XLINKS MOROCCO-UK POWER PROJECT

Preliminary Environmental Information Report

Volume 3, Chapter 4: Marine Mammals and Sea Turtles

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Glossary

Term	Meaning
Terminology Relating to the Proposed Development	
Proposed Development	The element of the Xlinks Morocco-UK Power Project within the UK, which includes the offshore cables (from the UK Exclusive Economic Zone to landfall), landfall site, onshore Direct Current and Alternating Current cables, converter stations, road upgrade works and, based on current assumptions, the Alverdiscott Substation Connection Development.
Offshore Cable Corridor	The proposed corridor within which the offshore cables are proposed to be located, which is situated within the United Kingdom Exclusive Economic Zone.
Further Terminology	
Maximum design scenario	The realistic worst-case scenario, selected on a topic-specific and impact specific basis, from a range of potential parameters for the Proposed Development.
Mean High Water Springs	The height of mean high water during spring tides in a year.
Mean Low Water Springs	The height of mean low water during spring tides in a year.
Protected species	A species of animal or plant which it is forbidden by law to harm or destroy.
Ramsar Site	Wetlands of international importance that have been designated under the criteria of the Ramsar Convention. In combination with Special Protection Areas and Special Areas of Conservation, these sites contribute to the national site network.
Site of Special Scientific Interest	A site designation specified and protected in the Wildlife and Countryside Act 1981. These sites are of particular scientific interest due to important biological (e.g. a rare species of fauna or flora), geological or physiological features.
Special Areas of Conservation	A site designation specified in the Conservation of Habitats and Species Regulations 2017. Each site is designated for one or more of the habitats and species listed in the Regulations. The legislation requires a management plan to be prepared and implemented for each SAC to ensure the favourable conservation status of the habitats or species for which it was designated. In combination with Special Protection Areas and Ramsar sites, these sites contribute to the national site network.

Acronyms

Acronym	Meaning
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CEA	Cumulative Effects Assessment
CLV	Cable Lay Vessel
CI	Confidence Interval
CV	Coefficients of variation
DCO	Development Consent Order
DTAG	Digital Acoustic Recording Tag
EDR	Effective Deterrence Range
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EPS	European Protected Species
ES	Environmental Statement
JNCC	Joint Nature Conservation Committee
MBES	Multibeam Echosounder
MSFD	Marine Strategy Framework Directive
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MMMP	Marine Mammal Mitigation Protocol
MPCP	Marine Pollution Contingency Plan
MU	Management Unit
NPS	National Policy Statement
NRW	Natural Resource Wales
OSPAR Convention	Convention for the Protection of the Marine Environment of the North-East Atlantic
OSPAR	Oslo and Paris Conventions
PEIR	Preliminary Environmental Information Report
PTS	Permanent Threshold Shift
ROV	remotely operated vehicle
SAC	Special Area of Conservation
SPA	Special Protection Area
SEL	Sound Exposure Level
SNCB	Statutory Nature Conservation Body
SSSI	Site of Special Scientific Interest
SSS	Sidescan Sonar
TTS	Temporary Threshold Shift
VMP	Vessel Management Plan
ZoI	Zone of Influence

Units

Units	Meaning
<	Less than
%	Percentage
dB	Decibel (sound pressure)
GW	gigawatt (power)
Hz	Hertz (frequency)
kHz	Kilohertz (frequency)
km	kilometre (distance)
km^2	kilometre squared (area)
m	Metre (distance)
MW	Megawatt (power)
nm	nautical mile (distance)
Pa	Pascal (pressure)
Pa^2s	Pascal squared seconds (acoustic energy)
µPa	Micropascal (pressure)

4 MARINE MAMMALS AND SEA TURTLES

4.1 Introduction

4.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the preliminary findings of the Environmental Impact Assessment (EIA) work undertaken to date for the United Kingdom (UK) elements of the Xlinks Morocco-UK Power Project. For ease of reference, the UK elements of the Xlinks Morocco-UK Power Project are referred to in this chapter as the 'Proposed Development'.

4.1.2 This chapter considers the potential impacts and effects of the Proposed Development on marine mammals and sea turtles during the construction, operation and decommissioning phases. Specifically, it relates to the offshore and coastal elements of the Proposed Development seaward of Mean Low Water Springs (MLWS).

4.1.3 In particular, this PEIR chapter:

- sets out the existing and future environmental baseline conditions, established from desk studies, surveys and consultation undertaken to date;
- presents the potential environmental impacts and effects on all aspects of marine mammals and sea turtles arising from the Proposed Development, based on the information gathered and the analysis and assessments undertaken to date;
- identifies any assumptions and limitations encountered in compiling the environmental information; and
- highlights any necessary monitoring and/or mitigation measures that could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process.

4.1.4 The assessment presented is informed by the following technical chapters:

- Volume 3, Chapter 1: Benthic Ecology;
- Volume 3, Chapter 2: Fish and Shellfish Ecology; and
- Volume 3, Chapter 5: Shipping and Navigation.

4.1.5 This chapter also draws upon information contained within Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR.

4.1.6 The PEIR will inform pre-application consultation. Following consultation, comments on the PEIR and any refinements in design will be reviewed and taken into account, where appropriate, in preparation of the Environmental Statement that will accompany the application to the Planning Inspectorate for development consent.

4.2 Legislative and Policy Context

Legislation

4.2.1 The following section provides information regarding key legislation, which is relevant to marine mammals and/or sea turtles:

4.2.2 The Marine and Coastal Access Act 2009 helps ensure clean, healthy, safe, productive and biologically diverse marine and coastal environments that meet long term needs of people and nature.

4.2.3 The Conservation of Habitats and Species Regulations 2017 (as amended) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) (collectively known as the 'Habitats Regulations') transposes the Habitats Directive (92/43/EEC) into UK Legislation out to the 12 nautical mile (nm) limit:

- All cetaceans (including harbour porpoise *Phocoena phocoena*, bottlenose dolphin *Tursiops truncatus*, Risso's dolphin *Grampus griseus,* short beaked common dolphin (hereafter common dolphin) *Delphinus delphis,* and minke whale *Balaenoptera acutorostrata*) and marine turtles (including leatherback turtle *Dermochelys coriacea*) are listed as European Protected Species (EPS) of Community Interest on Schedule 2 and in need of strict protection, making it an offense to injure, kill or disturb them.
- Certain pinniped (including grey seal *Halichoerus grypus*) and cetacean (including harbour porpoise and bottlenose dolphin) species are listed under Annex II as species of Community Interest, whose conservation requires the designation of Special Areas of Conservation (SACs).

4.2.4 The Marine Strategy Regulations 2010 transposes the Marine Strategy Framework Directive (MSFD) into UK Regulations: MSFD sets out measures for Good Environmental Status in the marine environment. Descriptor 1: Marine Biodiversity and Descriptor 11: Energy, including underwater noise, are particularly relevant to marine mammals and sea turtles.

