectable changes to grey seal populations.

4.3.4.1.7.1 Summary

254. The potential impacts of changes to prey availability are localised and short in duration and minimal in the context of the amount of similar available habitat in the wider area for prey species. Therefore, there will be **no adverse effect** on the integrity of the BNNC SAC due to potential changes in prey availability for grey seal during construction.

4.3.4.1.8 Impact C8: Disturbance at Seal Haul-out Sites

255. The BNNC SAC is located, at closest point, 152 km from Bellrock WFDA. The closest seal haul-out site is Ythan River Mouth which is 120 km from the Bellrock WFDA. Therefore, there would be no effects from construction activities within the Bellrock WFDA, only effects from vessels transiting to and from the Bellrock WFDA.
256. At the present time the construction port has not been confirmed, therefore effects have been considered on a precautionary basis.
257. The number of vessels relating to the construction of the Bellrock Wind Farm Infrastructure is expected to peak at a maximum of 34 vessels. Depending on the ports used, and the vessel routes to and from the Bellrock WFDA, there could be the potential for vessels to pass seal haul-out sites. The vessels transiting to and from the port would use the indicative transit corridors established and endeavour to stay at least 1 km from the coast where this retains compliance with the COLREGs (see the **Outline VMNSP** provided in **Volume V**).
258. Disturbance to seals from vessel noise and presence has been demonstrated to be up to 500 m away at haul-out sites in the UK (Cates and Acevedo-Gutierrez, 2017). However, A study carried out by the SMRU (Paterson et al., 2015) involved a series of controlled disturbance tests at seal haul-out sites. Seal behaviour was recorded via Global Positioning System tags, and it was found that even intense levels of disturbance did not cause seals to abandon their haul-out sites more than what would be considered normal (e.g. seals travelling between sites). The seals were observed to haul-out at nearby sites or to undertake foraging trips in response to the disturbance, but they would later return.
259. Further studies on the effects of disturbance from vessels on hauled-out seals suggest that even with repeated disturbance events severe enough to cause individuals to flee into the water, the likelihood of seals moving to a different haul-out site does not increase. Additionally, this disturbance appears to have little effect on their movements and foraging behaviour (Paterson et al., 2019).

4.3.4.1.8.1 Summary

260. Therefore, due to the evidence of limited behavioural effects from vessel presence near to haul out sites, there would be **no adverse effect** on the integrity of the BNNC SAC to disturbance at seal haul-out sites during construction.
261. Additionally, with construction vessels keeping in line with mitigation set out in **Outline VMNSP (Volume V)** potential disturbance effects will be reduced further.

4.3.4.2 Potential Effects During Operation and Maintenance

4.3.4.2.1 Impact O1: Underwater Noise during Geophysical Surveys

262. Underwater noise generated during the site-investigation surveys may lead to injury and/or disturbance to grey seal during the O&M phase. The worst-case scenario comprises of routine geophysical surveys (such as MBES and SBP) undertaken periodically during the O&M phase. Survey frequency is not fixed and will depend on site conditions. Monitoring is expected to be more frequent during the first five years to confirm cable burial and anchor point stability. Beyond this, the frequency and scope of surveys will be risk-based and informed by the outcomes of early-stage monitoring.
263. The potential impacts from auditory injury (PTS) and disturbance will be the same as those assessed for the construction phase i.e. affecting <1% and <5% of the grey seal population respectively (see **Section 4.3.4.1.2**). Since the injury is assumed to be fully mitigated via designed in measures (detailed in the **Outline MMMP, Volume V**) there is considered to be no residual risk of injury and therefore no population-level effects.

4.3.4.2.1.1 Summary

264. Given the small number of individuals affected there would be no significant effect on grey seal from underwater noise during geophysical survey activities and therefore **no adverse effect on the integrity** of the BNNC SAC.
265. Although there is no adverse effect on the integrity of the SNS SAC as a result of underwater noise during geophysical surveys, the MMMP includes mitigation measures for geophysical surveys that will further reduce the potential for effect. Mitigation measures and further details are provided in the **Outline MMMP (Volume V)**.

4.3.4.2.2 Impact O2: Underwater Noise from Operation and Maintenance Activities

266. The requirements for any potential O&M work, such as additional rock placement or cable re-burial, are currently unknown. However, the work required, and associated effects to grey seal from the BNNC SAC would be less than those during construction.
267. Modelling shows that there is no potential impact from auditory injury (PTS) (see **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)**) and disturbance will be the same as those assessed for the construction phase i.e. affecting <5% of the grey seal population (see **Section 4.3.4.1.4.1**).

4.3.4.2.2.1 Summary

268. The population disturbed by vessel noise during O&M activities at the Bellrock WFDA is less than 5% of the BNNC SAC population. Therefore, given the small number of individuals affected there would be **no adverse effect on the integrity** of the BNNC SAC.

4.3.4.2.3 Impact O3: Underwater Noise and Presence of Vessels

269. The assessment for underwater noise impacts from the presence of vessels during the O&M phase is considered to be the same as that for the construction phase, although to a lesser degree. As per the underwater noise modelling (see **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)**), the noise levels are low enough that grey seal would only be exposed to a minimal risk. This section will not investigate the risk to auditory injury (PTS) any further.

4.3.4.2.3.1 Behavioural Disturbance

270. During O&M, there is the potential for vessels transiting and conducting maintenance activities in the Bellrock WFDA. The number of vessels would be much less than those assessed during construction (**Section 4.2.4.1.5**), currently estimated to be a maximum of 21 vessels on site at any one time. However, it is unlikely that all 21 vessels would be present simultaneously and engaging in noisy activities. The same rationale for disturbance assessment as outlined for construction vessels has been used, noting that this impact is assumed to have a long-term effect, as the vessels will be present throughout the lifetime of the Bellrock Wind Farm Infrastructure.
271. Vessel movements to and from the O&M port (to be decided post-consent) would be incorporated within existing vessel routes where possible. The vessels conducting the maintenance work would be slow moving or stationary at times.
272. The disturbance assessment based on one vessel and the whole of the Bellrock WFDA has been presented in **Table 4.36**.
273. As described in **Section 4.2.4.1.5**, assuming that grey seal are within 4 km of a vessel, would be disturbed from the entire area, is very precautionary as marine mammals have been observed in and around OWFs during O&M activities (e.g. Lindeboom et al. 2011, Marine Scotland, 2012, McConnell et al. 2012 and Scheidat et al. 2011). In addition, It is unlikely all vessels would be present in the Bellrock WFDA at the same time and this has been assessed as a precautionary worst-case.
274. Less than 5% of the reference population is affected (**Table 4.36**), therefore, it is considered that there would be no significant effect.

Table 4.36: Maximum Number of Individuals (and % of Reference Population) that Could be Disturbed as a Result of Underwater Noise Associated with Operation and Maintenance Vessels at the Bellrock Wind Farm Development Area

Maximum Number of Individuals (% of Reference Population) for Any One Vessel in the Bellrock WFDA at Any One Time	Maximum Number of Individuals (% of Reference Population) for Bellrock WFDA, Including a 4 km Buffer (657.2 km ²)	Potential Adverse Effect on Site Integrity
6 (0.04% of BNNC MU)	19 (0.11% of BNNC MU)	No (under 5% of population affected)

4.3.4.2.3.2 Summary

275. Given the small number of individuals affected there would be no significant effect on grey seal from underwater noise from the presence of vessels during the O&M phase and therefore **no adverse effect on the integrity** of the BNNC SAC.

4.3.4.2.4 Impact O4: Underwater Noise from Operational WTGs and Moorings on the Seabed

276. The semi-qualitative assessment provided in **Appendix 9.2: Underwater Noise Modelling Report** of the **Bellrock WFDA EIA Report (Volume IV)** predicted operational noise levels from FOU's and mooring lines are below any PTS or injury criteria for grey seal. Further information is presented in **Section 4.2.4.2.4** for harbour porpoise, however the same conclusions can be applied to grey seal. The impact is predicted to be of local spatial extent, the effect of injury, which is highly unlikely to occur, would be low (PTS) and reversible and therefore, population level effects are highly unlikely to occur.

277. For disturbance, the impact (elevated underwater noise from FOU's and mooring lines) is predicted to be of a local spatial extent. Available evidence indicates that there is no lasting disturbance or exclusion of seals around OWF sites during operation (Diederichs et al. 2008, Lindeboom et al. 2011, Marine Scotland, 2012, Russell and McConnell, 2014). Data collected suggests that any behavioural responses for seals may only occur within a few hundred metres of an OWF (McConnell et al. 2012) and (Tougaard et al. 2009a). Monitoring studies at Nysted and Rødsand have also indicated that O&M activities have had no impact on regional seal populations (Teilmann et al. 2006, McConnell et al. 2012). Seals have been shown to forage within operational OWFs (Lindeboom et al. 2011, Russell and McConnell, 2014), indicating no restriction to movements in operational OWF sites. Aerial surveys of the adjacent seal haul-out sites conducted in the first few months of operation of the Nysted Wind Farm revealed that seals moved between the haul-out sites with the operating wind turbines having no effect on seal movements (Teilman et al. 2004).

278. Although noise levels are likely to be audible to grey seal, animals are unlikely to experience behavioural disturbance including displacement as a result of the increased underwater noise during the O&M phase.

4.3.4.2.4.1 Summary

279. There would be **no adverse effect** on the integrity of the BNNC SAC due to auditory injury (PTS) or disturbance of grey seal from operational wind turbine noise.

4.3.4.2.5 Impact O5: Collision Risk with Vessels

280. During the O&M phase, the maximum number of vessels that could be present in the Bellrock WFDA at any one time has been estimated as 21 vessels. The number, type and size of vessels would vary, depending on the activities taking place at any one time and are typically slow moving or stationary.
281. The increased risk of grey seal collision with O&M vessels would be the same or less than what was assessed for the construction period (**Section 4.3.4.1.6**), given the number of vessels required would be lower.
282. Given the existing levels of marine traffic, as outlined in **Chapter 12: Shipping and Navigation** of the **Bellrock WFDA EIA Report (Volume II)**, grey seal in and around the Bellrock WFDA would typically be habituated to the presence of vessels and would be able to detect and avoid vessels.
283. In addition, it is anticipated that vessels would follow an agreed indicative transit corridor to the relevant ports, where this retains compliance with the COLREGS, to minimise vessel volume in the areas outside of the agreed indicative transit corridor (see the **Outline VMNSP** and **Outline EMP** provided in **Volume V**). Where possible, these will be incorporated within existing vessel routes and hence to areas where grey seal are accustomed to vessels, in order to reduce any increased collision risk. In addition, vessel operators will use best practice to reduce any risk of collisions with grey seal, such as reducing the speed of vessel transits wherever possible.

4.3.4.2.5.1 Summary

284. There would be **no adverse effect on the integrity** of the BNNC SAC due to the potential collision risk with O&M vessels on for grey seal.

4.3.4.2.6 Impact O6: Secondary Entanglement

285. Given the background information presented in **Section 4.2.4.2.6** and **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)**, Pinnipeds (such as grey seal) are considered to be at a low risk of inadvertently becoming entangled in moorings and IACs associated with wind farm infrastructure (Benjamins et al. 2014). This is due to their advanced hearing which would allow them to detect any noise from cables (such as 'bangs', 'creaks', 'rattle', 'snapping' or 'pinging') as described in Burns et al. (2022). Pinnipeds also possess acute mechanosensitivity through their vibrissae or whiskers which may allow them to detect wakes formed downstream of a mooring or cable (Dehnhardt et al. 2001, Hanke et al. 2013). As such, grey seal is deemed to have some resilience to entanglement, largely due to avoidance behaviour.
286. The potential risk of secondary entanglement for grey seal is considered to be sufficiently reduced with the application of the designed in mitigation measures (e.g. routine surveys of the moorings and dynamic cabling). This, combined with the consideration with the potential for avoidance behaviour, supports the conclusion that population-level effects on grey seal are highly unlikely.

4.3.4.2.6.1 Summary

287. There would therefore be **no adverse effect** on the integrity of the BNNC SAC due to the effects of secondary entanglement on grey seal.

4.3.4.2.7 Impact O7: Changes to Prey Availability

288. Any impacts on prey species have the potential to indirectly affect mammals (see **Section 4.2.4.2.7**). The effects upon prey during the O&M phase of the Bellrock Wind Farm Infrastructure are likely to be the same or less than those assessed for construction (see **Section 4.3.4.1.7**) as there will be less activity and limited underwater noise effects. Given the minimal effects on prey resource it is considered highly unlikely that activities in the Bellrock WFDA would result in detectable changes to grey seal populations.

4.3.4.2.7.1 Summary

289. The effects arising during the O&M phase of the Bellrock Wind Farm Infrastructure are likely to be the same or less than those assessed for construction. Therefore, there will be **no adverse effect on the integrity** of the BNNC SAC due to potential changes in prey availability for grey seal during the O&M phase.

4.3.4.2.8 Impact O8: Disturbance at Seal Haul-out Sites

290. The closest seal haul-out sites are listed in **Appendix 9.1: Marine Mammals Technical Report** of the **Bellrock WFDA EIA Report (Volume IV)**. As the closest haul out is Ythan River Mouth which is 120 km from the Bellrock WFDA, there would be no effects from O&M activities within the Bellrock WFDA, only effects from vessels transiting to and from the Bellrock WFDA.

291. At the present time the O&M port has not been confirmed, therefore effects have been considered on a precautionary basis.

292. The annual vessel traffic that could potentially be passing seal haul-out sites during the O&M phase is projected to be lower than that during the construction period, with a maximum total number of 211 round trips per year during O&M. As discussed in **Section 4.3.4.1.8**, disturbance to seals from vessel noise and presence has been demonstrated to be up to 500 m away from haul-out sites. However, even intense levels of disturbance did not cause seals to abandon their haul-out sites and seals were found to return after disturbance ceased, see **Section 4.3.4.1.8**.

293. Additionally, vessels transiting to and from the port would follow good practice measures to minimise interactions with marine wildlife and use the indicative transit corridors established and endeavour to stay at least 1 km from the coast where this retains compliance with the COLREGs (see the **Outline VMNSP** provided in **Volume V**).

4.3.4.2.8.1 Summary

294. Therefore, there would be **no adverse effect** on the integrity of the BNNC SAC in relation to the conservation objectives for grey seal due to disturbance at seal haul-out sites during the O&M phase.

4.3.4.3 Potential Effects During Decommissioning

295. Information regarding decommissioning and its effects is presented in **Section 4.2.4.3**.
296. No decision has been made regarding the final decommissioning strategy for the offshore infrastructure at the Bellrock WFDA, as it is recognised that regulatory requirements and industry best practice change over time.
297. Whilst a detailed assessment of decommissioning impacts cannot be undertaken at this stage, for this assessment, it is assumed overall that decommissioning effects will be similar those of construction (i.e. any activities are likely to occur within the temporary construction working areas and require no greater amount or duration of activity than assessed for construction) albeit some effects will be greatly reduced (such as those related to underwater noise) .

4.3.4.3.1.1 Summary

298. The potential effects on grey seal during decommissioning are assumed to be the same or less than those assessed for construction, with key differences being the potential for underwater noise effects with the absence of piling or UXO clearance. Therefore, there would be **no adverse effect** on the integrity of the BNNC SAC due to the effects of decommissioning activities on grey seal.

4.3.4.4 Summary of Potential Effects on Site Integrity for Grey Seal in The Berwickshire and North Northumberland Coast Special Area of Conservation

299. There would be **no adverse effect on integrity** of the BNNC SAC in relation any of the effects upon grey seal considered above during construction, O&M or decommissioning.
300. Additionally, the **Outline MMMP (Volume V)** based on the information in the PNMP will provide mitigation or management measures to further reduce the potential for any auditory injury or disturbance to grey seal from underwater noise.
301. The **Outline VMNSP (Volume V)** details measures relating to vessel management and coordination which will be applied during the construction and O&M phases. These measures will further reduce potential collision risk and disturbance to seal haul-out site effects.
302. In order to further reduce the risk of any potential secondary entanglement the final O&M Plan also incorporates monitoring measures.

5 In-combination

5.1 Southern North Sea Special Area of Conservation

304. The following in-combination assessment has been undertaken based on findings of the Cumulative Effects Assessment (CEA) Screening process (the Bellrock WFDA EIA Report **Appendix 9.4: Marine Mammals Cumulative Effects Assessment Screening (Volume IV)**), and the results of the CEA (Section 9.9 of **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)**).
305. The in-combination assessment considers other plans and projects where the predicted effects have the potential to combine with the potential effects during construction of the Bellrock WFDA. The construction phase has been assessed as the worst-case for potential in-combination effects.
306. The schemes screened into the in-combination assessment for harbour porpoise are those that are located in the NS MU. Full information on the screening of effects considered for the in-combination assessment is provided in the **Appendix 9.4: Marine Mammals Cumulative Effects Assessment Screening** of the **Bellrock WFDA EIA Report (Volume IV)**.
307. The in-combination effects assessed are outlined in **Section 3.1.3**.

5.1.1 In-combination Impact 1: Auditory Injury and Behavioural Impacts from Underwater Noise

308. The mitigation measures agreed through the MMMP for piling would reduce the risk of physical injury or permanent auditory injury (PTS) in harbour porpoise. In light of this, and taking account of the type, scale and extent of potential effects arising from the Bellrock WFDA assessment, PTS is not considered further (see **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)**).
309. It is intended that assessing the potential effects of disturbance from underwater noise will reduce some of the uncertainties and complications in using the different assessments from HRAs, based on different noise models, thresholds and criteria, as well as different approaches to density estimates.
310. The greatest potential noise sources during the Bellrock Wind Farm Infrastructure construction, O&M or decommissioning phases is from pile driving. Therefore, the in-combination assessment applies the potential disturbance of harbour porpoise during piling for the Bellrock Wind Farm Infrastructure together with activities associated with other plans and projects. As piling for the Bellrock Wind Farm Infrastructure will not overlap with the SNS SAC, this assessment against the SNS SAC summer spatial and seasonal thresholds are not required, and only an assessment against the NS MU is undertaken.

5.1.1.1 In-combination Impact 1a: Indicative Assessment of Underwater Noise Impacts from Clearance of UXOs at Other OWFs

311. There is the potential for in-combination impacts from clearance of UXOs in the construction phase of the Bellrock Wind Farm Infrastructure and other plans and projects. For the purposes of this assessment, this potential impact has been assessed using the tiered approach outlined in Section 9.4.2 in **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)**.
312. Given the vast extent of available habitat, the fact that marine mammals are wide-ranging species and the low percentage of the population disturbed as a result of UXO clearance at respective projects, the likelihood of in-combination impacts with projects located at large distances (e.g. >100 km) from the Bellrock WFDA is considered to be low. There were seven projects within 100 km identified with potential for in-combination effects associated with this impact:
- Aspen OWF;
 - Bellrock OFTDA;
 - Berwick Bank OWF;
 - Cenos OWF;
 - Morven OWF;
 - Muir Mhòr OWF; and
 - Ossian OWF.
313. Projects screened in for this in-combination assessment are expected to involve similar construction activities to those described for the Bellrock WFDA, including UXO clearance activities. It is anticipated that, for all projects, impacts associated with these activities will also require additional assessment under EPS licensing. Three of the projects listed above have submitted an EIA, with the Bellrock OFTDA not having submitted but will be associated with the Bellrock WFDA and therefore has the same maximum UXO size assessed.
314. **Table 5.1** presents the assumptions presented in the assessments for the in-combination projects. Note that in all cases although low order clearance is the default option, high order detonation has been included as the worst-case as this may be unable to be avoided.

Table 5.1: Unexploded Ordnance Clearance Parameters for the Bellrock Wind Farm Development Area and Other Projects

Project	UXO Clearance Method	Maximum UXO Size
Aspen OWF	High order detonation	907 kg
Bellrock WFDA	High order detonation	750 kg
Bellrock OFTDA ¹	High order detonation	
Berwick Bank OWF	High order detonation	300 kg
Ossian OWF	High order detonation	698 kg
Muir Mhòr OWF	High order detonation	750 kg
Cenos	High order detonation	227 kg

Project	UXO Clearance Method	Maximum UXO Size
<p>Notes:</p> <p>¹ Bellrock WFDA charge size has been used as worst-case due to limited information currently for the Bellrock OfTDA and because there is a geographical overlap with the WFDA.</p>		

5.1.1.1.1 Disturbance

- 315. It was not possible to estimate the number of potential UXO clearance events that could be undertaken at the same time as construction and potential piling activity at the Bellrock WFDA as there are no current licence that overlap with the Project. As such an indicative assessment has been undertaken to consider the worst case scenario.
- 316. An assessment of potential disturbance arising from UXO clearances at the Bellrock WFDA can be found in **Appendix 9.3: Marine Mammals Unexploded Ordnance Assessment** of the **Bellrock WFDA EIA Report (Volume IV)**. A separate Marine Licence application for any required UXO clearance for the Bellrock WFDA would be submitted prior to any planned activities and would consider any potential in-combination effects.
- 317. Mitigation measures required for UXO clearance include the use of low-order clearance techniques, which could include a small donor charge, rather than full high-order detonation which is only used as a last resort. It is therefore highly unlikely that more than one UXO high-order detonation would occur at exactly the same time or on the same day as another UXO high-order detonation, even if they had overlapping UXO clearance operation durations.
- 318. The assessment is therefore based on potential for disturbance from one UXO high-order detonation (worst-case), as well as one low-order clearance event. JNCC guidance refers to the preference of using low-order deflagration, thus this is carried forward in the assessment below, in combination with piling at the Bellrock WFDA (JNCC, 2025a). The likelihood of this and temporal overlap with UXO clearance and piling for the Bellrock Wind Farm Infrastructure (as the worst case scenario) happening concurrently is low.
- 319. The potential disturbance from UXO clearance has been estimated based on the following shown in **Section 4.3.4.1.1** and **Appendix 9.3: Marine Mammals Unexploded Ordnance Assessment** of the **Bellrock WFDA EIA Report (Volume IV)**.
- 320. The potential impact area of 1,256.64 km² per project for harbour porpoises, based on 20 km EDR for unmitigated UXO high-order detonation, and 78.54 km² for low-order detonation, following the current SNCB guidance for the assessment of impact to harbour porpoise in the Southern NS SAC (JNCC, 2025a) guidance (**Table 5.2**).

Table 5.2: Quantified In-combination Assessment for the Potential Disturbance of Harbour Porpoise at a Single Point in Time During Unexploded Ordnance Clearance at Offshore Wind Farm Projects and Piling at the Bellrock WFDA

Project	Harbour Porpoise Density (/km ²)	Impact Area (km ²)	Maximum Number of Individuals Potentially Disturbance at Single Point in Time
Bellrock WFDA - Piling	1.273	DRC	8,554
Disturbance from high-order UXO clearance	0.599*	1,256.64	753
Disturbance from low-order UXO clearance	0.599*	78.54	48
Total number of harbour porpoise (without the Bellrock WFDA)			9,355
			801
Percentage of NS MU (without the Bellrock WFDA)			2.7%
			0.23%
Notes: * Density from SCANS-IV block NS-D.			

321. As outlined in the BEIS (2020) the Review of Consents (RoC) HRA for the SNS SAC, due to the nature of the sound arising from the detonation of UXO (i.e. each blast lasting for a very short duration), harbour porpoise were not predicted to be significantly displaced from an area. Any changes in behaviour, if they occur, would be an instantaneous response and short-term. Existing guidance suggested that disturbance behaviour was not predicted to occur from UXO clearance, if undertaken over a short period of time (JNCC, 2025a).

322. Mitigation measures required for UXO clearance include the use of low-order clearance techniques as the default method, which could include a small donor charge, rather than full high-order clearance, which is only used as a last resort. There is also the potential under the new policy that for any high-order clearance to use noise abatement measures which would further reduce the impact (UK Government et al., 2025).

5.1.1.1.2 Summary

323. Therefore, there is **no adverse effect** on the integrity of the SNS SAC as a result of underwater noise generated during UXO clearance from other plans and projects in-combination with the Bellrock Wind Farm Infrastructure during any phase of the Project.

5.1.1.2 In-combination Impact 1b: Indicative Assessment of Underwater Noise Impacts from Geophysical Surveys at Other OWFs

324. There is the potential for in-combination impacts from geophysical surveys in the construction and O&M phases of the Bellrock WFDA and other plans and projects. For the purposes of this assessment, this potential impact has been assessed using the tiered approach outlined in Section 2.3 of the **RIAA Part 1: Introductory Chapters**.
325. Four projects were identified with potential for cumulative effects associated with this impact within a 50 km buffer of the Bellrock WFDA, within the marine mammal study area:
- Bellrock OfTDA;
 - Cedar OWF;
 - Ossian OWF; and
 - Morven OWF.
326. Of the four projects within 50 km, only Ossian has submitted an EIA, with the other two having submitted a scoping report and the Bellrock OfTDA being at site selection stage. Therefore, there is uncertainty of the final design and location details of the projects, and it is not possible to provide a quantitative assessment of the impact from site-investigation surveys for all of them. It can be reasonably assumed the extent of the impacts for the project are expected to be similar to those of the Bellrock WFDA. Whilst the geographical location of the survey areas will differ, the extent of the disturbance per survey equipment at any one point will likely be very similar. As there are no current geophysical survey applications that overlap with the Bellrock WFDA construction timeline an indicative assessment has been undertaken to consider the worst case scenario.
327. There was no species or SAC specific information available for any of the projects identified for in-combination affects for this impact, therefore all Tiers have been addressed here (for further information on Tiers, see Section 3.8 of the **RIAA Part 1: Introductory Chapters**).
328. Geophysical surveys are expected to be short term in nature and occur intermittently. In addition, this potential impact is considered reversible, with animals returning to baseline levels shortly after surveys have ceased. For the Bellrock WFDA, the worst-case disturbance range for geophysical surveys was estimated as 3.77 km for SBP activity (see **Table 4.5**). The current advice from the UK SNCBs is that an EDR of 3 km (with an area of 28.3 km²) for SBP (all types) is used to determine the area that harbour porpoise may be disturbed from in relevant SACs (JNCC, 2025b). This is lower than that of the disturbance range as shown in **Table 4.6** of 3.77 km.
329. Therefore, the potential for in-combination effects is reduced, particularly for projects that are tens of kilometres away from the Bellrock WFDA. In-combination behavioural disturbance ranges are therefore highly unlikely to overlap with the SNS SAC, which is a minimum of 154 km southeast from the Bellrock WFDA.
330. The estimated number of harbour porpoise and percentage of the NS MU reference population that could be disturbed as a result of underwater noise during geophysical surveys (SBPs) for the Bellrock WFDA is presented in **Table 4.7**. It is difficult to determine what the potential area of effect would be when taking into account geophysical surveys as a moving source (and it is difficult to

predict how far a vessel may survey in a day). Based on survey vessels travelling at a speed of 4.5 to 5 kt, up to 199 km could be surveyed in one day. However, this does not take into account the survey downtime for line changes, weather, or other technical reasons. Approximately only 52% of the surveying time was spent surveying, as per a review of seismic surveys within the UK (BEIS, 2020). These assumptions have been applied to geophysical surveys due to their similarity in approach. Taking these into account, then up to 103.5 km could be surveyed in one day by one geophysical survey vessel.

331. Based on the potential disturbance range of using 3.77 km and the worst-case scenario of two geophysical surveys (one geophysical survey area including turning area utilising the 103.5 km distance and a 3.77 km buffer = 825.04 km²; **Table 5.3**) coinciding with piling activities on the Bellrock WFDA, less than 3% of the harbour porpoise reference population could be temporarily disturbed (**Table 5.3**).

Table 5.3: Impact area of Geophysical Surveys Calculated for the Marine Mammal Species in the Study Areas

Survey Length	Disturbance Buffer (km)	Total Area of One Geophysical Survey Including Turning Area (km ²)	Total Area of Two Geophysical Surveys Including Turning Area (km ²)
103.5 km	3.77	825.04	1,650.08

Table 5.4: Indicative Quantified Cumulative Effects Assessment for the Potential Disturbance of Harbour Porpoise During Geophysical Surveys at Offshore Wind Farm Projects

Project	Harbour Porpoise Density (/km ²)	Impact Area (km ²)	Maximum Number of Individuals Potentially Disturbance at Single Point in time
Bellrock WFDA - Piling	1.273	DRC	8,554
Disturbance from two geophysical surveys	0.599*	1,650.08	988
Total number of harbour porpoise (without the Bellrock WFDA)			9,542
			988
Percentage of NS MU (without the Bellrock WFDA)			2.8%
			0.3%
Notes:			
* Density from SCANS-IV block NS-D.			

5.1.1.2.1 Summary

332. Therefore, there is **no adverse effect** on the integrity of the SNS SAC as a result of disturbance due to geophysical surveys from other plans and projects in-combination with the Bellrock WFDA during any phase of the Project.
333. For construction and O&M activities, it is likely that all projects will also include a MMMP and follow relevant guidance as a mitigation measure, similar to that adopted for the Bellrock WFDA. As such, and in consideration of the potential incorporated measures in a MMMP and guidance, population-level effects associated with this potential impact are unlikely for the harbour porpoise feature of the SNS SAC.

5.1.1.3 In-combination Impact 1c: Assessment of Underwater Noise Impacts from Non-piling Construction Activities at Other OWFs

334. All OWFs with construction dates that have the potential to overlap with the construction window and are within the NS MU for the Bellrock WFDA have the potential for in-combination effects.
335. Construction activities (such as seabed preparation including sand wave levelling, slope levelling, boulder clearance, pre-lay grapnel run (PLGR), cable installation and protection) could occur at the same time as piling activities at Bellrock WFDA. Projects where piling overlap was considered have not been included in regard to other construction noise as piling is the worst-case even though other construction activities may be taking place at the same time.
336. OWFs screened in for other construction activities that could have potential in-combination impacts with piling at the Bellrock WFDA were (see **Appendix 9.4: Marine Mammals Cumulative Effects Assessment Screening** of the **Bellrock WFDA EIA Report (Volume IV)** for details of projects considered):
- Aspen;
 - Bellrock OfTDA;
 - Berwick Bank;
 - Bowdun;
 - Cedar;
 - Morven; and
 - Seagreen Phase 1a.
337. During the construction of the Bellrock WFDA, there is the potential for overlap with impacts from non-piling construction activities at other OWFs. Noise sources which could cause potential disturbance impacts during OWF construction activities, other than pile driving, can include vessels, mooring installation, seabed preparation including sand wave levelling, slope levelling, boulder clearance, PLGR, cable installation works and rock placement.
338. Based on the Bellrock Wind Farm Infrastructure-alone assessments of auditory injury and disturbance from non-piling construction activities in **Section 4.2.4.1.4**, the impact and disturbance ranges are significantly lower than those for piling. The expected effect, from construction activities ongoing at potentially eight different projects would be confined to the immediate vicinity of the noise source.

- 339. For other projects, the potential impact area for harbour porpoise applied was based on the worst-case disturbance range of 4 km (50.27 km²) for non-piling construction activities (Benhemma-Le Gall et al. 2021).
- 340. For all OWFs that could be constructing at the same time as piling at the Bellrock WFDA, the potential of the temporary effect was less than 5% of the reference population (**Table 5.5**). This was considered precautionary given the limited and intermittent duration of piling activities at the Bellrock WFDA.

Table 5.5: Quantified Cumulative Effects Assessment for the Potential Disturbance at a Single Point in Time of Harbour Porpoise during the other Construction Activities at Offshore Wind Farm Projects at the Same Time as Piling at the Bellrock Wind Farm Development Area

Project	Harbour porpoise Density (/km ²)	Impact Area (km ²)	Maximum Number of Individuals Potentially Disturbance at Single Point in Time
Bellrock WFDA - Piling	1.273	DRC	8,554
Aspen	0.5444	50.27	26
Bellrock OfTDA	0.5985		31
Berwick Bank	0.826		42
Bowdun	0.5985		31
Cedar	0.5985		31
Morven	0.5985		31
Seagreen Phase 1a	0.5985		31
Total number of harbour porpoise (without the Bellrock WFDA)			8,777
			223
Percentage of NS MU (without the Bellrock WFDA)			2.53%
			0.06%

5.1.1.3.1 Summary

- 341. Therefore, there is **no adverse effect** on the integrity of the SNS SAC as a result of disturbance from underwater noise due to non-piling construction activities with other plans and projects in combination with the Bellrock WFDA during any phase of the Project.