4.2.5 Wildlife and Countryside Act 1981 (as amended): includes provisions relating to nature conservation including species of marine mammals and sea turtles, making it an offence to intentionally (or recklessly) kill, injure or take any animal listed on Schedule 5 of the Act and prohibits interference with places used for shelter or protection, or intentionally disturbing animals occupying such places. Bottlenose dolphin, harbour porpoise, minke whale, common dolphin, Risso's dolphin, grey seal and leatherback turtle are listed under Schedule 5. Bottlenose dolphin, harbour porpoise and common dolphin are listed in Schedule 6 of the Act, which protects animals from being killed or taken by certain methods.

4.2.6 Conservation of Seals Act, 1970: provides seasonal protection and with some exceptions, prohibits the taking, injury and killing of seals.

4.2.7 The Bonn Convention: Aims to conserve migratory species and their habitats by providing strict protection for endangered migratory species (Appendix I) and lists migratory species which would benefit from multilateral agreements for conservation and management (Appendix II). There are 44 cetacean species, six pinniped species and five turtle species listed under Appendix I of the Convention including harbour porpoise, bottlenose dolphin, minke whale, grey seal and leatherback turtle.

4.2.8 The Bern Convention: Aims to ensure conservation and protection of wild plant and animal species and their natural habitats (listed in Appendices I and II of the Convention). There are 30 species of cetacean listed under Annex II of the Bern Convention (strictly protected fauna). Listed species relevant here are: harbour porpoise, bottlenose dolphin, minke whale and leatherback turtle. All other relevant species are listed under Annex II of the Bern Convention.

4.2.9 Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS): All small cetaceans are listed, including bottlenose dolphin, harbour porpoise, common dolphin and Risso's dolphin. The aim is to promote close cooperation between countries with a view of achieving and maintaining a favourable conservation status for small cetaceans throughout the Agreement Area.

4.2.10 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 1973: All cetaceans, pinnipeds and sea turtles are listed under CITES which aims to ensure that international trade does not threaten species survival.

4.2.11 The Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention) aims to protect the marine environment in the North East Atlantic. Harbour porpoise and leatherback turtle are listed under Annex V of the Convention.

4.2.12 The Convention on Biological Diversity and the Aichi Biodiversity Targets aims to conserve biological diversity by implementing strategic goals and biodiversity targets.

Planning Policy Context

4.2.13 The Proposed Development will be located within UK inshore waters and the UK EEZ offshore waters - beyond 12 nautical miles (nm) from the English coast (with the onshore infrastructure located wholly within Devon, England). As set out in Volume 1, Chapter 1: Introduction, of the PEIR, the Secretary of State for the Department for Energy Security and Net Zero has directed that elements of the Proposed Development are to be treated as a development for which development consent is required under the Planning Act 2008, as amended.

National Policy Statements

4.2.14 There are currently six energy National Policy Statements (NPSs), three of which contain policy relevant to the Proposed Development, specifically:

- Overarching NPS for Energy (NPS EN-1) which sets out the UK Government's policy for the delivery of major energy infrastructure (Department for Energy Security & Net Zero 2023a);
- NPS for Renewable Energy Infrastructure (NPS EN-3) (Department for Energy Security & Net Zero 2023b); and
- NPS for Electricity Networks Infrastructure (NPS EN-5) (Department for Energy Security & Net Zero 2023c).

4.2.15 **Table 4.1**: Summary of relevant NPS policy sets out key aspects from the NPSs relevant to the Proposed Development, with particular reference to the need for and approach to consenting such infrastructure.

Table 4.1: Summary of relevant NPS policy

Summary of NPS requirement	How and where considered in the PEIR
NPS EN-1	
Applicants should ensure that the Environmental Statement clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England), on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity (paragraph 5.4.17).	Designated sites relevant to marine mammals and sea turtles can be found in **section 4.5, Table 4.14** with a preliminary assessment of effects on these receptors in **sections 4.8, 4.9** and **4.10**.
The design of energy NSIP proposals will need to consider the movement of mobile/migratory species such as birds, fish and marine and terrestrial mammals and their potential to interact with infrastructure. As energy infrastructure could occur anywhere within England and Wales, both inland and onshore and offshore, the potential to affect mobile and migratory species across the UK and more widely across Europe (transboundary effects) requires consideration, depending on the location of development (paragraph 5.4.22).	Mobile marine mammal and sea turtle species are the subject of this PEIR chapter. The baseline for these species in the study area is detailed in **section 4.5.** The assessment of impacts to these species is provided in **sections 4.8 4.9** and **4.10.**
NPS EN-3	
Applicants should have regard to the specific ecological and biodiversity considerations that relate to proposed offshore renewable energy infrastructure developments, namely marine mammals (paragraph 2.8.98).	Ecological and biodiversity considerations regarding marine mammals (and sea turtles) are the focus of this chapter. The baseline for these species in the study area is detailed in **section 4.5**. The assessment of impacts to these species is provided in **sections 4.8, 4.9** and **4.10.**
Where necessary, assessment of the effects on marine mammals should include details of: likely feeding areas and impacts on prey species and prey habitat; known birthing areas/haul out sites for breeding and pupping; migration routes; protected sites; baseline noise levels; predicted construction and soft start noise levels in relation to mortality, permanent threshold shift (PTS), temporary threshold shift (TTS) and disturbance; operational noise; duration and spatial extent of the impacting activities including cumulative/in-combination effects with other plans or projects; collision risk; entanglement risk; and barrier risk (paragraph 2.8.131).	All of the specified marine mammal ecology considerations are included in this chapter. Construction and operational noise impacts and their effects on marine mammal behaviour and ecology have been assessed in **sections 4.8**, **4.9** and **4.10.** Cumulative impacts have been assessed in **section 4.11.**
The applicant should discuss any proposed noisy activities with the relevant statutory body and must reference the joint JNCC and SNCB underwater noise guidance, and any successor of this guidance, in relation to noisy activities (alone and in combination with other plans or projects) within SACs, SPAs, and Ramsar sites, in addition to the JNCC mitigation guidelines for piling, explosive use, and geophysical surveys. NRW has a position statement on assessing noisy activities which, should also be referenced where relevant (paragraph 2.8.133).	Potential impacts of noise and their effects on marine mammal behaviour and ecology have been assessed in **sections 4.8, 4.9** and **4.10.** Cumulative impacts have been assessed in **section 4.11**.. Where relevant, reference to/consideration of the JNCC and SNCB underwater guidance has been made in these sections.

Summary of NPS requirement	How and where considered in the PEIR
Where the assessment identifies that noise from construction and UXO clearance may reach noise levels likely to lead to noise thresholds being exceeded (as detailed in the JNCC guidance) the applicant must look at possible alternatives or appropriate mitigation (paragraph 2.8.134).	Potential impacts of noise and their effects on marine mammal behaviour and ecology have been assessed in **sections 4.8, 4.9** and **4.10.** Cumulative impacts have been assessed in **section 4.11** Cumulative Effects Assessment Where relevant, reference to/consideration of the JNCC and SNCB underwater guidance has been made in these sections. A separate marine licence application will be made for any unexploded ordnance (UXO) detonation, as agreed by MMO; therefore, impact pathways in relation to UXO clearance have not been considered in the current assessment. UXO will be undertaken as a standalone activity, prior to cable lay activities.

Marine Policy

UK Marine Policy Statement

4.2.16 The UK Marine Policy Statement was adopted in 2011 and provides the policy framework for the preparation of marine plans and establishes how decisions affecting the marine area should be made (HM Government, 2011).

4.2.17 The high-level marine objective "Living within environmental limits" includes the following requirements which are relevant to marine mammals and sea turtles:

- Biodiversity is protected, conserved and where appropriate recovered and loss has been halted;
- Healthy marine and coastal habitats occur across their natural range and are able to support strong, biodiverse biological communities and the functioning of healthy, resilient and adaptable marine ecosystems; and
- Our oceans support viable populations of representative, rare, vulnerable, and valued species.

South West Inshore and South West Offshore Marine Plans

4.2.18 **Table 4.2** sets out a summary of the specific policies set out in the South West Inshore and South West Offshore Marine Plans (MMO, 2021) relevant to this chapter.

Table 4.2: Summary of inshore and offshore marine plan policies relevant to this chapter

Policy	Key provisions	How and where considered in the PEIR
SW-MPA-1	SW-MPA-1 encourages and supports proposals for activities that further the conservation objectives of marine protected areas. SW-MPA-1 also ensures proposals take account of adverse impacts on individual sites and the overall network,	MPAs and their associated features of interest that may be affected by project activities are considered in **sections 4.8, 4.9** and **4.10**.

Policy	Key provisions	How and where considered in the PEIR
	protecting important habitats, species and geological features, and enabling the successful and continued management of these sites.	
SW-BIO-1	SW-BIO-1 encourages and supports proposals that enhance the distribution of priority habitats and priority species. SW-BIO-1 seeks to maintain the distribution of priority habitats and priority species through the management of significant adverse impacts.	Impacts on priority species relevant to this chapter have been considered in **sections 4.8, 4.9** and **4.10**. Where significant adverse effects are identified, mitigation measures are detailed in **section 4.7.**
SW-BIO-2	SW-BIO-2 supports and encourages proposals that enhance or facilitate native species or habitat adaptation or connectivity, or native species migration. SW-BIO-2 requires proposals to manage negative effects which may significantly adversely impact the functioning of healthy, resilient and adaptable marine ecosystems.	Impacts on native species are considered in **sections 4.8, 4.9** and **4.10**. Where significant adverse effects are identified, mitigation measures are detailed in **section 4.7.**
SW-DIST-1	SW-DIST-1 reduces the effects of disturbance and displacement on highly mobile species by requiring proposals to manage impacts, highlighting good practice and encouraging strategic management of unauthorised activities.	Impacts on highly mobile species (i.e. marine mammals and sea turtles) are considered in **sections 4.8, 4.9** and **4.10**. Where significant adverse effects are identified, mitigation measures are detailed in **section 4.7.**
SW-UWN-2	SW-UWN-2 supports management of underwater noise, requiring proposals to take appropriate noise reduction actions.	The potential impacts of underwater noise on marine mammals and sea turtles have been considered in **sections 4.8, 4.9** and **4.10**. Where significant adverse effects are identified, mitigation measures are detailed in **section 4.7.** This assessment has been informed by information in Volume 3, Appendix 4.1: Underwater Noise Assessment.
SW-CE-1	In conjunction with, and in support of, other relevant south west plan policies, this policy is intended to ensure relevant effects, including those that may seem less significant in their own right, are taken account of and addressed. In doing so, the policy will help to ensure that the cumulative effect on the wider environment of the south west marine area and other relevant receptors are effectively managed.	Potential cumulative effects on marine mammals and sea turtles have been considered in **section 4.11.**

Local Planning Policy

4.2.19 The onshore elements of the Proposed Development are located within the administrative area of Torridge District Council. The relevant local planning policies applicable to marine mammals and sea turtles based on the extent of the study areas for this assessment are summarised in **Table 4.3**.

Table 4.3: Summary of local planning policy relevant to this chapter

Policy	Key provisions	How and where considered in the PEIR
North Devon and Torridge Local Plan		
ST14: Enhancing Environmental Assets	The quality of northern Devon's natural environment will be protected and enhanced by ensuring that development contributes to: [inter alia] *… (b) protecting the hierarchy of designated sites in accordance with their status; (c) conserving European protected species (EPS) and the habitats on which they depend; …(h) recognising the importance of the undeveloped coastal, estuarine and marine environments through supporting designations, plans and policies that aim to protect and enhance northern Devon's coastline;… (i) conserving and enhancing the robustness of northern Devon's ecosystems and the range of ecosystem services they provide.*	All marine mammal and sea turtle species in UK waters are EPS. Potential impacts on EPS have been considered in **sections 4.8, 4.9** and **4.10**.
North Devon Marine Nature Recovery Plan 2022-2027		
Local Implementation Plan	This Marine Nature Recovery Plan covers the biodiversity found in the coastal, estuarine and marine areas of the North Devon Biosphere Reserve and has been developed in order to deliver against relevant international, national and local policies and initiatives. The plan highlights habitats and species of high importance, including harbour porpoise and grey seal, and recommends actions that need to be taken forward to support their recovery.	Impacts on relevant high importance marine mammal species, as defined by the Plan, have been considered in **sections 4.8, 4.9** and **4.10**.

North Devon Biosphere Reserve

4.2.20 The Proposed Development is located within the North Devon Biosphere Reserve, which is recognised under UNESCO's Man and the Biosphere (MAB) Programme and designated as an area for testing and demonstrating sustainable development on a sub-regional scale.

4.2.21 The North Devon Biosphere Reserve consists of three zones; a core zone centred around Braunton Burrows SAC / SSSI, a buffer zone consisting of the Taw Torridge Estuary (as far as Barnstaple and Bideford), and a transition zone

formed by the catchment area of the rivers and streams that drain to the North Coast of Devon in addition to an area of sea as far out as Lundy.

4.2.22 The Biosphere Reserve is overseen by the North Devon Biosphere Reserve Partnership, which is a collaboration of 26 partnership organisations who work to deliver sustainable development through direct action, through advocacy and providing advice. The non-statutory 'North Devon Biosphere Reserve Strategy for Sustainable Development 2014 to 2024' (NDB undated) provides a context for stakeholders to deliver programmes and plans in support of the sustainable development of the Biosphere Reserve.

4.2.23 Within the North Devon Biosphere Reserve, non-statutory programmes and plans relevant to marine mammals and sea turtles include:

- Marine wildlife watching code of conduct
- North Devon Marine Natural Capital Plan
- North Devon Marine Nature Recovery Plan 2022-2027

4.2.24 The extent to which the Proposed Development impacts on the North Devon Biosphere Reserve and its relevant programmes / plans has been considered in this marine mammals and sea turtles chapter, and consultation will take place with the North Devon Biosphere Reserve Partnership ahead of ES stage to further characterise any potential impacts. **Table 4.4** presents a summary of the specific policies set out in the North Devon Marine Natural Capital plan (North Devon UNESCO Biosphere Reserve, 2020) and the Strategy for Sustainable Development (NDB undated) relevant to this chapter.