5.1.1.4 In-combination Impact 1d: Assessment of Underwater Noise from Other Industries and Activities

342. There is the potential for disturbance to harbour porpoise associated with other potential noise sources alongside the Bellrock WFDA including:
- UXO Clearance (assessed above see **Section 5.1.1.1**);
 - Geophysical surveys (assessed above see **Section 5.1.1.2**);
 - Aggregate extraction and dredging; and
 - Seismic surveys.
343. For the installation of oil and gas infrastructure, marine renewable schemes, coastal developments, gas storage, offshore mining, carbon capture and storage, and disposal sites, all potential schemes have been screened out. Further information on the CEA screening (and these results) is provided in **Appendix 9.4: Marine Mammals CEA Screening of the Bellrock WFDA EIA Report (Volume IV)**.

5.1.1.4.1 *Disturbance from Aggregate Extraction and Dredging*

344. Three aggregate/dredging projects have been screened in that could have potential in-combination disturbance impacts with piling taking place at the Bellrock WFDA (see **Appendix 9.4: Marine Mammals CEA Screening of the Bellrock WFDA EIA Report (Volume IV)**):
- Inner Dowsing 481/1-2;
 - West Bassurelle 458; and
 - West Bassurelle 464.
345. Taking into account the small potential impact ranges and the distances of the aggregate extraction and dredging projects from the Bellrock WFDA, the potential for contribution to in-combination effects is very small. As outlined in the BEIS (2020) RoC HRA for the SNS SAC, studies have indicated that harbour porpoise may be displaced by dredging operations within 600 m of the activities (Diederichs et al. 2010). This would result in a potential disturbance area of 1.13 km² for each project, or up to 2.26 km² for two aggregate projects.
346. The Inner Dowsing aggregate/dredging project lies on the East coast of England, near Lincolnshire and the other two aggregate/dredging projects lie next to each other in the English Channel. To represent the animals disturbed, the densities from SCANS-IV block NS-C were used for Inner Dowsing and block NS-A for the two West Bassurelle projects. This was the best available data for this area.
347. For the potential for in-combination disturbance from aggregate and dredging schemes undertaken at the same time as construction of Bellrock WFDA, with no other in-combination activities, up to 2.47% of the NS MU population may be disturbed (**Table 5.6**).

348. None of the screened in aggregate schemes are within (or within 600 m) the summer area of the SNS SAC. Therefore, an assessment against the spatial and seasonal thresholds has not been undertaken.

Table 5.6: Quantitative Assessment for In-combination Disturbance of Harbour Porpoise Due to Aggregate and Dredging Schemes

Project	Species Density (/km ²)	Impact Area (km ²)	Maximum Number of Individuals Potentially Disturbance at Single Point in Time
Bellrock WFDA - Piling	1.273	1,256.64	8,554
Inner Dowsing 481/1-2	0.6027	2.26	<2
West Bassurelle 458	0.1045		<1
West Bassurelle 464			<1
Total number of harbour porpoise (without the Bellrock WFDA)			8,558
			4
Percentage of NS MU (without the Bellrock WFDA)			2.47%
			<0.01%

5.1.1.4.2 Summary

349. Therefore, there is **no adverse effect** on the integrity of the SNS SAC as a result of disturbance from underwater noise due to aggregate and dredging schemes in-combination with the Bellrock WFDA during any phase of the Project.

5.1.1.4.3 Disturbance from Seismic Surveys

350. It was not possible to estimate the location, or number, of potential seismic surveys that could be undertaken at the same time as construction and potential piling activity for the Bellrock Wind Farm Infrastructure.

351. As a precautionary approach, the potential for cumulative impacts from seismic surveys has been screened into the CEA for further consideration. It was assumed, as a worst-case scenario, that there could potentially be two seismic surveys in the NS at any one time during construction (piling) in the Bellrock WFDA. To date, it is unknown how many other licences or licence applications with an overlapping time period with Bellrock Wind Farm Infrastructure construction. Therefore, the following indicative assessment for two seismic surveys has been included for information at this stage.

352. Seismic surveys are a moving source, travelling up to 199 km in one day (based on a speed of 4.5 knots), of which 52% (103.5 km) is active survey time (BEIS, 2020). **Table 5.7** summarises the total impact area for harbour porpoise, taking into account the recommended disturbance ranges, based on the potential impact area using a 10 km EDR and the worst-case scenario of two seismic

surveys (survey area including turning area utilising the 103.5 km distance and a 10 km buffer = 2,384.16km²) coinciding with piling activities on the Bellrock WFDA.

353. It must be noted that this approach was highly precautionary as it is unlikely that the whole seismic survey transect area would cause disturbance to harbour porpoise, as animals would return once the vessel had passed, and the disturbance had ceased.

Table 5.7: Impact area of Seismic Surveys Calculated for the Marine Mammal Species in the Study Areas

Survey Length	Disturbance Buffer (km)	Total Area of One Seismic Survey Including Turning Area (km ²)	Total Area of Two Seismic Surveys Including Turning Area (km ²)
103.5 km	10 EDR	2,384.16	4,768.32

354. For two seismic surveys, undertaken at the same time as construction of the Bellrock Wind Farm Infrastructure, up to 3.29% of the NS MU population may be disturbed (**Table 5.8**).

Table 5.8: Quantitative Assessment for In-combination Disturbance of Harbour Porpoise Due to up to Two Seismic Surveys

Project	Harbour Porpoise Density (/km ²)	Impact Area (km ²)	Maximum Number of Individuals Potentially Disturbance at Single Point in Time
Bellrock WFDA - Piling	1.273	DRC	8,554
Disturbance from two seismic surveys	0.599	4,768.32	2,856
Total number of harbour porpoise (without the Bellrock WFDA)			11,410
			2,856
Percentage of NS MU (without the Bellrock WFDA)			3.29%
			0.82%

5.1.1.4.4 Summary

355. Therefore, there is **no adverse effect** on the integrity of the SNS SAC as a result of disturbance from underwater noise due to seismic surveys activities from other plans and projects in-combination with the Bellrock WFDA during any phase of the Project.

5.1.1.5 Combined Disturbance from Underwater Noise from All Other Industries and Activities

356. Each of the above described noise sources (considered in **Section 5.1.1.1** to **Section 5.1.1.4**) are brought together in **Table 5.9**.

Table 5.9: Quantitative Assessment for All Noisy Activities with the Potential for In-combination Disturbance Effects for Harbour Porpoise

Activity	Maximum Number of Individuals Potentially Disturbed (% of Reference Population)
Worst-case disturbance from the Bellrock WFDA (Piling)	8,554
UXO clearance	<i>801</i>
Geophysical surveys	<i>988</i>
Construction activities at other OWFs (excluding piling)	223
Aggregates and dredging	4
Seismic surveys	2,856
Total number of individuals	13,426
<i>(without indicative activities)</i>	<i>8,781</i>
Percentage of MU	3.9%
<i>(without indicative activities)</i>	<i>2.5%</i>
Notes: Numbers in italics refers to activities where calculations are indicative.	

357. For harbour porpoise, for noisy activities with the potential for in-combination disturbance effects together with piling at the Bellrock WFDA, (assessed as the worst case scenario for the Bellrock WFDA) or up to 3.9% of the population is at risk of disturbance (based on the full quantitative assessment).
358. Less than 5% of the reference population could potentially be disturbed, therefore, there would be **no adverse effect** on integrity of the SNS SAC in relation to harbour porpoise, either alone or when in-combination with other schemes against the NS MU population. It is important to note that this is very precautionary, as it is unlikely that all other activities would be taking place at exactly the same time as construction for the Bellrock Wind Farm Infrastructure.
359. Although no adverse effect is assessed, the **Outline MMMP (Volume V)** will include the potential for noise reduction methods based on the PNMP and final project design.
360. Behavioural effects from UXO clearance, if they occur, would be an instantaneous response and short-term. Guidance suggests that disturbance behaviour is not predicted to occur from UXO clearance if undertaken over a short period of time (JNCC, 2025a) and therefore could be excluded from the total.

361. Mitigation measures required for UXO clearance include the use of low-order clearance techniques, which could include a small donor charge, rather than full high-order detonation which is only used as a last resort. It is therefore highly unlikely that more than one UXO high-order detonation would occur at exactly the same time or on the same day as another UXO high-order detonation, even if they had overlapping UXO clearance operation durations. The in-combination is therefore based on potential for disturbance from one UXO high-order detonation without mitigation (worst-case), as well as one low-order clearance event.

362. It should be noted that while the schemes included within the in-combination assessment for disturbance from other plans and projects were included based on the current knowledge of their possible construction or activity windows, it is very unlikely that all activities would be taking place on the same day or in the same season. Therefore, this likely represents an over-precautionary and worst-case estimate of the harbour porpoise that could be at risk of disturbance during the offshore construction period of the Bellrock Wind Farm Infrastructure.

5.1.1.5.1 Summary

363. In conclusion, there would be **no adverse effect** on the integrity of the SNS SAC due to in-combination disturbance effects of underwater noise on harbour porpoise from all other industries and activities in-combination with the Bellrock Wind Farm Infrastructure during any phase of the Bellrock WFDA.

5.1.1.6 In-combination Impact 1e: Assessment of Disturbance from Operational Offshore Developments

364. This in-combination assessment considered disturbance effects from operational developments associated with wind, wave or tidal projects on the SNS SAC. Plans and projects that have already been assessed in phases other than operation were not repeated here.

365. The screened in projects within 50 km of the Bellrock WFDA (see **Appendix 9.4: Marine Mammals CEA Screening of the Bellrock WFDA EIA Report (Volume IV)**) have either become operational since the Bellrock WFDA site-specific DAS surveys commenced in March 2021 or would become operational during the construction phase of the Bellrock Wind Farm Infrastructure. These projects are:

- Bellrock OFTDA;
- Cedar OWF;
- Morven OWF; and
- Ossian OWF.

366. This section assessed the potential for in-combination impacts arising from the piling noise at the Bellrock WFDA, in conjunction with operational noise generated by the screened in projects. As disturbance ranges to other operational projects was not known, a qualitative approach has been taken to assess this impact.

367. For the Bellrock Wind Farm Infrastructure-alone assessment, the disturbance effect of the operational WTGs was assessed as having a minimal effect resulting in no adverse effect on integrity of the SNS SAC (**Section 4.2.4.2.4.2**). The evidence review (in **Section 4.2.4.2.4**) focused on specific considerations of floating OWFs, for the in-combination assessment there is also consideration of operational noise from fixed-bottom OWFs and wave and tidal projects.

5.1.1.6.1 Fixed-bottom Substructure Wind Farms

368. The main sources of sound generated during the operation of WTGs are aerodynamic and mechanical. The mechanical noise is from the nacelle at the top of the wind turbine tower. As the wind turbine blades rotate, vibrations are generated that travel down the turbine tower and radiate into the surrounding water column and seabed (Tougaard et al. 2009a), (Tougaard et al. 2020), and (Nedwell et al. 2003).

369. Noise levels associated with operational OWFs are relatively low, with recorded levels between 141 and 146 dB re 1 μ Pa-m (RMS SPL) at four UK OWFs (MMO, 2015; Cheesman, 2016), and levels of 106 and 126 dB re 1 μ Pa-m (RMS SPL) at three operational OWFs in Sweden and Denmark, which could not be audible for harbour porpoise at a distance of 70 m from the WTGs (Tougaard et al. 2009b). It has also been predicted that within a few hundred metres of a WTG, noise would be comparable to background noise levels (MMO, 2015, Cheesman, 2016).

370. If the ambient background noise was masking the sound of operational WTGs, then it is not expected for an animal to change their behaviour. In Marmo et al. (2013) the results showed that neither seals nor bottlenose dolphin were predicted to exhibit a behavioural response to operational OWF noise. Approximately 10% of harbour porpoise and minke whale were predicted to behaviourally respond to operational noise up to ranges of ~18 km (particularly at wind speeds of 15 ms^{-1}). However, the majority (50% or 90%) of harbour porpoise and minke whale would not respond to operational wind farm noise (Marmo et al. 2013).

371. In fact, there was an overall increase in acoustic activity of harbour porpoise inside the operating wind farm, compared to pre-construction surveys at the Egmond aan Zee OWF (Scheidat et al. 2011). The reason for this may have been the reef effect, attracting more prey species, and/or the sheltering effect of the turbines from heavy ship traffic.

372. The underwater noise levels emitted during the operation of the WTGs are low and not expected to cause physiological injury to harbour porpoise but could cause behavioural reactions if the animals are in the immediate vicinity of the wind turbine (Tougaard et al. 2009a) and (Sigray and Andersson, 2011).

373. Measurements made at three different OWFs in Denmark and Sweden at ranges between 14 m and 40 m from the turbine substructure found that the sound generated due to turbine operation was only detectable over underwater ambient noise at frequencies below 500 Hz (Tougaard et al. 2009a).

374. Tougaard et al. (2020), reviewed the available measurements of underwater noise from different wind turbines during operation and found that source levels were at least 10–20 dB lower than ship noise in the same frequency range. A simple multi-turbine model indicated that cumulative noise levels could be elevated up to a few kilometres from a wind farm under very low ambient noise conditions. However, the noise levels were well below ambient levels unless very close to the

individual turbines in locations with high ambient noise from shipping or high wind speeds (Tougaard et al. 2020).

375. An underwater noise study from a Chinese OWF in Shanghai found that the noise of ebb and flow around the wind farm was louder than the WTGs (Yang et al. 2018). It must be noted that the capacity of the OWFs in this study are between 3 – 6 MW only, therefore smaller than those within the Bellrock WFDA.
376. The trend of larger turbine sizes leads to the projection of elevated source levels. In particular, this extrapolation suggested a modelled source level of 177 dB re 1 μ Pa for a 10 MW turbine and the subsequent increase in impact areas for behavioural disruption in marine mammals (Stöber and Thomsen, 2021). While there are limitations in extrapolation for larger turbines, it is also important to note that larger turbines are spaced further apart than smaller ones.
377. In a separate study envisioning the deployment of large-scale turbine arrays across the North Sea using 5 MW turbines with source levels reaching 167.6 dB re 1 μ Pa, predictions were made (van der Molen et al. 2014). Within this hypothetical OWF array comprising 60 no. 5 MW turbines the anticipated noise levels were estimated to range between 113–115 dB re 1 mPa (RMS) within 400 m of an WTG. The expected noise levels would diminish below 102 dB re 1 μ Pa (RMS) in the spaces between two such farms with a 5 km separation. It was noted that under specific sea-states, the noise levels might decrease even further, potentially falling below the typical ambient noise. This scenario would enable animals to travel through quieter corridors.

5.1.1.6.2 Floating Wind Farms

378. Other floating OWFs would have similar impacts to that discussed in the Bellrock Wind Farm Infrastructure-alone assessment (see **Section 4.2.4.2.4.2**). The disturbance effect of the operational WTGs would be highly localised and have a minimal effect resulting in no adverse effect on integrity of the SNS SAC.

5.1.1.6.3 Wave and Tidal Projects

379. The noise that is generated from devices harvesting wave energy, derives from the moving parts in the wave energy convertors and the hydraulic pumps. In an underwater noise study by Tougaard (2015), the noise recorded from the Wavestar converter was barely detectable above the ambient nearshore noise, which was relatively high compared to offshore noise), although the hydraulic pumps caused noise of 20–25 dB above ambient. Based on marine mammal audiogram, harbour porpoise should not hear any noise, whereas seals would hear the hydraulic pump clearly.
380. Extensive wildlife observations around the European Marine Energy Centre (EMEC) wave and tidal energy test sites in Orkney have found little evidence of any long-term effects such as avoidance. There was no clear relationship between harbour porpoise and grey seal abundance and the operational sites (Long, 2017).
381. The same report found the influence of the test site on other cetacean species difficult to assess due to the varying sizes (i.e. unusually large pods) and sporadic sightings in and around the site during the surveys. However, a slight reduction in density was modelled when the site became operational.

382. It was suggested that vessel movement could be influencing marine mammal abundance, rather than the test site itself and Long (2017) stated that for seals beyond 1 km there appeared to be little change from baseline abundances.

5.1.1.6.4 Summary

383. There is potential for temporal overlap with the operational noise from other projects with piling at the Bellrock WFDA, which could cause potential disturbance impacts. Note that given the highly localised range of operational noise from other projects there would be no spatial overlap.

384. Considering the evidence, the geographical spread of the projects in the wider North Sea region and the highly localised and small spatial footprint of operational effects (determined in **Appendix 9.2: Underwater Noise Assessment** of the **Bellrock WFDA EIA Report (Volume IV)**), the in-combination impact is unlikely to be significantly greater than the piling at the Bellrock WFDA, and would be episodic, only occurring when piling was actually taking place.