Table 4.4: Summary of North Devon Biosphere Marine Natural Capital Plan and Strategy for Sustainable Development policies relevant to this chapter

Policy	Description	How and where considered in the PEIR
Marine Natural Capital Plan PL08: *Set management priorities that will rapidly enable 'recovery' of estuarine and coastal intertidal habitats within MPAs, where this conservation objective exists.*	*In the North Devon Marine Natural Capital Plan area these habitats, particularly saltmarsh as well as shallow subtidal reefs and sediments, support multiple ecosystem benefits including food provision, sea defence, healthy climate, and, tourism and recreation. PL08 recognises the importance of these habitats and focuses management measures towards delivering multiple ecosystem service benefits.*	Impacts (direct and indirect) on marine mammal and marine turtle species (marine biodiversity) across the whole North Devon Biosphere Reserve have been considered in **sections 4.8, 4.9** and **4.10**.
Marine Natural Capital Plan PL09: *Support MPA management priorities that consider the wider ecological structures and processes that have the potential for 'recovery' and 'renewal' beyond the delineated boundaries of features*	*Environmental net gain for natural capital may be achieved via MPA management though a more ambitious approach to marine biodiversity conservation. PL09 supports proposals that seek a reduction in pressure across*	Impacts (direct and indirect) on marine mammal and marine turtle species (marine biodiversity) across the whole North Devon Biosphere Reserve have been considered in **sections 4.8, 4.9** and **4.10**.

Policy	Description	How and where considered in the PEIR
of conservation interest within an MPA.	*the whole site instead of considering only the designated features, along with the identification of thresholds for sustainable use.*	
Marine Natural Capital Plan PL10: *Support the implementation of management measures that reduce pressure across subtidal sediments*	*Deeper subtidal habitats provide multiple ecosystem service benefits including food provision and water quality. These habitat assets make up a significant proportion of the plan area but very large extents of these deeper offshore habitats are in an impacted condition, both within and outside MPAs, due to previous interactions with abrasive pressure from demersal fishing activities. PL10 recognises that management must consider improving the condition of this habitat.*	Impacts (direct and indirect) on marine mammal and marine turtle species (marine biodiversity) across the whole North Devon Biosphere Reserve have been considered in **sections 4.8, 4.9** and **4.10**.
Strategy for Sustainable Development ENV2	*Develop fishery management and methods in conjunction with a sustainable sea area management programme that includes Marine Conservation Zones that will effectively support both fisheries and conservation of marine ecosystem services.*	Impacts on marine mammal and marine turtle species, which are part of marine conservation zones, have been considered in **sections 4.8, 4.9** and **4.10**.
Strategy for Sustainable Development ENV3	*Ensure that development should not be permitted that removes critical natural sites and land-take by development is subjected to a programme that ensures no net loss of ecosystem services and biodiversity through on site design and offsite offsetting.*	Impacts on marine mammal and marine turtle species, and any associated protected sites (Table 4.14), have been considered in **sections 4.8, 4.9** and **4.10**.

4.3 Consultation and Engagement

4.3.1 In January 2024, the Applicant submitted a Scoping Report to the Planning Inspectorate, which described the scope and methodology for the technical studies being undertaken to provide an assessment of any likely significant effects for the construction and operational phases of the Proposed Development. It also described those topics or sub-topics which are proposed to be scoped out of the

EIA process and provided justification as to why the Proposed Development would not have the potential to give rise to significant environmental effects in these areas.

4.3.2 Following consultation with the appropriate statutory bodies, the Planning Inspectorate (on behalf of the Secretary of State) provided a Scoping Opinion on 07 March 2024. Key issues raised during the scoping process specific to marine mammals and sea turtles are listed in **Table 4.5**, together with details of how these issues have been addressed within the PEIR.

Table 4.5 Summary of Scoping Responses

Comment	How and where considered in the PEIR
Planning Inspectorate	
The Scoping Report states that separate consents would be sought for offshore UXO clearance works, if required. The Inspectorate advises that the ES should still include a high-level assessment of offshore UXO clearance in relevant aspect chapters based on a likely worst case scenario (any assumptions used in the definition of the worst case scenario should be explained in the ES). The ES should address any cumulative effects from the construction of the Proposed Development with the likely effects from the UXO clearance.	UXO clearance would be undertaken as standalone activity prior to cable lay activities. Should UXO clearance be required, any impacts arising from these works will be assessed as part of the standalone marine licence process. This Scoping Opinion response was specifically discussed with the MMO in preparation of this PEIR. The MMO confirmed their preference that UXO assessment and licensing should be undertaken as a two-stage marine licence process separate to the EIA. (This approach is understood to be in the process of becoming mandatory.) The two stages would consist of initial marine licence for UXO survey and separate marine licence for site specific clearance (where identified as necessary). As discussed, this process allows a feature specific response to be developed, which could not be assessed in advance. Therefore, impact pathways in relation to UXO clearance have not been considered in the EIA.
Several aspect chapters in the Scoping Report refer to fixed distance study areas with no explanation as to why these have been selected. The ES should ensure the study area for each aspect reflects the Proposed Development's Zone of influence (ZoI) and the impact assessment should be based on the ZoI from the Proposed Development with reference to potential effect pathways. Clear justification should be provided to support any distances applied.	Justification of the marine mammal and sea turtle study areas and respective distances is provided in **section 4.4,** under Study Area.
The Inspectorate acknowledges that data and knowledge regarding the baseline environment exists for the offshore area in which the Proposed Development would be located. The Inspectorate understands the benefits of utilising this information to supplement site-specific survey data but advises that suitable care should be taken to ensure that the information in the ES remains representative and fit for purpose. The Applicant should make effort to agree the suitability of information used for the	The data and knowledge used to determine the baseline environment submitted in the Scoping Report was reviewed to ensure it was presented in a manner such that it informed the PEIR (**section 4.5**). It will also be reviewed for the ES to ensure that the most up to date information is taken into account at the time of ES submission, with baseline data sources used to be agreed with relevant consultation bodies prior to the ES.

Comment	How and where considered in the PEIR
assessments in the ES with relevant consultation bodies.	
It is noted that the Scoping Report includes consideration of potential transboundary effects in relation to marine mammals and sea turtles. The Inspectorate recommends that the ES should identify whether the Proposed Development has the potential for significant transboundary effects, and if so, what these are, and which EEA States would be affected. The Inspectorate will undertake a transboundary screening on behalf of the SoS in due course.	Transboundary effects are assessed in **section 4.12**
The CIEEM guidelines for Ecological Impact Assessment for Terrestrial, Freshwater and Coastal Environments (2018) was updated in April 2022 as version 1.2. The assessment should refer to the most recent iteration of the guidelines as relevant	Reference updated in **section 4.2**, and version 1.2 of the guidance was reviewed to ensure information relating to reference was still correct (no further amendments needed).
The Inspectorate is content for the effect of the introduction of hard substrate to be considered during operational phase and therefore agrees this matter can be scoped out of the construction stage assessment. The ES should however consider the removal of subsequent hard substrate in the decommissioning (removal) phase, where likely significant effects could occur, or provide evidence demonstrating agreement with the relevant consultation bodies that significant effects are not likely to occur.	An assessment of the effects of the removal of hard substrate in the decommissioning phase on marine mammal and sea turtle receptors will be considered in the ES, but significant effects are not likely to occur. The removal of hard substrate can lead to the loss or disturbance to key prey species of marine mammals and sea turtles but given their varied diet, ability to travel long distances to forage and expected return to the baseline habitat, the impacts are expected to minimal.
The Scoping Report states that impacts on fish and shellfish receptors would affect prey availability for some marine mammal and bird receptors, but the scale of this inter-related effect has already been considered and scoped out at Section 8.5.	The impacts on fish and shellfish receptors have been assessed in **Volume 3, Chapter 2,** of the PEIR, as not significant. This is in agreement with the assessment at scoping phase to scope out the impact on marine mammals and sea turtles, hence no consideration is given in the PEIR.
On the basis that disturbance due to noise and vessels would not arise during the operation (excluding repair) and decommissioning (where cable left in situ) phases, the Inspectorate is content that this matter can be scoped out of further assessment.	N/A (scoped out)
In the absence of information demonstrating clear agreement with relevant statutory bodies, the Inspectorate is not in a position to agree to scope the risk of collision with marine mammals out of further assessment. The ES should include an assessment of vessel interaction and collision risk to marine mammals, where likely significant effects could occur, or evidence demonstrating the agreement of the relevant consultation bodies that the matter can be scoped out and the absence of likely significant effects. The Inspectorate advises that the Applicant should provide an outline VMP to demonstrate how effects on marine mammals would be minimised.	An assessment of vessel interaction and risk of collision to marine mammals will be considered in the ES, but significant effects are not likely to occur as vessels working in the Proposed Development will be travelling at slow speeds and have predictable movements. The risk of collision between marine mammals and vessels is directly influenced by vessel type and vessel travelling speed (Laist *et al*, 2001). In addition, marine mammals and sea turtles are relatively small and highly mobile, and given observed responses to noise, are expected to detect vessels in close proximity and largely avoid collision. A VMP will also be provided with the ES.

Comment	How and where considered in the PEIR
The Scoping Report contains very limited information regarding the likely noise generated from the Proposed Development and coupled with the presence of marine mammal qualifying features of the Bristol Channel Approaches SAC, which are sensitive to noise disturbance, the Inspectorate considers that insufficient justification has been provided as to why hearing damage and auditory injury and temporary changes in hearing caused by increased anthropogenic noise can be scoped out. The ES should therefore include an assessment of PTS and TTS effects on marine mammals and sea turtles, where significant effects are likely to occur. The Applicant should seek to agree the approach to assessment with the relevant consultation bodies, such as NE and JNCC.	The Proposed Development activities will generate non-impulsive noise only (i.e, no impulsive noise sources form part of these works). A literature review of underwater noise assessments (some including empirical modelling) undertaken for other projects carrying out similar activities has demonstrated that instantaneous TTS and PTS thresholds are not exceeded for the key receptors, hence this impact was initially intended to be scoped out. Underwater noise modelling has been undertaken as part of the PEIR to assess the potential impacts on marine mammals of the different activities with an overview of the PTS results presented in **Table 4.21** and further details (including TTS) available in Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR. This assessment has concluded that it is unlikely that instantaneous PTS and /or TTS impacts will take place across all functional hearing groups (FHGs) during the proposed noise emitting activities. Prior to having reviewed the underwater noise modelling Natural England have further confirmed their expectation that PTS and TTS effects are included in the ES. The Applicant will consult further with relevant bodies to discuss and will include an appropriate level of assessment within the ES.
The Scoping Report seeks to scope out accidental pollution on the grounds that measures including the Marine Pollution Contingency Plan (MPCP) as part of the Offshore CEMP would ensure that accidental spills/leaks would be very limited. The Inspectorate agrees that, provided the measures to mitigate the risks of accidental pollution are clearly described in the ES and secured in the DCO, this matter can be scoped out of further assessment.	N/A (scoped out)
The Inspectorate agrees that EMF impacts to seals and cetaceans can be scoped out of further assessment. It is less clear whether leatherback turtles would be affected by EMF. The ES should include either an assessment of this matter or information demonstrating agreement with the relevant consultation bodies and the absence of alikely significant effect.	To our knowledge, no further literature/evidence is available with respect to EMF and potential impacts on leatherback turtles (or other species of marine turtle). Further engagement will be sought on this topic with relevant stakeholders during the next stages of consultation and the resulting views will be taken into account in the ES.
In the absence of the findings of the fish assessment and information demonstrating clear agreement with relevant statutory bodies, the Inspectorate is not able to agree to scope indirect impacts resulting from impacts on marine mammal prey species out of further assessment at this stage. The ES should include an assessment of indirect impacts to marine mammals as a result of impacts to prey species,	The impacts on fish and shellfish receptors have been assessed in **Volume 3, Chapter 2,** of the PEIR, as not significant. This is in agreement with the assessment at scoping phase to scope out indirect impacts resulting from impacts on prey species of marine mammals and sea turtles, hence no consideration is given in the PEIR. The Applicant will further consult with the relevant consultation bodies on the above and include in the ES an assessment if required.

Comment	How and where considered in the PEIR
including consideration of the implications for the marine mammal populations of the Bristol Channel Approaches SAC, where likely significant effects could occur.	Consideration of the implications for the marine mammal populations of the Bristol Channel Approaches SAC will be undertaken in the HRA. The HRA will be relevant to the harbour porpoise only, as it is the only species of marine mammal that is a qualifying feature of the site. The HRA also includes consideration of Conservation Objective 3 (i.e. 'The condition of supporting habitats and processes, and the availability of prey is maintained').
The Scoping Report identifies that the closest known haul-out sites for grey seals are Lundy Island and the Isles of Scilly at 3.6km and 32km from the Proposed Development, respectively. This matter is proposed to be scoped out based on distance to haul-out sites and the nature of the construction activities, which are not expected to directly impact seal haul-outs. The Inspectorate agrees that on this basis, disturbance at seal haul-out sites can be scoped out of the impact assessment.	N/A (scoped out)
The Inspectorate agrees that water quality changes are unlikely to result in significant effects to marine mammals and sea turtles and therefore this matter can be scoped out.	N/A (scoped out)
The receptor value table does not include reference to EPS. It is recommended that EPS be included in the appropriate definition within this table.	**Table 4.10** updated to include EPS.
The table of magnitude in all cases refers to reversibility; however, the Inspectorate queries whether there may be instances when impacts are deemed irreversible. The ES should clearly define the magnitude of impacts including likely reversibility and permanence.	As requested by the Inspectorate, magnitude will be revised to include likely reversibility and permanence in the ES.
The ES should assess impacts from climate change, including extreme weather events over the construction and decommissioning periods, where significant effects are likely to occur and describe and secure any relevant mitigation measures.	Potential changes to the assessment as a result of in-combination climate impacts have been assessed from **paragraph 4.9.199** to **4.9.209.** Information on impacts of extreme weather events on marine mammals and sea turtles (if available) will be incorporated in the ES.
The ES should set out the methodologies used to explain any departure from the proposed approach where professional judgement is applied. Outputs from other assessments should be clearly explained where these have been applied.	Noted, relevant information will be included in the ES if required.
Where significance criteria are not explicitly defined within the guidance, the ES should clearly set out where deviation from guidance has occurred and professional judgement has been applied.	The significance criteria is defined in the Impact Assessment methodology, from **paragraph 4.4.21** to **4.4.26.**
The Inspectorate agrees that likely significant effects arising from residues and emissions (eg dust, pollutants, light, noise, vibration) are to be	Noted, relevant information relating to marine mammal and sea turtle receptors will be included in the ES.