385. In conclusion, there would be **no adverse effect** on the integrity of the SNS SAC as a result of disturbance from underwater noise on harbour porpoise due to the Bellrock Wind Farm Infrastructure in-combination with operational offshore developments.

5.1.1.7 In-combination Impact 1f: Assessment of Underwater Noise and Presence of Vessels

386. It is difficult to quantify the level of increased disturbance to marine mammals resulting from increased vessel activity on an in-combination basis, given the large degree of temporal and spatial variation in vessel movements between projects and regions, coupled with the spatial and temporal variation in marine mammal movements across the region.

387. However, vessel routes to and from OWFs and other offshore projects will, for the majority of time, use existing vessel routes for pre-existing vessel traffic which harbour porpoise will be accustomed to. They may also have become habituated to the volume of regular vessel movements and therefore the additional risk is predominantly confined to the Bellrock WFDA. The vessel movements for OWFs are likely to be limited and slow, resulting in less risk of disturbance harbour porpoise. Vessels associated with operation are likely to undertake similar activities to those for construction, albeit with much lower frequency. It is expected that the vessel movements to the screened in projects, and from any port, will be largely incorporated within existing vessel routes and therefore to areas where harbour porpoise may already be accustomed to their presence.

388. While there is evidence that marine mammals can become habituated to vessel traffic to some degree (Jones et al. 2017, (Koroza and Evans, 2022), a possible response to vessels is temporary displacement from the area. Marine mammals will be exposed to a short-term fluctuation of vessel traffic during the respective project construction phase but will return once the vessel has passed.

389. Currently available monitoring studies for operational wind farms suggest that marine mammals are not significantly disturbed by vessel traffic, and that any impact is localised and temporary (e.g. Diederichs et al. 2008, Teilmann et al. 2006, McConnell et al. 2012). Harbour porpoise have also been found to continue to forage within operational wind farm sites (Lindeboom et al. 2011, Russell et al. 2014, Leemans and Fijn, 2023). These monitoring studies suggest that there is no significant disturbance from operational wind farms, which may have a number of vessels present at any one time.

390. While the disturbance from vessels during construction is considered a temporary impact (as assessed for Bellrock Wind Farm Infrastructure-alone in **Section 4.2.4.1.5**, vessels during O&M are a long-term impact. This means that harbour porpoise could be affected by repetitive exposure to disturbance from vessel over the lifetime of the individual project. However, the evidence highlights that the long-term effects of shipping disturbance is difficult to quantify but that short-term effects are likely to occur, and recovery has been observed (Wisniewska et al. 2018; New et al. 2020).
391. Once on-site, vessels would be stationary or slow moving while undertaking their activities, minimising the potential for disturbance. However, in a worst-case scenario, projects' array areas could become areas of disturbance if several vessels were to be present simultaneously. The space between the individual projects and corridors within the array sites would allow sufficient space for harbour porpoise to travel in between turbines to reach their foraging grounds, haul-out sites or migration routes.
392. Best practice measures, as implemented for the Bellrock WFDA (see **Section 4.3.4.1.6**), would be in place for all other projects considered, further limiting the potential for disturbance.

5.1.1.7.1 Summary

393. Therefore, there would be **no adverse effect** on the integrity of the SNS SAC as a result of underwater noise and the presence of vessels from activities within the Bellrock WFDA in-combination with other schemes during any phase of the Bellrock Wind Farm Infrastructure.

5.1.1.8 Long-term effects of In-combination Impact 1: Auditory Injury and Behavioural Impacts from Underwater Noise

394. A scenario of cumulative disturbance events over the long term for noisy activities other than piling can be caused by:
- Seismic surveys and geophysical surveys;
 - UXO clearance;
 - Other OWFs; and
 - Construction, O&M, or decommissioning activities (other than piling);
 - Operational turbine noise (has been assessed in **In-combination Impact 1e**); and
 - Presence of vessels (has been assessed in **In-combination Impact 1f**).
 - Other offshore projects (such as subsea cables, disposal activities, and aggregates and dredging projects).
395. From the list of disturbance impacts, piling represents the worst-case disturbance scenario for harbour porpoise during construction. Consequently, activities that produce much lower levels of noise, such as other construction activities, are expected to have comparatively less impact on harbour porpoise populations.

396. With regard to repeated disturbance from cumulative activities, in **In-combination Impact 1**, present a quantitative assessment of effects from all overlapping construction at other OWFs, as well as other industry noisy activities occurring simultaneously to piling at the Bellrock WFDA. The result of this assessment presents a snapshot of the cumulative effect on the harbour porpoise populations, but the assessment in **In-combination Impact 1 (Table 5.9)** highlights that the likelihood of this effect to occur on the same day is very low. However, throughout the lifetime of the Bellrock Wind Farm Infrastructure, any of these activities may occur at any one point. The effect would therefore be spatially and temporally dispersed.

5.1.1.8.1 Seismic Surveys and Geophysical Surveys

397. Longer-term consequences of exposure to noise from activities other than piling, such as shipping or seismic surveys, have not been well studied and are difficult to quantify (Gordon et al., 2003). For example, the effects from seismic surveys are more evidenced than those from other construction activities. Literary evidence highlights that the long-term effects of shipping disturbance is difficult to quantify but that short-term effects are likely to occur, and recovery has been observed (Wisniewska et al., 2018; New et al., 2020; Hao et al., 2024). As for piling, the evidence of cumulative effects, which may be biologically significant, is poorly researched.

398. Continuous exposure to any noise source could lead to chronic stress in marine mammals, potentially weakening their immune systems and making them more susceptible to diseases (Gordon et al., 2003). The study suggests potential implications for social organisation among marine mammals, for social bonds and survival. Disruptions can affect communication and cohesion within groups, potentially leading to effects on population dynamics.

399. In contrast, Thompson et al. (2013) found that seismic surveys cause short-term disturbances, but these effects were minor compared to natural variation. Porpoises were detected at affected sites within a few hours of a seismic survey ceasing, indicating that the seismic survey did not result in long-term displacement into suboptimal or higher-risk habitats. The animals typically returned to impacted sites shortly after the disturbance, and their response to the noise decreased over the 10-day survey period.

400. The evidence provided above suggests that disturbance from seismic surveys is unlikely to have a significant long-term impact on the harbour porpoise population.

5.1.1.8.2 Unexploded Ordnance Clearance

401. UXO clearances are by their nature single pulse events, with limited potential for ongoing disturbance. In January 2025, an updated joint position statement was issued (UK Government et al., 2025) which strengthened this position, stating that:

- Low noise methods of clearance should be the default method used to clear any type of UXO in the marine environment; and
- High-order methods should always be the last resort and used only in extraordinary circumstances where:
 - Low noise methods cannot be attempted or have failed following \geq three attempts,
 - All best practice has been demonstrably applied, and
 - There is prior agreement with the licensing authority.

402. The supporting guidance (Marine Directorate, 2025) notes that for any high-order UXO clearance licensed, applicants should expect noise abatement to be required.
403. As a result of the latest position statement and guidance, low-order method is anticipated to account for a large majority of future UXO clearances, with any high-order clearances likely to be accompanied by a noise abatement system. Unmitigated high-order clearance has been considered as the worst-case in this assessment and are now expected to be a last resort.
404. Despite high-order clearance involving the detonation of the full explosive material estimated within the UXO, studies did not report a strong correlation between estimated UXO NEQ and measured noise levels (Majewska et al., 2025). There is uncertainty over how much of the UXO does detonate, with many measurements appearing to be consistent with the levels for the donor charge alone. Further, it has been suggested that the seabed may reduce the radiated sound compared to that predicted for a mid-water explosion, with models based on the latter generally overestimating noise levels at large ranges (Majewska et al., 2025).
405. There are a few studies for which distance to TTS-onset threshold for high order detonation is smaller than 15–20 km, with reported distances ranging between 1.5 – 12 km and 2.0 – 15 km for unweighted SPL_{pk} and VHF-weighted SEL, respectively (Majewska et al., 2025). Additionally, distances to aversive behavioural reaction threshold of SPL_{pk} 168 dB re 1 µPa inferred from data in Lepper et al. (2024) for UXO charge weight of 34 – 344 kg NEQ suggest potential for behavioural disturbance within that range.
406. The evidence provided suggests that disturbance from UXO clearance through high or low order methods is unlikely to have a significant long-term impact on the harbour porpoise population.

5.1.1.8.3 Offshore Wind Farms

5.1.1.8.3.1 Construction, Operation and Maintenance, and Decommissioning Activities (Other Than Piling)

407. During the lifetime of the Bellrock Wind Farm Infrastructure and other projects, maintenance activities will be required and are likely to be conducted using vessels. The effect of repeated and cumulative disturbance from vessels has already been discussed in **In-combination Impact 1c**. The evidence provided in these sections found that while repeated disturbance events are likely to occur, there would be no long-term effect on harbour porpoise. This is because individual events such as maintenance work or vessel presence would be temporary and intermittent and not continuously present throughout the 35 years of operation.
408. As the worst-case disturbance impacts from piling at several projects within the same time window have shown no significant effects on the relevant harbour porpoise population, it can be expected that any noisy activity (other than piling) that is quieter, and/or non-impulsive would result in even less numbers of disturbed. Further, the Bellrock WFDA has outlined mitigation measures to reduce its contribution to cumulative effects in the MMMP and PNMP.
409. While seismic surveys are not a good proxy for construction noise, due to their comparatively high levels of underwater noise, the evidence (included below) shows that marine mammals returned to natural behaviour shortly after the noise had dissipated, similar to observations for piling.

410. In contrast to loud activities such as seismic surveys and piling, one study by Taormina et al. (2018) concluded that the effects of cable-laying activities were insignificant, as the noise is likely to be masked by the noise emitted from the vessels conducting the work. Taormina et al. (2018) stated that noise from submarine cable installation has a negligible to weak impact on marine mammals, as the underwater noise associated with installation of undersea cables remains low. Cable installation is a spatially localised, temporary event, so the impact of noise on marine communities is expected to be minor and brief.
411. While the long-term effects of construction activities (other than piling) are unknown, the evidence provided above and below (sub-section: oil and gas seismic surveys and geophysical surveys) suggests that disturbance from comparatively loud sources such as piling or seismic surveys is unlikely to have a significant long-term impact, and therefore is it considered unlikely that other construction activities would have a long-term impact on the harbour porpoise population.

5.1.1.8.3.2 *Operational Noise*

412. During the 35-year operational lifetime of the Bellrock Wind Farm Infrastructure, there is the possibility that recurring disturbances have the potential to affect on the harbour porpoise population. Piling activities and other construction noise from all screened-in projects would have ceased, with the operational FOU or WTG noise commencing following commissioning at the Bellrock WFDA and the other screened-in projects. This effect has been assessed quantitatively in **In-combination Impact 1e** and concluded the effect was **not significant**.
413. In addition to the literary evidence provided, **In-combination Impact 1e**, disturbance at operational wind farms would be limited to the array sites themselves (Leemans and Fijn, 2023), and as such there would be no overlapping areas of disturbance with other projects.
414. However, even within the array areas themselves, marine mammals are not excluded as several studies have shown (Diederichs et al., 2008; Lindeboom et al. 2011; Marine Scotland, 2012; McConnell et al., 2012; Russell et al., 2014; Scheidat et al. 2011; Teilmann et al. 2006; Tougaard et al., 2005; Tougaard et al., 2009a; Tougaard et al., 2009b). The level of noise from the turbines has not been shown to disturb animals, in contrast, harbour porpoise and seals have been recorded foraging within operational windfarm sites (e.g. Lindeboom et al., 2011; Russell et al., 2014; Leemans and Fijn, 2023).
415. It can therefore be concluded that operational noise from turbines is not likely to have a repeated effect to harbour porpoise as the evidence suggests that operational noise minimally affects them.

5.1.1.8.3.3 *Decommissioning*

416. Currently the exact timings and end-of-life procedures for decommissioning offshore infrastructures are unknown. Consequently, any anticipated cumulative disturbance events are also currently unknown. It can however be expected that some decommissioning activities such as cutting, as well as increased vessel traffic have the potential to cause a repeated disturbance effect. As construction is considered to be the worst-case phase of a project, it can be presumed for now that it would be no greater for the decommissioning phase. **In-combination Impact 1** provides a more detailed assessment of cumulative decommissioning activities with the Bellrock Wind Farm Infrastructure.

5.1.1.9 Potential Effect on the Southern North Sea Special Area of Conservation

417. For In-combination effects, no significant effects have been identified, based on the noise sources where detailed variables were known (piling at other OWFs), in conjunction with piling in the Bellrock WFDA for harbour porpoise.

418. It is noted for the In-combination assessment that:

- The assessment assumed the worst-case impact range for all plans and projects with no mitigation;
- The effect of the Bellrock Wind Farm Infrastructure on harbour porpoise was based on the worst-case density from two years of site-specific DAS surveys in which harbour porpoise sightings were consistently high and also skewed by a single month with exceptionally high numbers. The resulting density used was over two times higher than would be expected from use of SCANS-IV (2023);
- The harbour porpoise dose response curve has been shown to be a highly conservative approach (as outlined in **Appendix 9.5: Marine Mammals Information and Modelling Methods for Disturbance** of the **Bellrock WFDA EIA Report (Volume IV)**) and has likely over-estimated the number of individuals affected;
- There was no direct impact overlap from effects at the Bellrock WFDA (e.g. the SNS SAC);
- Not all individuals would be displaced over the entire potential disturbance range used within the assessments;
- Behavioural effects from UXO clearance, if they occur, would be an instantaneous response and short-term. Guidance suggested that disturbance behaviour was not predicted to occur from UXO clearance if undertaken over a short period of time (JNCC, 2025a);
- It is noted that there would be repeated disturbance over the harbour porpoise study area from a number of projects over time. Outside of population modelling for piling there is no quantitative method to present repeated impacts and the long term effects of multiple disturbance events. The quantitative methods (noting the precaution built into this), iPCoD modelling, and review of available literature, all inform the overall evidence base to determine the overall significance of effects.

419. This in-combination assessment has included information from other projects to the best of knowledge up until the agreed six-month cut-off date prior to submission.

420. Therefore, there is **no adverse effect** on the integrity of the SNS SAC as a result of long term effects of non-piling noisy activities from other plans and projects in-combination with the Bellrock Wind Farm Infrastructure.

5.1.2 In-combination Impact 2: Assessment of Underwater Noise Impacts from Piling at Other Offshore Wind Farms

421. One of the largest potential noise sources during OWF construction is from pile driving. The in-combination assessment considers the potential disturbance of harbour porpoise during piling for the Bellrock Wind Farm Infrastructure, with the piling at other OWF schemes screened into the in-

combination assessment. As the piling for the Bellrock Wind Farm Infrastructure will not overlap with the SNS SAC, this assessment against the SNS SAC summer spatial and seasonal thresholds are not required, and only an assessment against the NS MU is undertaken.

422. Following the initial screening of UK and European OWFs, further screening was undertaken to identify those OWF projects that have the potential for overlapping construction phases with the Bellrock WFDA. This screening considered known construction periods of UK and European OWF projects, including known piling activities and/or construction timings, to determine a more realistic, but still worst-case, list of UK and European OWF projects that may have the potential for overlapping piling activities within the Bellrock WFDA (see **Appendix 9.4: Marine Mammals Cumulative Effects Assessment Screening** of the **Bellrock WFDA EIA Report (Volume IV)** for further details):

- Buchan;
- Cenos;
- Dogger Bank D;
- Dogger Bank South (West);
- Muir Mhor;
- North Falls;
- Ossian;
- Sheringham Shoal Extension; and
- West of Orkney.

423. The potential piling period for the Bellrock Wind Farm Infrastructure has been based on the widest likely range of offshore construction and piling dates, dependent on the construction scenario, as a precautionary approach. It should be noted that while the schemes included within the in-combination have the potential for piling to overlap with the Bellrock WFDA, there is a great deal of uncertainty on when OWFs could be piling. This assessment is therefore considered to be a precautionary worst-case.

424. Where possible, the CEA screening (see **Appendix 9.4: Marine Mammals CEA Screening** of the **Bellrock WFDA EIA Report (Volume IV)**) included consideration of the realistic potential for in-combination impacts during construction for the Bellrock WFDA.

425. The assessment for harbour porpoise is based on the approach to disturbance as per the current advice from the UK SNCBs on the assessment of effect on the harbour porpoise designated SACs. The potential for prolonged exposure to noisy is not well understood, with a limited number of studies mainly focusing on harbour porpoise. Nabe-Neilson et al. (2018) found that harbour porpoise densities returned to normal levels between two and six hours following piling, and Brandt et al. (2011) found that porpoise densities recovered between 2.5 and 11.5 hours post piling.

426. Graham et al. (2019) found that the level of response from harbour porpoise to piling reduced over time (i.e. as the piling campaign continued, the response and recovery time of harbour porpoise reduced). At the beginning of the piling campaign (in the Moray Firth), there was more than a 50% chance of harbour porpoise responding to piling in the 24 hours directly following the cessation of piling up to 7.4 km (95% CI = 5.7–9.4). By the middle of the piling campaign, this 50% response distance had decreased to 4.0 km (95% CI = 2.7–5.2) and decreased to 1.3 km (95% CI = 0.2–2.8) by the end of the piling campaign. This demonstrates that for this piling campaign, harbour

porpoise recovery was within 24 hours at a closer range to the piling itself by the end of the piling, indicating a level of habituation, and of decreased disturbance over time.

427. The worst-case disturbance numbers for piling at the Bellrock WFDA have been carried forward to the in-combination assessment. For all other projects, the worst-case disturbance numbers were taken from the relevant EIAs for the in-combination assessment. It should be noted that the potential areas of disturbance assumed that there would be no spatial overlap in the areas of disturbance between different projects and were therefore highly conservative. Not all animals within the effect radius would be uniformly displaced. While some animals would flee, others might remain in the area of effect from piling but additionally (or again) be disturbed by other noise sources. The approach to the in-combination for piling at OWFs is based on the potential for single piling at each OWF at the same time as single piling for the Bellrock Wind Farm Infrastructure. This approach allows for some of the OWFs not to be piling at the same time, while others could be simultaneously piling. This is considered to be the most realistic worst-case scenario, as it is highly unlikely that all other OWFs would be simultaneously piling at exactly the same time as piling for the Bellrock Wind Farm Infrastructure.
428. It is important to note the actual duration for active piling time which could disturb harbour porpoise is only a very small proportion of the potential construction period, of up to approximately 148 days over the construction period at the Bellrock WFDA (based on approximately 3 hours per pile), based on the estimated maximum duration to install individual piles.
429. For harbour porpoise, the potential worst-case scenario of other OWFs piling at the same time as the Bellrock WFDA is assessed in **Table 5.10**. More than 5% of the reference population could potentially be disturbed due to in-combination piling. It is important to note that this is very precautionary, as it is unlikely that all other OWF schemes could be piling at exactly the same time as piling for the Bellrock Wind Farm Infrastructure.

Table 5.10: Quantitative Assessment for the Potential Disturbance of Harbour Porpoise from Single Piling (20 km) at Other Offshore Wind Farms at the Same Time as Piling for the Bellrock Wind Farm Infrastructure

Project	Harbour Porpoise Density (per km ²)	Source of Project Specific Information	Maximum Number of Individuals Potentially Disturbed
Single piling at other OWFs that could be piling at the same time as the Bellrock WFDA			
Bellrock WFDA	1.273	DRC	8,554
Buchan	0.5156	EIA	11,527
Cenos	1.0398	EIA	8,863
Dogger Bank D	0.842	PEIR	5,014
Dogger Bank South (West)	0.66	EIA	5,098
Muir Mhor	0.5985	EIA	14,630
North Falls	3.217	EIA	6,832

Project	Harbour Porpoise Density (per km ²)	Source of Project Specific Information	Maximum Number of Individuals Potentially Disturbed
Ossian	0.651	EIA	8,309
Sheringham Shoal Extension	0.888	EIA	8,554
West of Orkney ¹	N/A	N/A	N/A
Total number of harbour porpoise with Bellrock WFDA <i>(without the Bellrock WFDA)</i>			77,381 <i>(68,827)</i>
Percentage of NS MU (with Bellrock WFDA) <i>(without the Bellrock WFDA)</i>			22.33% <i>(19.86%)</i>
Notes: ¹ Offshore Wind Power Limited (2023), SNS SAC screened out of RIAA, therefore not assessed.			

430. This was considered to be the most precautionary worst-case scenario, as it is highly unlikely that all other wind farms would be simultaneously undertaking piling activities at exactly the same time as piling activity at the Bellrock WFDA, especially given the limited active piling time. The overly conservative quantitative impact assessment using an additive approach for disturbance to harbour porpoise from piling activities at OWFs, including the Bellrock WFDA shows a potential for significant disturbance of the wider NS MU population.
431. In practice, the potential temporary effects would be less than those predicted in this assessment as there is likely to be a great deal of variation in timing, duration, and hammer energies used throughout the various OWF project construction periods. In addition, not all individuals would be displaced over the entire potential disturbance range (20 km) used within the assessments. For example, the study of harbour porpoise at Horns Rev (Brandt et al. 2011), indicated that at closer distances (2.5 to 4.8 km) there was 100% avoidance. However, this proportion decreased significantly moving away from the pile driving activity and at distances of 10 km to 18 km avoidance was 32% to 49% and at 21 km the abundance was reduced by just 2%.
432. As a result of the quantified assessment, applied assumptions and potentially inflated numbers of animals, this has been demonstrated through the application of the deterrence function for harbour porpoise showing a more realistic disturbance effect which is 10 times lower than the DRC assessment (see **Appendix 9.5: Marine Mammals Information and Modelling Methods for Disturbance** of the Bellrock WFDA EIA Report (**Volume IV**)). Furthermore, none of the projects included any mitigation measures in their assessments which have the potential to reduce the number of individuals at risk. Conclusions of the record of The Crown Estate Round 4 Leasing Habitats Regulations Assessment (The Crown Estate, 2022), expect that all OWFs overlapping with the SNS SAC will have to produce a Site Integrity Plan (SIP) to ensure that the spatial threshold is not exceeded and there is no significant disturbance and no adverse effect on the integrity of the SNS SAC. Therefore, this applies to some of the other projects assessed (in **Table 5.10**), the number of animals potentially disturbed for other projects are likely to be less than what

was assessed due to the requirement for some to produce a SIP. This could include the use of noise abatement and reduction measures (which would reduce the EDR to 11 km; JNCC, 2025b), and/or seasonal restrictions and agreements on when OWF piling could be undertaken. It is also important to note that the in-combination assessments are based on the worst-case for all possible OWFs.

433. As schemes develop and programmes are established there will be changes to the potential piling periods for each OWF scheme. There will also be limitations on the fabrication of wind turbines and the vessels available to install the wind turbine foundations. It is also highly unlikely that a single developer would progress piling at multiple projects concurrently (note that in Table 5.10, Ossian, Dogger Bank D and North Falls are all SSE projects). Therefore, it is unlikely that all OWFs would or could be all piling at the same time. Additional assessments using iPCoD modelling were undertaken to predict the harbour porpoise population effect due to cumulative disturbance from piling, using the number at risk of disturbance from each project as provided in **Table 5.10**.
434. As a consequence of the potential significant effects identified, population modelling was used, which incorporates detailed demographic information and an understanding of the relationship between days of disturbance and individual survival and reproductive rates (Sinclair et al. 2023). This method is considered appropriate for assessing potential cumulative disturbance from piling and its population consequences for harbour porpoise. The application of iPCoD modelling (see **Section 5.1.2.1.1**) allows for the full piling schedule of each project to be considered, allowing for overlapping and sequential piling (repeated disturbances) events over the construction period.

5.1.2.1.1 Population Modelling for Cumulative Disturbance from Offshore Wind Farm Projects

435. To show if the results indicated a significantly disturbed population, the decline is considered, in the context of a threshold of a 1% annual population decline per year, compared to the modelled unimpacted reference population is used to inform the overall significance of effect. This approach has been applied to the assessments and if a decline is predicted by the population modelling, then the significance of this decline will be considered on a case-by-case, species-by-species basis.
436. It is important to note that the harbour porpoise density used for the Bellrock WFDA was derived from two years of site-specific DAS surveys. The resulting density used was much higher than what was known for the surrounding area. As shown in **Appendix 9.1: Marine Mammals Technical Report of the Bellrock WFDA EIA Report (Volume IV)**, the density of 1.273 animals per km² is to be used for the wider area.
437. For the in-combination scenario assessed the reference population 346,601 was applied for the NS MU for harbour porpoise, the iPCoD model predicts there to be little effect on the harbour porpoise population over time from disturbance due to piling at all OWF projects (see **Table 5.11**).
438. The median population size was predicted to be 100% of the un-impacted population size at the end of 2031 (one year after the piling has commenced in the wider area). By the end of 2037 (the year piling ends) the median population size for the impacted population is predicted to be 99.43% of the un-impacted population size. Beyond 2037, the impacted population is expected to maintain the same stable trajectory as the un-impacted population (as far as 2056 which is the end point of

the modelling, at which point the median impacted to un-impacted ratio is 99.29% (see **Table 5.11** and **Plate 5.1**).

439. For harbour porpoise, iPCoD modelling resulted in no significant effect on the population (**Table 5.11**). Whether the mean or median value is used to inform the results, the results show a less than 1% decline over the first six years and over the 25-year period for both.

5.1.2.1.2 Summary

440. Taking in to account the sensitivity of harbour porpoise to disturbance, the highly precautionary number of animals included in the assessment and the recoverability of the effect disturbance, there would be no significant effect on the harbour porpoise population due to in-combination effects of piling.
441. In conclusion, there would be **no adverse effect on the integrity** of the SNS SAC due to in-combination disturbance effects of underwater noise piling on harbour porpoise.

Plate 5.1: Simulated Worst-case Harbour Porpoise NS Population Sizes for Both the Un-impacted and the Impacted Populations for the Cumulative Assessment (scientific notation used in these charts, e.g. 4e+04 = 40,000)

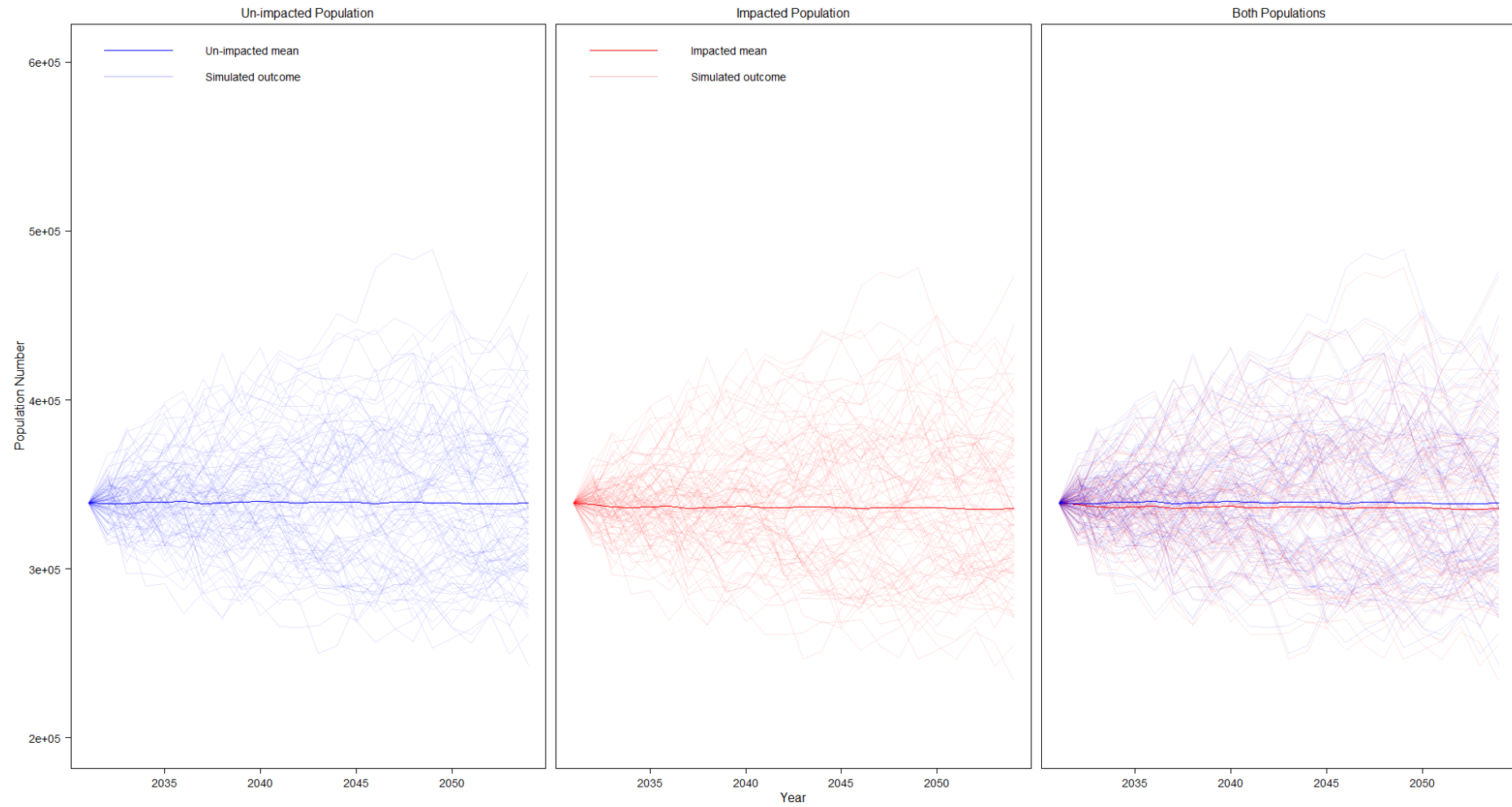


Table 5.11: Results of the iPCoD Modelling for the Cumulative Assessment, Giving the Mean and Median Population Size of the Harbour Porpoise. Population (North Sea Management Unit (NS MU)) for Years up to 2056 for Both Impacted and Un-impacted Populations in Addition to the Mean and Median Ratio Between their Population Sizes

Time Point	Year	Mean			Median			95% Confidence Intervals	
		Un-impacted Population	Impacted Population	Impacted as % of Un-impacted	Un-impacted Population	Impacted Population	Impacted as % of Un-impacted	Un-impacted Population	Impacted Population
1	2031	338,918	338,918	100.00%	338,918	338,918	100.00%	338,918 – 338,918	338,918 – 338,918
2	2032	338,603	337,888	99.79%	339,328	338,473	99.86%	311,602 – 362,716	310,497 – 361,782
3	2033	338,766	336,441	99.31%	338,847	336,129	99.48%	305,455 – 371,148	302,593 – 368,981
7	2037	338,384	335,669	99.20%	337,972	335,259	99.43%	285,820 – 391,627	284,059 – 388,527
13	2043	339,650	336,693	99.13%	338,731	336,003	99.36%	273,230 – 411,921	271,107 – 408,647
19	2049	339,137	336,061	99.10%	337,715	334,560	99.33%	260,057 – 428,056	255,890 – 426,899
26	2056	339,046	335,831	99.06%	335,850	332,347	99.29%	249,224 – 450,664	246,960 – 446,003

5.1.3 In-combination Impact 3: Vessel Collision Risk

442. The in-combination effects from an increase in the number of vessels and vessel movements can pose a potential collision risk for harbour porpoise.
443. As outlined in **Section 4.2.4.1.6** (construction) and **Section 4.2.4.2.5** (O&M), vessels would be intermittently present throughout the lifetime of the Bellrock WFDA. As vessel movements to and from any port would be incorporated within established shipping routes to the relevant ports to minimise vessel volume in the area. Therefore, there would be no increased collision risk, as the increase in the number of OWF vessels would be relatively small compared to the baseline levels of vessel movements in these areas. Once on-site, OWF vessels and other construction-related vessels would be stationary or slow-moving as they undertake their associated activities.
444. To reduce any marine mammal collision risk, vessel movements, where possible, would be incorporated into established shipping routes and hence to areas where marine mammal species are accustomed to vessels. All vessel movements would be kept to the minimum number that is required to reduce any potential for collision risk, and vessel speeds will be minimised, where practicable, whilst transiting. Additionally, vessel operators would use best practice to reduce any risk of collisions with marine mammals. Such best practice measures are set out in the **Outline VMNSP (Volume V)**. It is expected that other offshore projects and industries would follow similar measures in order to reduce the potential for collision risk of marine mammals with vessels.
445. As vessel movements to and from any port would be incorporated within established shipping routes as far as possible, there would be no increased collision risk as the increase in the number of OWF vessels would be relatively small compared to the baseline levels of vessel movements in these areas. Once on-site, OWF vessels and other construction related vessels would be stationary or slow moving, as they undertake the activity they are associated with. Therefore, the risk of any increased collision risk for in-combination projects for marine mammals would be extremely low.
446. Vessels associated with aggregate extraction and dredging are large and typically slow moving, using established transit routes to and from ports. Therefore, the potential increased collision risk with vessels is considered to be extremely low. Increased collision risk from aggregate extraction and dredging has therefore been screened out from further consideration in the in-combination assessment.
447. In addition, based on the assumption that harbour porpoise would be disturbed as a result of underwater noise from piling, other construction activities, O&M activities, and vessels, there should be no potential for increased collision risk with vessels.
448. In conclusion, there would be **no adverse effect on the integrity** of the SNS SAC due to in-combination increases in vessel collision risk on harbour porpoise during any phase of the Bellrock Wind Farm.