Comment	How and where considered in the PEIR
assessed in the relevant aspect chapters of the ES and a standalone aspect chapter for residues and emissions is not required.	
The Scoping Report confirms that EMFs generated during the operation of the Proposed Development will be considered in the relevant aspect chapters (including marine mammals and sea turtles) and would not be included in a standalone ES chapter in respect of heat and radiation. The Inspectorate is content with this approach.	Noted (no action needed).
JNCC	
We note that the project passes through the following sites designated for nature conservation: • East of Haig Fras Marine Conservation Zone (MCZ); • South-West Approaches to Bristol Channel MCZ; • Lundy Sand Special Area of Conservation (SAC); • Lundy MCZ; • Bristol Channel Approaches SAC; • North West of Lundy MCZ; and • Bidefor to Foreland Point MCZ. The East of Haig Fras MCZ is an offshore site and so JNCC is the responsible agency for this site. The South West Approaches to the Bristol Channel MCZ and Bristol Channel Approaches SAC are jointly managed sites between Natural England, Natural Resources Wales (in the case of Bristol Channel Approaches SAC) and JNCC. JNCC defer to Natural England for comments on the remaining sites as they are the responsible agency.	Noted, Natural England has been consulted on the Proposed Development and Natural Resources Wales will be consulted regarding the Bristol Channel Approaches SAC. Further engagement will be sought with JNCC on The East of Haig Fras MCZ during the next stages of consultation. Any relevant recommendations will be taken into account in the ES. The JNCC have confirmed the requirement to assess impacts on conservation objective 3 (i.e. 'The condition of supporting habitats and processes, and the availability of prey is maintained'), which is undertaken within the HRA Screening report, which accompanies this PEIR.
We would recommend that the Applicant uses 'Nature conservation considerations and environmental best practice for subsea cables for English inshore and UK offshore waters' (Natural England and JNCC, 2022) guidance.	The recommended guidance has been considered in the PEIR.
JNCC agree with approach taken to identify marine mammal study areas. It would be beneficial if territorial waters were marked on Figure 8.5.1 to demonstrate whether proposed cable route enters Welsh territorial waters. This is of particular interest for where the route passes through the Bristol Channel Approaches SAC, as this site is jointly managed by JNCC, Natural England and Natural Resources Wales.	Figure 8.5.1 Cetacean Study Area (Figure 4.1 in the PEIR) has been updated to show the boundaries of the relevant territorial waters.
JNCC agree with the impacts scoped into the assessment (Table 8.5.5) however we disagree with scoping out auditory injury and indirect impacts to prey, as the regulator will need to understand the potential impacts of both in order	The impacts on fish and shellfish receptors have been assessed in **Volume 3, Chapter 2,** of the PEIR, as not significant. This is in agreement with the assessment at scoping phase to scope out indirect impacts resulting from impacts on marine mammals and sea turtles prey species, hence no consideration is given in the PEIR.

Comment	How and where considered in the PEIR
to undertake their HRA for the Bristol Channel Approaches SAC.	The Proposed Development activities will generate non-impulsive noise (i.e, no impulsive noise sources form part of these works). A literature review of underwater noise assessments (some including empirical modelling) undertaken for other projects carrying out similar activities has demonstrated that instantaneous TTS and PTS thresholds are not exceeded for the key receptors, hence this impact has been scoped out. Underwater noise modelling has been undertaken as part of the PEIR to assess the potential impacts on marine mammals, assessing all noise-generating activities; an overview of the PTS results presented in **Table 4.21** (see Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR, for further information, including TTS assessments). This assessment has concluded that it is unlikely that instantaneous PTS and /or TTS impacts will take place across any of the FHGs during the proposed works. The Applicant will consult with JNCC on the above and will consider this advice where relevant in the HRA.
JNCC are content with the approach proposed in Table 8.5.7, however it would be beneficial to understand where the percentages that are included have come from and what will happen if it is not possible to estimate the likelihood of an effect occurring as a percentage?	The Probability ratings and percentages indicated are based on former guidance from IEEM (2010), in which these values were suggested based on conventions for quantifying statistical significance. However, we accept it is more common and appropriate to align to the qualitative description approach as per 2018 ECIA guidelines in which professional judgement is applied to determine likelihood of impact. Professional judgement has been applied in the assessment undertaken in the PEIR.
In table 8.5.8 there is not mention of European Protected Species (EPS) and we would recommend they are included here.	EPS has been added to table 8.5.8 (**Table 4.10** in the PEIR).
JNCC are content with the approach proposed in table 8.5.10, however, we note that all categories assume there will be a recovery should impacts occur. What would happen if this were not to be the case?	As requested by the JNCC, magnitude (Table 8.5.10 (**Table 4.11** in the PEIR)) will be revised to include likely reversibility and permanence/recovery in the ES.
Marine Management Organisation	
The relevant Marine Plan for the location of the Proposed Development is the South West Marine Plans. The MMO expects the Applicant to clearly demonstrate how all relevant marine plan policies have been considered, as well as providing a statement noting whether the Proposed Development is compliant with the marine plan.	The South West Inshore and Offshore Marine Plan have been taken into account in the PEIR, with further details provided in **Table 4.2.** The Proposed Development is compliant with the marine plan.
Natural England	