5.1.4 In-combination Impact 4: Secondary Entanglement

449. There is the potential for in-combination impacts due to secondary entanglement in the Bellrock WFDA and other plans and projects. There are a number of floating offshore wind projects being developed in Scottish waters, including Green Volt, Pentland Floating, Broadshore, Caledonia,

Cenos, Culzean, Salamander, Buchan, Aspen, Muir Mohr, Ossian, Bowdun OWFs. There are no floating offshore wind projects within English waters of the North Sea that have a pathway of effect for the SNS SAC.

450. Out of all projects, no project-specific details were identified in the public domain for the Bowdun OWF. The Culzean project scoped out the risk of entanglement to marine mammals from further consideration at the scoping stage (Total Energies, 2023). All projects identified that the accumulation of marine debris on floating lines and cables (secondary entanglement) has the potential to generate adverse interactions between mobile marine species (i.e. marine mammals) and project infrastructure.
451. Projects with EIA submission documents in the public domain, provided detailed account on the monitoring plans of the entanglement risk, including monitoring of large strains on mooring lines, remotely operated vehicle (ROV) surveys, removal of debris from project infrastructure, as well as reporting on entanglement (Pentland Floating Offshore Wind Farm, 2022, Muir Moir, 2025), (Salamander Offshore Wind Farm, 2023). Most of the reports identified periodic inspections, including visual surveys and identification of debris, as a measure necessary to reduce the risk of entanglement (Buchan Offshore Wind, 2023; Broadshore Hub, 2024; Muir Moir, 2025; Caledonia, 2024).
452. As such, there is awareness across the industry about mitigation measures that needs to be applied in order to reduce the risk of the entanglement. The risk of secondary entanglement is restricted to the respective Array Areas so is of local spatial extent and temporary (dynamic infrastructure will be removed from the water column at the end of the O&M phases of respective projects). There is a risk of entanglement to take place over the lifetime of the projects (long term). If the effect would occur, it would affect only a small proportion of the receptor population and without an alteration to population trajectories.
453. Mitigation measures to monitor the risk of entanglement will be implemented in the final O&M Plan (further details in **Section 4.2.4.2.6**).
454. The additional mitigation proposed will be implemented to reduce the potential impact on harbour porpoise. Therefore, there would be **no adverse effect** on the integrity of the SNS SAC due to in-combination secondary entanglement effects on harbour porpoise with Bellrock Wind Farm Infrastructure.

5.1.5 In-combination Impact 5: Changes to Prey Availability

455. Potential effects on changes to prey availability from the Bellrock Wind Farm Infrastructure were assessed in **Section 4.2.4.1.7** (construction) and **Section 4.2.4.2.7** (O&M). No adverse effect on integrity of the SNS SAC in relation to the conservation objectives for harbour porpoise was concluded. Any effects on prey species are likely to be intermittent, temporary and highly localised, with potential for recovery following cessation of the disturbance activity. Any permanent loss or changes of prey habitat will typically represent a small percentage of the potential habitat in the surrounding area. This will be the case for all schemes and although the in-combination effects are additive, the effect would be proportionate to the wider range over which effects would occur.

456. Harbour porpoise have a diverse diet that varies geographically and seasonally, reflecting changes in available food resources. They have relatively high daily energy demands and need to capture enough prey to meet these requirements. It has been estimated that, depending on the environmental conditions, harbour porpoise can rely on stored energy (primarily blubber) for three to five days, depending on body condition (Kastelein et al. 1997).
457. Therefore, there would be **no adverse effect** on the integrity of the SNS SAC due to in-combination changes in prey availability during any phase of the Bellrock Wind Farm Infrastructure.

5.2 Berwickshire and North Northumberland Coast Special Area of Conservation

458. The following in-combination assessment has been undertaken based on findings of the CEA Screening process (**Appendix 9.4: Marine Mammals Cumulative Effects Assessment Screening** of the **Bellrock WFDA EIA Report (Volume IV)**), and the results of the CEA (Section 9.9 of **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)**).
459. The in-combination assessment considers other plans and projects where the predicted effects have the potential to combine with the potential effects during construction of the Bellrock Wind Farm Infrastructure. The construction phase and piling during construction has been assessed as the worst-case for potential in-combination effects.
460. The schemes screened into the in-combination assessment for grey seal are those that are located in the combined regions of Moray Firth, East Scotland and Northeast England Seal MUs. Full information on the screening of effects considered for the in-combination assessment is provided in the **Appendix 9.4: Marine Mammals Cumulative Effects Assessment Screening** of the **Bellrock WFDA EIA Report (Volume IV)**. The in-combination screening for grey seal considers the same schemes as considered in the cumulative screening, as the BNNC SAC is in the Northeast England MU, therefore all schemes occurring in this MU, alongside the Moray Firth and East Scotland MUs have been considered in the assessment.
461. The in-combination effects assessed are outlined in **Section 3.1.3**.

5.2.1 In-combination Impact 1: Auditory Injury and Behavioural Impacts from Underwater Noise

462. The mitigation measures agreed through a PNMP and MMMP for piling would reduce the risk of physical injury or permanent auditory injury (PTS) in grey seal. In light of this, and taking account of the type, scale and extent of potential effects arising from the Bellrock Wind Farm Infrastructure assessment, PTS is not considered further (see **Chapter 9: Marine Mammals** of the **Bellrock WFDA EIA Report (Volume II)**).
463. It is intended that this approach to assessing the potential effects of disturbance from underwater noise will reduce some of the uncertainties and complications in using the different assessments from HRAs, based on different noise models, thresholds and criteria, as well as different approaches to density estimates.

464. The greatest potential noise sources during the Bellrock Wind Farm Infrastructure construction is from pile driving. Therefore, the in-combination assessment assesses the potential disturbance of grey seal during piling for the Bellrock Wind Farm Infrastructure against activities associated with other projects.

5.2.1.1 In-combination Impact 1a: Indicative Assessment of Underwater Noise Impacts from Clearance of Unexploded Ordnances at Other Offshore Wind Farms

465. There is the potential for in-combination impacts from clearance of UXOs in the construction phase of the Bellrock WFDA and other plans and projects. For the purposes of this assessment, this potential impact has been assessed using the tiered approach outlined in **Section 2.3: RIAA Part 1: Introductory Chapters**.

466. Given the vast extent of available habitat, the fact that marine mammals are wide-ranging species and the low percentage of the population disturbed as a result of UXO clearance at respective projects, the likelihood of in-combination impacts with projects located at large distances (e.g. >100 km) from the Bellrock WFDA is considered to be low. There were seven projects within 100 km identified with potential for cumulative effects associated with this impact:

- Aspen OWF;
- Bellrock OFTDA;
- Berwick Bank OWF;
- Cenos OWF;
- Morven OWF;
- Muir Mhòr OWF; and
- Ossian OWF.

467. Potential impacts of underwater noise from UXO detonations on marine mammals are detailed further in **Section 5.1.1.1**. Although that is the section for harbour porpoise, the potential of this impact is deemed to be the same for grey seals and the BNNC SAC. As there are no current UXO clearance licence that overlap with construction of the Bellrock Wind Farm Infrastructure an indicative assessment has been undertaken to consider the worst case scenario.

5.2.1.1.1 Disturbance

468. As noted in **Section 5.1.1.1**, the assessment is based on potential for disturbance from one UXO high-order detonation (worst-case), as well as one low-order clearance event. However, the likelihood of this and temporal overlap with piling for the Bellrock Wind Farm Infrastructure is low. JNCC guidance refers to the preference of using low-order deflagration, thus this is carried forward in the assessment below, in combination with piling at the Bellrock WFDA (JNCC, 2025a).

469. The potential disturbance from UXO clearance has been estimated based on the following shown in **Section 4.3.4.1.1** and **Appendix 9.3: Marine Mammals Unexploded Ordnance Assessment of the Bellrock WFDA EIA Report (Volume IV)**.

470. The potential impact areas used for the assessment have followed the same approach as used to assess harbour porpoise, **Section 5.1.1.1.1**. Based on a 20 km EDR for unmitigated UXO high order detonation, 1,256.64 km² per project was used for grey seal, and 78.54 km² for low-order detonation (**Table 5.12**).

Table 5.12: Quantified In-combination Assessment for the Potential Disturbance of Grey Seal at a Single Point in Time During Unexploded Ordnance Clearance at Offshore Wind Farm Projects

Project	Grey Seal Density (/km ²)	Impact Area (km ²)	Maximum Number of Individuals Potentially Disturbance at Single Point in Time
Bellrock WFDA - Piling	0.028	DRC	153
Disturbance from high-order UXO clearance		1,256.64	36
Disturbance from low-order UXO clearance		78.54	3
Total number of grey seal (without the Bellrock WFDA)			192
			39
Percentage of BNNC SAC (without the Bellrock WFDA)			1.14%
			0.23%

5.2.1.1.2 Summary

471. Therefore, there is **no risk of an adverse effect** on the integrity of the BNNC SAC as a result of underwater noise generated during UXO clearance from other plans and projects in-combination with the Bellrock Wind Farm Infrastructure during any phase.

5.2.1.2 In-combination Impact 1b: Indicative Assessment of Underwater Noise Impacts from Geophysical Surveys at Other Offshore Wind Farms

472. There is the potential for in-combination impacts from geophysical surveys in the construction and O&M phases of the Bellrock Wind Farm Infrastructure and other plans and projects. For the purposes of this assessment, this potential impact has been assessed using the same approach as **Section 5.1.1.2**. As there are no current geophysical survey applications that overlap with the Bellrock WFDA construction timeline an indicative assessment has been undertaken to consider the worst case scenario.

473. Four projects were identified with potential for cumulative effects associated with this impact within a 50 km buffer, within the marine mammal study area:

- Bellrock OfTDA;
- Cedar OWF;
- Ossian OWF; and
- Morven OWF.

474. Based on the potential impact area using a 3.12 km disturbance range (BEIS, 2020) and the worst-case scenario of two geophysical surveys coinciding with piling activities in the Bellrock WFDA, less than 5% of the grey seal SAC reference population could be temporarily disturbed (**Table 5.13**).

Table 5.13: Indicative Quantified Cumulative Effects Assessment for the Potential Disturbance of Grey Seal During the Geophysical Surveys at other Offshore Wind Farm Projects

Project	Grey Seal Density (/km ²)	Impact Area (km ²)	Maximum Number of Individuals Potentially Disturbance at Single Point in Time
Bellrock WFDA - Piling	0.028	DRC	153
Disturbance from two geophysical surveys		707	20
Total number of grey seal (without the Bellrock WFDA)			173
			20
Percentage of BNNC SAC (without the Bellrock WFDA)			1.02%
			0.12%

5.2.1.2.1 Summary

475. Therefore, there is **no adverse effect** on the integrity of the BNNC SAC as a result of disturbance due to geophysical surveys from other plans and projects in-combination with the Bellrock Wind Farm Infrastructure during any phase. For construction and O&M activities, it is likely that all projects will also include a MMMP as a mitigation measure, similar to that adopted for the Bellrock WFDA. As such, and in consideration of the potential designed in measure of a MMMP, population-level effects associated with this potential impact are unlikely for the grey seal feature of the BNNC SAC.

5.2.1.3 In-combination Impact 1c: Assessment of Underwater Noise Impacts from Non-piling Construction Activities at Other Offshore Wind Farms

476. All OWFs with construction dates that have the potential to overlap with the construction window for the Bellrock Wind Farm Infrastructure and are within the grey seal combined MUs have the potential for in-combination effects. This assessment has used the same methodology as that in **Section 5.1.1.3** but updated to relate to the BNNC SAC. OWFs screened in for other construction activities that could have potential in-combination impacts with the BNNC SAC and piling at the Bellrock WFDA were (see **Appendix 9.4: Marine Mammals Cumulative Effects Assessment Screening of the Bellrock WFDA EIA Report (Volume IV)** for details of projects considered):

- Aspen;
- Bellrock OfTDA;
- Berwick Bank;
- Bowdun;
- Cedar;
- Morven; and
- Seagreen Phase 1a.

477. During the construction of the Bellrock Wind Farm Infrastructure, there is the potential for overlap with impacts from non-piling construction activities at other OWFs. Noise sources which could cause potential disturbance impacts during OWF construction activities, other than pile driving, can include vessels, mooring installation, seabed preparation including sand wave levelling, slope levelling, boulder clearance, PLGR, cable installation works and rock placement.
478. For other projects, the potential impact area for grey seal applied was based on the worst-case disturbance range of 4 km (50.27 km²) for non-piling construction activities (Benhemma-Le Gall et al. 2021).
479. For all OWFs that could be constructing at the same time as piling at the Bellrock WFDA, the potential of the temporary effect was less than 5% of the SAC reference population (**Table 5.14**). This was considered precautionary given the limited and intermittent duration of piling activities at the Bellrock WFDA.

Table 5.14 Quantified Cumulative Effects Assessment for the Potential Disturbance at a Single Point in Time of Grey Seal during the other Construction Activities at Offshore Wind Farm Projects at the Same Time as Piling at the Bellrock Wind Farm Development Area

Project	Grey Seal Density (/km ²)	Impact Area (km ²)	Maximum Number of Individuals Potentially Disturbance at Single Point in Time
Bellrock WFDA - Piling	0.028	DRC	153
Bellrock OfTDA		50.27	<2
Aspen			<2
Berwick Bank			<2
Bowdun			<2
Cedar			<2
Morven			<2
Seagreen Phase 1a			<2
Total number of grey seal (without the Bellrock WFDA)			167
			14
Percentage of BNNC SAC (without the Bellrock WFDA)			0.99%
			0.08%

5.2.1.3.1 Summary

480. Therefore, there is **no adverse effect** on the integrity of the BNNC SAC as a result of disturbance from underwater noise due to non-piling construction activities from other plans and projects in combination with the Bellrock Wind Farm Infrastructure during any phase.

5.2.1.4 In-combination Impact 1d: Assessment of Underwater Noise from Other Industries and Activities

481. There is the potential for disturbance to marine mammals associated with other potential noise sources alongside construction of the Bellrock Wind Farm Infrastructure, including:
- UXO Clearance (see **Section 5.1.1.1**);
 - Geophysical surveys (see **Section 5.1.1.2**);
 - Aggregate extraction and dredging (see **Section 5.1.1.4.1**); and
 - Seismic surveys (see **Section 5.1.1.4.3**).
482. For the installation of oil and gas infrastructure, marine renewable schemes, coastal developments, gas storage, offshore mining, carbon capture and storage, and disposal sites, all potential schemes have been screened out. Further information on the CEA screening (and these results) is provided in **Appendix 9.4: Marine Mammals CEA Screening of the Bellrock WFDA EIA Report (Volume IV)**.

5.2.1.4.1 *Disturbance from Aggregate Extraction and Dredging*

483. Taking into account the small potential impact ranges and the aggregate extraction and dredging projects falling outside of the grey seal MUs being assessed for the Bellrock WFDA, the pathway of effect for the potential contribution to in-combination effects is non-existent. The aggregate/dredging projects screened in for the SNS SAC do not apply for the BNNC SAC given the distances from both the Bellrock WFDA and the BNNC SAC. Therefore, disturbance from aggregate extraction and dredging will not be assessed here.

5.2.1.4.2 *Disturbance from Seismic Surveys*

484. It was not possible to estimate the location, or number, of potential seismic surveys that could be undertaken at the same time as construction and potential piling activity for the Bellrock Wind Farm Infrastructure. As a precautionary approach, the same methodology used for **Section 5.1.1.4.3** will be used here to produce an indicative assessment.
485. For two seismic surveys, undertaken at the same time as construction of the Bellrock WFDA, up to 1.7% of the SAC reference population may be disturbed (**Table 5.15**).

Table 5.15: Quantitative Assessment for In-combination Disturbance of Grey Seal Due to up to Two Seismic Surveys

Project	Grey Seal Density (/km ²)	Impact Area (km ²)	Maximum Number of Individuals Potentially Disturbance at Single Point in Time
Bellrock WFDA - Piling	0.028	DRC	153
Disturbance from two seismic surveys		4,768.32	134
Total number of grey seal (without the Bellrock WFDA)			287
			134
Percentage of BNNC SAC (without the Bellrock WFDA)			1.70%
			0.79%

5.2.1.4.3 Summary

486. Therefore, there is **no adverse effect** on the integrity of the BNNC SAC as a result of disturbance from underwater noise due to other industries and activities from other plans and projects in-combination with the Bellrock Wind Farm Infrastructure during any phase.

5.2.1.5 Combined Disturbance from Underwater Noise from All Other Industries and Activities

487. Each of the above described noise sources with the potential for disturbance on grey seal are quantitatively assessed together in **Table 4.16**.

488. For grey seal, for noisy activities with the potential for in-combination disturbance effects together with piling at the Bellrock WFDA of up to 2.13% of the population of grey seal within the MU is at risk of disturbance based on the full quantitative assessment.

489. Less than 5% of the reference population could potentially be disturbed, therefore, there would be **no adverse effect** on integrity of the BNNC SAC in relation to grey seal, either alone or when in-combination with other schemes. It is important to note that this is very precautionary, as it is unlikely that all other activities would be taking place at exactly the same time as piling for the Bellrock Wind Farm Infrastructure. The same mitigation measures as discussed in **Section 5.1.1.7** will also be utilised for grey seals.

490. Therefore, in conclusion, there would be **no adverse effect** on the integrity of the BNNC SAC as a result of underwater noise effects on grey seal as a result of the Bellrock Wind Farm Infrastructure in-combination with other projects or schemes.

Table 5.16: Quantitative Assessment for All Noisy Activities with the Potential for In-combination Disturbance Effects for Grey Seal

Activity	Maximum Number of Individuals Potentially Disturbed (% of Reference Population)
Worst-case disturbance from the Bellrock WFDA (Piling)	153
UXO clearance	39
Geophysical surveys	20
Construction activities at other OWFs (excluding piling)	14
Aggregates and dredging	-
Seismic surveys	134
Total number of individuals	360
<i>(without indicative activities)</i>	167
Percentage of MU	2.13%
<i>(without indicative activities)</i>	0.99%

5.2.1.6 In-combination Impact 1e: Assessment of Disturbance from Operational Offshore Developments

491. This in-combination assessment considered disturbance effects from operational developments associated with wind, wave or tidal projects on the BNNC SAC. Plans and projects that have already been assessed in phases other than operation were not repeated here and the assessment used the same approach as that in **Section 5.1.1.4.4** alongside the impact to grey seals and BNNC specifically as assessed in **Section 4.3.4.2.4**.
492. Taking into account both of the sections noted above and utilising the same approach, if all noise from the operational projects were taking place at the same time as piling at the Bellrock WFDA, the potential for overlap with the operational noise from other projects which could cause potential disturbance impacts was identified.
493. Considering the aforementioned evidence, the geographical spread of the projects in the wider North Sea region and the short impact ranges arising from operational projects (determined in **Appendix 9.2: Underwater Noise Assessment** of the Bellrock WFDA EIA Report (**Volume IV**)), the impact would be temporary and limited to the Bellrock WFDA's timeframe. Consequently, it was assessed as having a minor impact for grey seal. This is also considered over precautionary given the connectivity between the project and the BNNC SAC only covers a small portion of the North Sea.

5.2.1.6.1 Summary

494. In conclusion, there would be **no adverse effect** on the integrity of the BNNC SAC as a result of disturbance of grey seal from underwater noise due to operational offshore developments in combination with the Bellrock Wind Farm Infrastructure during any phase.

5.2.1.7 In-combination Impact 1f: Assessment of Underwater Noise and Presence of Vessels

495. It is difficult to quantify the level of increased disturbance to marine mammals resulting from increased vessel activity on an in-combination basis, given the large degree of temporal and spatial variation in vessel movements between projects and regions, coupled with the spatial and temporal variation in marine mammal movements across the region. The same assessment that was used for **Section 5.1.1.7** will be used here but with the BNNC SAC population.

496. Best practice measures, as implemented for the Bellrock WFDA (see **Section 4.3.4.1.6**), would be in place for all other projects considered, further limiting the potential for disturbance.

497. Once on-site, vessels would be stationary or slow moving while undertaking their activities, minimising the potential for disturbance. However, in a worst-case scenario, projects' array areas could become areas of disturbance if several vessels were to be present simultaneously. The space between the individual projects and corridors within the array sites would allow sufficient space for marine mammals to travel in between turbines to reach their foraging grounds, haul-out sites or migration routes.

5.2.1.7.1 Summary

498. Therefore, there would be **no adverse effect** on the integrity of the BNNC SAC as a result of the effects of underwater noise and the presence of vessels on grey seal from other schemes in combination with the Bellrock Wind Farm Infrastructure during any phase.

5.2.1.8 Long-term effects of In-combination Impact 1: Auditory Injury and Behavioural Impacts from Underwater Noise

499. A scenario of cumulative disturbance events over the long term for noisy activities other than piling can be caused by:

- Seismic surveys and geophysical surveys;
- UXO clearance;
- OWFs;
 - Construction, O&M, or decommissioning activities (other than piling);
 - Operational turbine noise (has been assessed in **In-combination Impact 1e**); and
 - Presence of vessels (has been assessed in **In-combination Impact 1f**).
- Other offshore projects (such as subsea cables, disposal activities, and aggregates and dredging projects).

500. From the list of disturbance impacts, piling represents the worst-case disturbance scenario for grey seal during construction. Consequently, activities that produce much lower levels of noise, such as other construction activities, are expected to have comparatively less impact on grey seal populations.

501. With regard to repeated disturbance from cumulative activities, in **In-combination Impact 1**, present a quantitative assessment of effects from all overlapping construction at other OWFs, as well as other industry noisy activities occurring simultaneously to piling at the Bellrock WFDA. The result of this assessment presents a snapshot of the cumulative effect on the grey seal populations, however, as explained for the harbour porpoise assessment (**Section 5.1.1.7**), the likelihood of this effect to occur on the same day is very low. However, throughout the lifetime of the Bellrock Wind Farm Infrastructure, any of these activities may occur at any one point. The effect would therefore be spatially and temporally dispersed.

5.2.1.9 Potential Effect on The Berwickshire And North Northumberland Coast Special Area of Conservation

502. For In-combination effects, no residual significant effects have been identified, based on the noise sources where detailed variables were known (noisy activities other than piling at other plans and projects), in conjunction with piling in the Bellrock WFDA for grey seal.

503. It is noted for the In-combination assessment that:

- The assessment assumed the worst-case impact range for all plans and projects with no mitigation;
- The number of grey seals potentially disturbed by the Bellrock Wind Farm Infrastructure-alone has been calculated based on the dose response curve which was a highly conservative approach as outlined in **Appendix 9.5: Marine Mammals Information and Modelling Methods for Disturbance of the Bellrock WFDA EIA Report (Volume IV)** and in the species sensitivity and has likely over-estimated the number of individuals affected;
- There was no direct impact overlap from effects at the Bellrock WFDA with any key areas (e.g. with the BNNC SAC);
- Not all individuals would be displaced over the entire potential disturbance range used within the assessments;
- Behavioural effects from UXO clearance, if they occur, would be an instantaneous response and short-term. Guidance suggested that disturbance behaviour was not predicted to occur from UXO clearance if undertaken over a short period of time Figure (JNCC, 2025a);
- It is noted that there would be repeated disturbance over the marine mammal study areas from a number of projects over time. Outside of population modelling for piling there is no quantitative method to present repeated impacts and the long-term effects of multiple disturbance events. The quantitative methods (noting the precaution built into this), iPCoD modelling, and review of available literature, all inform the overall evidence base to determine the overall significance of effects.

504. This in-combination assessment has included information from other projects to the best of knowledge up until the agreed six-month cut-off date prior to submission.

505. Therefore, there is **no adverse effect** on the integrity of the BNNC SAC as a result of long term effects of non-piling noisy activities from other plans and projects in-combination with the Bellrock Wind Farm Infrastructure.

5.2.2 In-combination Impact 2: Assessment of Underwater Noise Impacts from Piling at Other Offshore Wind Farms

506. One of the greatest potential noise sources during OWF construction is from pile driving. The in-combination assessment considers the potential disturbance of grey seal during piling for the Bellrock Wind Farm Infrastructure, with the piling at other OWF schemes screened into the in-combination assessment. As the piling for the Bellrock Wind Farm Infrastructure will not overlap with the BNNC SAC, this assessment against the BNNC SAC will cover all projects that have assessed their impact against the BNNC SAC and not those that have screened out the BNNC SAC. This is due to these projects which screened out the BNNC SAC will have concluded no impact pathway and therefore not be required to be considered in the assessment.

507. Following the initial screening of UK and European OWFs, further screening was undertaken to identify those OWF projects that have the potential for overlapping construction phases with the Bellrock Wind Farm Infrastructure. This screening considered known construction periods of UK and European OWF projects, including known piling activities and/or construction timings, to determine a more realistic, but still worst-case, list of UK and European OWF projects that may have the potential for overlapping piling activities within the Bellrock WFDA (see **Appendix 9.4: Marine Mammals Cumulative Effects Assessment Screening** of the Bellrock WFDA EIA Report (**Volume IV**) for further details):

- Dogger Bank D;
- Dogger Bank South (West); and
- Ossian.

508. The assessment for grey seal is based on the approach used in **Section 5.1.2**. For grey seal, the potential worst-case scenario of other OWFs piling at the same time as the Bellrock Wind Farm Infrastructure is assessed in **Table 5.17**. More than 5% of the reference population could potentially be disturbed due to in-combination piling. It is important to note that this is very precautionary, as it is unlikely that all other OWF schemes could be piling at exactly the same time as piling for the Bellrock Wind Farm Infrastructure.

Table 5.17: Quantitative Assessment for the Potential Disturbance of Grey Seal from Single Piling (20 km) at Other Offshore Wind Farms at the Same Time as Piling for the Bellrock Wind Farm Infrastructure

Project	Grey Seal Density (per km ²)	Source of Project Specific Information	Maximum Number of Individuals Potentially Disturbed
Single piling at other OWFs that could be piling at the same time as the Bellrock WFDA			
Bellrock WFDA	0.024	DRC	153
Dogger Bank D	0.03	PEIR	59
Dogger Bank South (West)	0.054	DRC	1,155
Ossian	0.18	EIA	436
Total number of grey seal (without the Bellrock WFDA)			1,803
			1,650
Percentage of BNNC SAC (without the Bellrock WFDA)			10.67%
			9.76%

509. This was considered to be the most precautionary worst-case scenario, as it is highly unlikely that all other wind farms would be simultaneously undertaking piling activities at exactly the same time as piling activity at the Bellrock WFDA, especially given the limited active piling time. The overly conservative quantitative impact assessment using an additive approach for disturbance to grey seal from piling activities at OWFs, including the Bellrock WFDA shows a potential for significant disturbance of the BNNC SAC population.
510. In practice, the potential temporary effects would be less than those predicted in this assessment as there is likely to be a great deal of variation in timing, duration, and hammer energies used throughout the various OWF project construction phase. In addition, not all individuals would be displaced over the entire potential disturbance range (20 km) used within the assessments. Furthermore, none of the projects included any mitigation measures in their assessments which have the potential to reduce the number of individuals at risk. Some projects may include the use of noise abatement and reduction measures (which would reduce the EDR to 11 km; JNCC, 2025b) It is important to note that the in-combination assessments are based on the worst-case for all possible OWFs.
511. As schemes develop and programmes are established there will be changes to the potential piling periods for each OWF scheme. There will also be limitations on the fabrication of wind turbines and the vessels available to install the wind turbine foundations. Therefore, it is unlikely that all OWFs would or could be all piling at the same time. Additional assessments using iPCoD modelling were undertaken to predict the effect on grey seal population due to cumulative disturbance from piling, using the number at risk of disturbance from each project as provided in **Table 5.17**.

512. As a consequence of the potential significant effects identified, population modelling was used, which incorporates detailed demographic information and an understanding of the relationship between days of disturbance and individual survival and reproductive rates (Sinclair et al. 2023). This method is considered appropriate for assessing potential cumulative disturbance from piling and its population consequences for grey seal. The application of iPCoD modelling (see **Section 5.1.2.1.1**) allows for the full piling schedule of each project to be considered, allowing for overlapping and sequential piling (repeated disturbances) events over the construction period.
513. Using the disturbance numbers predicted for each OWF, as indicated in **Table 5.10**, on every piling day, the iPCoD model estimated there to be only the slightest discernible impact on grey seal of the Combined MU population (**Table 5.18** and **Plate 5.2**).

5.2.2.1.1 *Summary*

514. Taking in to account the sensitivity of grey seal to disturbance, the highly precautionary number of animals included in the assessment and the recoverability of the effect disturbance, there would be no significant effect on the grey seal population due to in-combination effects of piling.
515. In conclusion, there would be **no adverse effect** on the integrity of the BNNC SAC due to in-combination disturbance effects of underwater noise piling on grey seal.

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Table 5.18: Results of the iPCoD Modelling for the In-combination Assessment, giving the Mean Population Size for the Grey Seal Population (Berwickshire And North Northumberland Coast Special Area of Conservation) for Years up to 2056 for Both Impacted and Un-impacted Populations, in Addition to the Mean and Median Ratio Between the Population Sizes

Time Period	Year	Mean			Median			95% Confidence Intervals	
		Un-impacted Population	Impacted Population	Impacted as % of Un-impacted	Un-impacted Population	Impacted Population	Impacted as % of Un-impacted	Un-impacted Population	Impacted Population
1	2031	16,902	16,902	100.00%	16,902	16,902	100.00%	16,902 – 16,902	16,902 – 16,902
2	2032	17,079	17,079	100.00%	17,161	17,161	100.00%	15,548 – 18,210	15,548 – 18,210
3	2033	17,249	17,248	99.99%	17,311	17,310	100.00%	15,386 – 18,758	15,386 – 18,758
7	2037	17,976	17,975	99.99%	17,966	17,966	100.00%	15,493 – 20,764	15,492 – 20,764
13	2043	19,032	19,030	99.99%	18,932	18,932	100.00%	15,029 – 23,482	15,025 – 23,449
19	2049	20,126	20,125	99.99%	19,950	19,950	100.00%	15,299 – 25,756	15,299 – 25,756
26	2056	21,652	21,651	99.99%	21,468	21,465	100.00%	15,392 – 29,015	15,392 – 29,015

Plate 5.2: Simulated Worst-case Grey Seal (BNNC SAC) Population Sizes for Both the Un-impacted and the Impacted Population for the In-combination Assessment



5.2.3 In-combination Impact 3: Vessel Collision Risk

516. The in-combination effects from an increase in the number of vessels and vessel movements can pose a potential collision risk for grey seals. As outlined in **Section 4.3.4.1.6** (construction) and **Section 4.3.4.2.5** (O&M), vessels would be intermittently present throughout the lifetime of the Bellrock Wind Farm Infrastructure. Grey seal in the relevant study area(s) are likely to be accustomed to vessels or exhibit avoidance behaviours, therefore, increased collision risk due to vessels is unlikely.
517. As for harbour porpoise in **Section 5.1.3** it is considered that any increased collision risk for in-combination projects for marine mammals would be extremely low.
518. All vessel movements would be kept to the minimum number that is required to reduce any potential for collision risk, and vessel speeds will be minimised, where practicable, whilst transiting. Additionally, vessel operators would use best practice to reduce any risk of collisions with marine mammals. Such best practice measures are set out in the **Outline VMNSP** and **Outline EMP (Volume V)**. It is expected that other offshore projects and industries would follow similar measures in order to reduce the potential for collision risk of marine mammals with vessels.
519. Given the information presented in **Sections 4.3.4.1.6, 4.3.4.2.5 and 5.1.3**, there would be **no adverse effect** on integrity of the BNNC SAC due to in-combination vessel collision risk for grey seals during any phase of the Bellrock Wind Farm Infrastructure.