Comment	How and where considered in the PEIR
The development site is within or may impact on the following Habitats/internationally designated nature conservation sites: Marine sites: • Bristol Channel Approaches Special Area of Conservation (SAC) • Lundy SAC • Isles of Scilly Complex SAC • Severn Estuary SAC/Ramsar Terrestrial sites: • Braunton Burrows SAC Based on the information provided, Natural England's advice is that the proposed cable route is unlikely to have a significant effect on terrestrial European sites and can therefore be screened out from requiring further assessment.	All SACs with marine mammals as qualifying features (**Table 4.14**) have been considered in the PEIR. Consideration of conservation objective 3 of the Bristol Channel Approaches SAC (i.e. 'The condition of supporting habitats and processes, and the availability of prey is maintained') is made in the HRA Screening report which accompanies this PEIR.
While Natural England agrees with the decision to scope out EMF impacts and water quality changes on marine mammals, Natural England does not agree with the scoping out of other impacts on marine mammals.	Noted. Addressed in comments below relating to specific potential pathways.
Natural England advise the impact of collisions with vessels on marine mammals should be scoped into the EIA.	The impact of collisions with vessels on marine mammals will be assessed in the ES. No significant impact is expected as vessels working in the Proposed Development will be travelling at slow speeds and have predictable movements. The risk of collision between marine mammals and vessels is directly influenced by vessel type and vessel travelling speed (Laist *et al*, 2001). In addition, marine mammals are relatively small and highly mobile, and given observed responses to noise, are expected to detect vessels in close proximity and largely avoid collision.
Natural England advise that indirect impacts on marine mammals resulting from changes to the seabed should be scoped into the EIA for the Bristol Channel Approaches.	The impact of indirect impacts on marine mammals from changes to the seabed will be assessed in the ES. No effects on marine mammal receptors are expected, given that no significant effects have been identified on seabed morphology as part of the Physical Processes PEIR assessment (c.f. Volume 3, Chapter 8). These considerations contribute to the assessment (presented within the HRA Screening report which accompanies this PEIR) of potential impact on conservation objective 3 of the Bristol Channel Approaches SAC (i.e. 'The condition of supporting habitats and processes, and the availability of prey is maintained').
Natural England advise the impact of hearing damage and auditory injury on marine mammals should be scoped into the EIA for the Bristol Channel Approaches SAC.	The Proposed Development activities will generate non-impulsive noise, (i.e, no impulsive noise sources form part of these works). A literature review of underwater noise assessments (some including empirical modelling) undertaken for other projects carrying out similar activities has demonstrated that instantaneous

Comment	How and where considered in the PEIR
	TTS and PTS thresholds are not exceeded for the key receptors, hence this impact has been scoped out. Underwater noise modelling has been undertaken as part of the PEIR to assess the potential impacts on marine mammals, assessing all noise-generating activities; an overview of the PTS results presented in **Table 4.21** (see Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR for further information, including TTS assessments). This assessment has concluded that it is unlikely that instantaneous PTS and /or TTS impacts will take place across any of the FHGs during the proposed works. The Applicant will further consult with Natural England on the above and include in the ES an assessment if required.
Natural England advise indirect impacts on marine mammals resulting from impacts on marine mammal prey species should be scoped into the EIA for the Bristol Channel Approaches	The impacts on fish and shellfish receptors have been assessed in **Volume 3, Chapter 2,** of the PEIR as not significant. This is in agreement with the assessment at scoping phase to scope out indirect impacts resulting from impacts on marine mammals and sea turtles prey species, hence no further consideration is given in the PEIR. Consideration of prey species contribute to the assessment (presented within the HRA Screening report which accompanies this PEIR) of potential impact on conservation objective 3 of the Bristol Channel Approaches SAC (i.e. 'The condition of supporting habitats and processes, and the availability of prey is maintained'). The Applicant will further consult with Natural England on the above and include in the ES an assessment if required.

4.3.3 Following scoping, consultation and engagement with interested parties specific to marine mammals and sea turtles has continued. A summary of the key issues raised during consultation activities undertaken to date is presented in **Table 4.6**, together with how these issues have been considered in the production of this PEIR chapter.

Table 4.6 Summary of consultation relevant to this chapter

Date	Consultee and type of response	Issues raised	How and where considered in the PEIR
January 2024	JNCC meeting	Initial discussions around extent of marine mammals assessment. JNCC are minded to adopt a precautionary stance to Scoping because the route passes through an SAC designated for Harbour Porpoise i.e. some impacts may need to be scoped in to assessment, even if these will ultimately be non-significant.	Subsequent meetings to be arranged with JNCC marine mammal leads. Additional disturbance effects are assessed (relative to the Scoping Report) in Sections **4.8, 4.9**, and **4.10**. Additional noise impacts will be included in the ES, where necessary, following technical discussions with JNCC marine mammal experts.
March 2024	Natural England meeting	Discussion of: • Inclusion of EMF impacts on marine turtles in ES. • Assessment of indirect impacts on marine mammals resulting from indirect impacts on marine mammal prey species for the Bristol Channel Approaches SAC • Impact of hearing damage and auditory injury on marine mammals for the Bristol Channel Approaches SAC	• NE advised that EMF impacts on marine turtles should be included in the ES, hence not considered in the PEIR. • NE agreed with the Applicant approach of assessing indirect impacts on marine mammal prey species in the HRA, hence not considered in the PEIR. • NE confirmed the requirement to undertake an assessment of underwater noise. Underwater noise calculations have been undertaken with the results presented in Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR. An overview of results is presented in paragraph 4.8.44 and Table 4.21.

Date	Consultee and type of response	Issues raised	How and where considered in the PEIR
n/a	JNCC	Further technical meetings with JNCC to discuss the PEIR approach have been scheduled at the time of drafting this PEIR Chapter.	n/a

4.4 Methodology

4.4.1 The marine mammal and sea turtle assessment has considered the potential impacts of the construction, operation and decommissioning phases of the Proposed Development. The assessment was carried out in accordance with the methodology set out in Volume 1, Chapter 5: EIA Methodology, of the PEIR.

Relevant Guidance

4.4.2 With respect to marine mammals and sea turtles, the following guidance documents have been used to inform the assessment of potential impacts on marine mammals and sea turtles:

- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2 (CIEEM, 2018);
- Nature conservation considerations and environmental best practice for subsea cables for English inshore and UK offshore waters (Natural England and JNCC, 2022);
- Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects (Southall *et al*., 2019);
- Marine mammal noise exposure criteria: assessing the severity of marine mammal behavioural response to human noise (Southall *et al*., 2021);
- The Protection of Marine EPS from Injury and Disturbance: Draft Guidance for the Marine Area in England and Wales and the UK Offshore Marine Area (JNCC *et al*., 2010);
- Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (JNCC, 2020);
- National Oceanic and Atmospheric Administration technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing (NMFS, 2018);
- Sound Exposure Guidelines for Fishes and Sea Turtles (Popper *et al*., 2014); and
- Wildlife Safe (WiSe) Scheme Code of Conduct for best practices for wildlife watching.

Scope of the Assessment

4.4.3 The scope of this PEIR has been developed in consultation with relevant statutory and non-statutory consultees as detailed in **Table 4.5** and **Table 4.6.**

4.4.4 During construction, there is potential for underwater noise impacts on sensitive ecological receptors due to cable installation activities and increased vessel disturbance. During operation, there is potential for underwater noise impacts on sensitive ecological receptors due to repair and maintenance activities. Decommissioning effects associated with the removal of offshore infrastructure are envisaged to be the same or similar to those described for the construction phase. Decommissioning effects associated with leaving offshore infrastructure *in situ* are envisaged to be the same or similar to those described for standard

operation of the Proposed Development. The potential impacts of these on marine mammal and sea turtle receptors are assessed within this chapter.

4.4.5 Taking into account the scoping and consultation process, **Table 4.7** summarises the issues considered as part of this assessment.