5.2.4 In-combination Impact 4: Secondary Entanglement

520. There is the potential for in-combination impacts due to secondary entanglement in the Bellrock WFDA and other plans and projects. There are a number of floating offshore wind projects being developed in Scottish waters, including Green Volt, Pentland Floating, Broadshore, Caledonia, Cenos, Culzean, Salamander, Buchan, Aspen, Muir Mohr, Ossian, Bowdun. There are no floating offshore wind projects within English waters of the North Sea that have a pathway of effect for the BNNC SAC.
521. As for harbour porpoise in **Section 5.1.4** it is considered that there is limited risk of secondary entanglement across projects and mitigation will also be implemented to reduce the potential impact on grey seal. Therefore, there would be **no adverse effect** on the integrity of the BNNC SAC due to in-combination secondary entanglement effects on grey seal.

5.2.5 In-combination Impact 5: Changes to Prey Availability

522. Potential effects on changes to prey availability for the Bellrock WFDA were assessed in **Section 4.3.4.1.7** (construction) and **Section 4.3.4.2.7** (O&M). No adverse effect on integrity of the BNNC SAC in relation to the conservation objectives for grey seal was concluded. Any effects on prey species are likely to be intermittent, temporary and highly localised, with potential for recovery following cessation of the disturbance activity. Any permanent loss or changes of prey habitat will typically represent a small percentage of the potential habitat in the surrounding area. This will be the case for all schemes and although the in-combination effects are additive, the effect would be proportionate to the wider range over which effects would occur.

523. In addition, grey seal are opportunistic feeders, feeding on a wide range of prey species. They are able to forage in other areas and have relatively large foraging ranges.
524. Therefore, there would be **no adverse effect** on the integrity of the BNNC SAC due to in-combination changes in prey availability during any phase of the Bellrock Wind Farm Infrastructure.

5.2.6 In-combination Impact 6: Disturbance at Seal-Haul Out Sites

525. Due to baseline vessel traffic being relatively high, and the closest distance of the Bellrock WFDA to any seal haul-out site being over 120 km, it was not expected that the Bellrock Wind Farm Infrastructure would have any significant impact to seal at haul-out sites. In addition, best practice measures would be implemented by the Bellrock Wind farm Infrastructure, such as reducing vessel transit speeds, wherever possible, and the avoidance of transiting within 1 km (outside of established navigation routes) of any seal haul-out site.
526. It has been assumed that all other projects would follow the similar best practice measures with regards to avoiding disturbance at haul-out sites if deemed required, unless within an established navigation route where seal haul-out sites are near to a vessel corridor (where seals present in that area would be used to vessels transiting past the area). It was therefore assessed that there would be limited potential for any in-combination disturbance effect at any seal haul-out site. Considering the sensitivity of medium for grey seal, and the expected effect for cumulative disturbance at seal haul-out sites would therefore be minor. Additionally, vessel operators would use industry best practice to reduce any risk of collisions with marine mammals and adhere to a VMNSP and EMP. An **Outline VMNSP** and **Outline EMP** are both provided in **Volume V**.
527. Therefore, if the vessels committed to keep at least a distance of 500 m from the shore there would be no adverse effect on the integrity of the BNNC SAC due to in-combination disturbance at seal haul-out sites during any phase of the Bellrock Wind Farm Infrastructure.

6 Conclusion

528. A summary of the assessments presented in this Bellrock WFDA RIAA, considering the relevant SACs, is provided in the sections below. **Table 6.1** presents the conclusions of Adverse Effects on Site Integrity in relation to the Bellrock Wind Farm Infrastructure alone and in-combination with other plans and projects.

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Table 6.1: Summary of Conclusions

Site ID	Site Name	Relevant Qualifying Features	Project Phase	Potential Impact	Conclusion of Assessment on the Bellrock Wind Farm Infrastructure Alone	Conclusion of the Assessment on the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects
UK0030311	Southern North Sea SAC	Harbour porpoise	Construction	Underwater noise during UXO clearance	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise during geophysical surveys	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise during piling	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise during non-piling construction activities	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise and presence of vessels	No adverse effect on site integrity	No adverse effect on site integrity
				Collision risk with vessels	No adverse effect on site integrity	No adverse effect on site integrity
				Changes to prey availability	No adverse effect on site integrity	No adverse effect on site integrity
			O&M	Underwater noise during geophysical surveys	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise from O&M activities	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise and presence of vessels	No adverse effect on site integrity	No adverse effect on site integrity
				Collision risk with vessels	No adverse effect on site integrity	No adverse effect on site integrity
				Secondary entanglement	No adverse effect on site integrity	No adverse effect on site integrity
				Changes to prey availability	No adverse effect on site integrity	No adverse effect on site integrity

Site ID	Site Name	Relevant Qualifying Features	Project Phase	Potential Impact	Conclusion of Assessment on the Bellrock Wind Farm Infrastructure Alone	Conclusion of the Assessment on the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects
			Decommissioning	Whilst a detailed assessment of decommissioning impacts cannot be undertaken at this stage, for this assessment, it is assumed that decommissioning is likely to operate within the parameters identified for construction (i.e. any activities are likely to occur within the temporary construction working areas and require no greater amount or duration of activity than assessed for construction). The decommissioning sequence will generally be the reverse of the construction sequence. It is therefore assumed that decommissioning impacts would likely be of similar nature to, and no worse than, those identified during the construction phase. The decommissioning phase is expected to have less underwater noise impacts due to no piling during the decommissioning phase.		
UK0017072	Berwickshire and North Northumberland Coast SAC	Grey Seal	Construction	Underwater noise during UXO clearance	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise during geophysical surveys	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise during piling	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise during non-piling construction activities	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise and presence of vessels	No adverse effect on site integrity	No adverse effect on site integrity
				Collision risk with vessels	No adverse effect on site integrity	No adverse effect on site integrity
				Changes to prey availability	No adverse effect on site integrity	No adverse effect on site integrity
				Disturbance at seal haul-out sites	No adverse effect on site integrity	No adverse effect on site integrity

Site ID	Site Name	Relevant Qualifying Features	Project Phase	Potential Impact	Conclusion of Assessment on the Bellrock Wind Farm Infrastructure Alone	Conclusion of the Assessment on the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects
			O&M	Underwater noise during geophysical surveys	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise from O&M activities	No adverse effect on site integrity	No adverse effect on site integrity
				Underwater noise and presence of vessels	No adverse effect on site integrity	No adverse effect on site integrity
				Collision risk with vessels	No adverse effect on site integrity	No adverse effect on site integrity
				Secondary entanglement	No adverse effect on site integrity	No adverse effect on site integrity
				Changes to prey availability	No adverse effect on site integrity	No adverse effect on site integrity
				Disturbance at seal haul-out sites	No adverse effect on site integrity	No adverse effect on site integrity
			Decommissioning	Whilst a detailed assessment of decommissioning impacts cannot be undertaken at this stage, for this assessment, it is assumed that decommissioning is likely to operate within the parameters identified for construction (i.e. any activities are likely to occur within the temporary construction working areas and require no greater amount or duration of activity than assessed for construction). The decommissioning sequence will generally be the reverse of the construction sequence. It is therefore assumed that decommissioning impacts would likely be of similar nature to, and no worse than, those identified during the construction phase. The decommissioning phase is expected to have less underwater noise impacts due to no piling during the decommissioning phase.		

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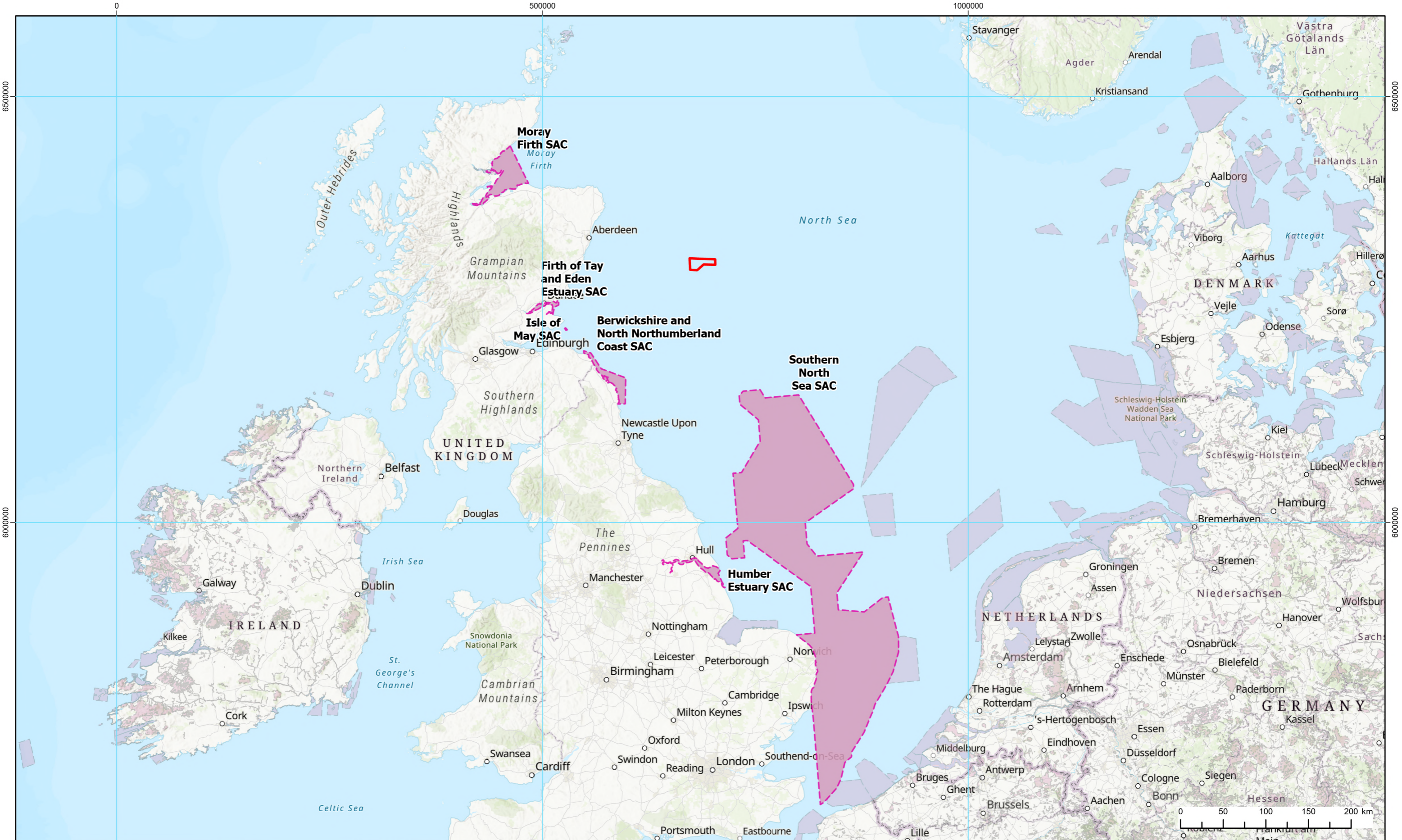
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Appendix A – Figures RIAA Part 2

Figure A 1: Annex II Marine Mammal Special Area of Conservation Zones Screened In

Figure A.2: Grey seal At-sea Mean Densities for Those Individuals Associated with the Berwickshire and North Northumberland Coast SAC

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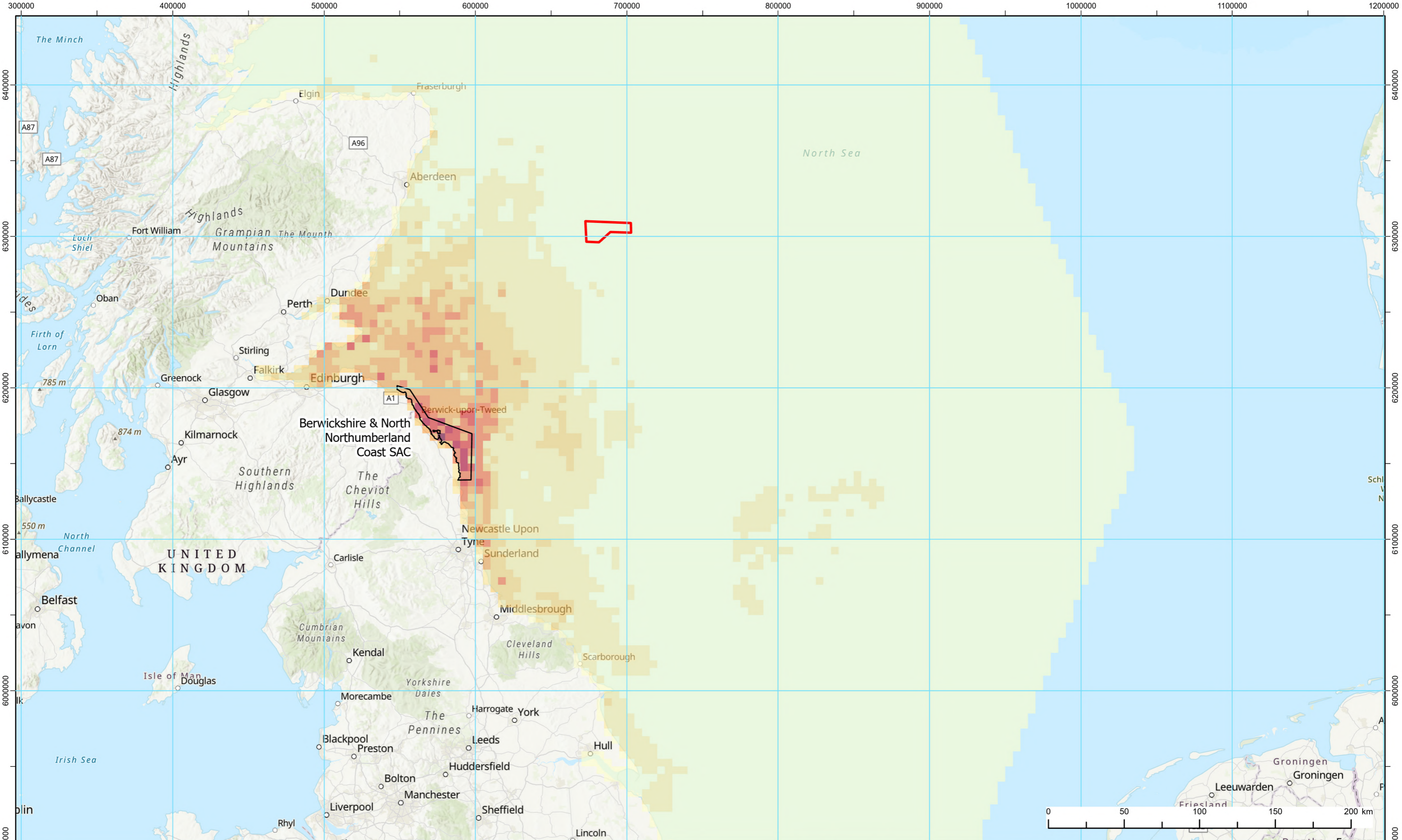


Legend:

- Bellrock Wind Farm Development Area
- Designated Sites Screened In
- Designated Sites Screened Out

1	31/03/2026	Final	DL	SA	BMcG
REV	DATE	STATUS	DRW	CHK	APR
Coordinate System: WGS 1984 UTM Zone 30N					
Source: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS, © 2026 Subacoustech. © Haskoning UK Ltd, 2026.					
Scale @ A3			1:4,000,000		

Figure Title: Annex II Marine Mammal Special Areas of Conservation Screened In	
Project: Bellrock Wind Farm Development Area (WFDA)	Report: RIAA: Part 2
Drawing No.: RHDV_BEL_CST_REP_0003_078	
Figure A.1	



Legend:

- Bellrock Wind Farm Development Area
- Special Area of Conservation (SAC)

BNNC SAC Grey Seal Density

Value

- 0.000001 - 0.010142
- 0.010143 - 0.038007

- 0.038008 - 0.083998
- 0.083999 - 0.154854
- 0.154855 - 0.288694
- 0.288695 - 0.523660
- 0.523661 - 1.012806
- 1.012807 - 1.803618

1	31/03/2026	Final	DL	SA	BMcG
REV	DATE	STATUS	DRW	CHK	APR
Coordinate System: WGS 1984 UTM Zone 30N			Scale @ A3		
Source: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS, © 2026 Subacoustech. © Haskoning UK Ltd, 2026.			1:2,250,000		

Figure Title:
Grey seal At-Sea Mean Densities for Those Individuals Associated with the Berwickshire and North Northumberland Coast Special Area of Conservation

Project: Bellrock Wind Farm Development Area (WFDA) Report: RIAA: Part 2

Drawing No.: RHDV_BEL_CST_REP_0003_079 **Figure A.2**

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