Table 4.7: Issues considered within this assessment

Activity	Potential effects scoped into the assessment
Construction Phase	
Ground condition surveys, seabed preparation, route clearance, cable lay and burial activities.	Increased disturbance due to anthropogenic noise
	Increased vessel disturbance
Operational Phase – repair activities only	
Repair works (cable cut, recover, and burial activities)	Increased disturbance due to anthropogenic noise
	Increased vessel disturbance
Decommissioning Phase – removal	
Repair works (cable cut, recover, and burial activities)	Increased disturbance due to anthropogenic noise
	Increased vessel disturbance

4.4.6 Effects which are not considered likely to be significant have been scoped out of the assessment. A summary of the effects scoped out is presented in **Table 4.8**.

Table 4.8: Issues scoped out of the assessment

Activity	Potential effects scoped out of the assessment
Construction Phase	
Ground condition surveys, seabed preparation, route clearance, cable lay and burial activities.	Collision with vessels - Vessels will operate at low to moderate speeds and follow predefined routes, reducing the risk of collisions.
	Hearing damage and auditory injury (Permanent Threshold Shift; PTS) and temporary (Temporary Threshold Shift; TTS) changes in hearing – The proposed construction activities do not have the potential, or are extremely unlikely, to cause PTS or TTS.
	Accidental pollution – Implementation of best practice measures and compliance with the requirements of the MARPOL Convention limits the potential for effects from this impact pathway.
	Indirect impacts resulting from impacts on marine mammal prey species - Marine mammals and sea turtles are highly mobile and able to exploit other prey resources nearby. Consequently, any indirect impacts on marine mammals and sea turtles due to impacts on their prey species would be short-term and localised.
	Disturbance at seal haul-out sites – There are no seal haul-out sites in close proximity to the Proposed

Activity	Potential effects scoped out of the assessment
	Development, the nearest site being over 3 km from the Offshore Cable Corridor.
	Water quality changes – The highly mobile and wide-ranging nature of marine mammals and sea turtles means they are able to exploit alternative feeding sites away from the ZoI of the Proposed Development.
Operational Phase	
Standard operation of the Proposed Development	Presence of EMF - There is no evidence of EMF having any impact (either positive or negative) on marine mammals (Copping, 2018). Leatherback turtles use multiple cues for navigation, including EMF. Given this, and the EMF relating to the Proposed Development will be localised, the risk of navigational miscues as a result of EMF relating to the development is considered highly unlikely.
Operational Phase – repair activities only	
Inspection surveys, repair works (cable cut, recovery, and burial activities)	Collision with vessels - Vessels will operate at low to moderate speeds and follow predefined routes, reducing the risk of collisions.
	Hearing damage and auditory injury (Permanent Threshold Shift; PTS) and temporary (Temporary Threshold Shift; TTS) changes in hearing – The proposed operational activities do not have the potential, or are extremely unlikely, to cause PTS or TTS.
	Accidental pollution - Implementation of best practice measures and compliance with the requirements of the MARPOL Convention limits the potential for effects from this impact pathway.
	Indirect impacts resulting from impacts on marine mammal prey species - Marine mammals and sea turtles are highly mobile and able to exploit other prey resources nearby. Consequently, any indirect impacts on marine mammals and sea turtles due to impacts on their prey species would be short-term and localised.
	Disturbance at seal haul-outs - There are no seal haul-out sites in close proximity to the Proposed Development, the nearest site being over 3 km from the Offshore Cable Corridor.
	Water quality changes - The mobile and wide-ranging nature of marine mammals and sea turtles means they can exploit alternative feeding sites away from the ZoI of the Proposed Development.
Decommissioning Phase – removal	
Inspection surveys, repair works (cable cut, recovery, and burial activities)	Collision with vessels - Vessels will operate at low to moderate speeds and follow predefined routes, reducing the risk of collisions.
	Hearing damage and auditory injury (Permanent Threshold Shift; PTS) and temporary (Temporary Threshold Shift; TTS) changes in hearing - The

Activity	Potential effects scoped out of the assessment
	proposed decommissioning activities do not have the potential, or are extremely unlikely, to cause PTS or TTS.
	Accidental pollution - Implementation of best practice measures and compliance with the requirements of the MARPOL Convention limits the potential for effects from this impact pathway.
	Indirect impacts resulting from impacts on marine mammal prey species - Marine mammals and sea turtles are highly mobile and able to exploit other prey resources nearby. Consequently, any indirect impacts on marine mammals and sea turtles due to impacts on their prey species would be short-term and localised.
	Disturbance at seal haul-outs - Disturbance at seal haul-outs - There are no seal haul-out sites in close proximity to the Proposed Development, the nearest site being over 3 km from the Offshore Cable Corridor.
	Water quality changes - The mobile and wide-ranging nature of marine mammals and sea turtles means they are able to exploit alternative feeding sites away from the ZoI of the Proposed Development.

Study Area

4.4.7 Marine mammals and sea turtles are highly mobile and differ in their foraging distances and seasonal distribution based on their ecology and behaviour. Therefore, the marine mammal and sea turtle study areas were considered at two spatial scales: a broad scale and a more site-specific scale. The site-specific scale more accurately reflected the extent of potential disturbance and/or indicative information on local species densities.

4.4.8 The site-specific study area for all marine mammals was the Offshore Cable Corridor which runs from the MLWS to the EEZ boundary, with a precautionary 5 km buffer.

4.4.9 The site-specific study area was based on a precautionary (ZoI) of the works, using the Joint Nature Conservation Committee (JNCC, 2020) guidance for assessing noise disturbance in harbour porpoise SACs. This guidance recommends the use of activity specific Effective Deterrence Ranges (EDRs), to assess ZoI. However, there are no EDRs presented in the guidance for the construction, operation and decommissioning activities considered in the PEIR, which would have a lower impact radius, with respect to underwater noise, than any of the activities listed in the guidance. Therefore, the smallest EDR of 5 km for 'other geophysical surveys' was applied here, as a precautionary approach.

4.4.10 The precautionary EDR of 5 km was used because there is potential to disturb and/or displace marine mammals and sea turtles present in the Offshore Cable Corridor, due to noise disturbance during the construction and decommissioning phases of the Proposed Development.

4.4.11 For each cetacean species the broad scale study area was defined by the appropriate species Management Unit (MU; defined by the Inter Agency Marine Mammal Working Group, IAMMWG; IAMMWG, 2023).

4.4.12 At the broad MU scale, the Proposed Development is located within the following specific cetacean MUs:

- Harbour porpoise: Celtic and Irish Seas MU;
- Bottlenose dolphin: Offshore Channel, Celtic Sea and South West England MU;
- Common dolphin: Celtic and Greater North Seas MU;
- Risso's dolphin: Celtic and Greater North Seas MU; and
- Minke Whale: Celtic and Greater North Seas MU.

4.4.13 A cetacean MU typically refers to a geographical area in which the animals of a particular species are found, to which management of human activities is applied. It may be smaller than what is believed to be a 'population' (which is defined as a collection of individuals of the same species found in the same area, where genetic variation occurs within the population and between other populations), to reflect spatial differences in human activities and their management (IAMMWG, 2023). Using MUs in the assessment of cetacean species allows consideration of the scale of movement of a species and its respective populations, whilst taking account of jurisdictional boundaries and the management of human activities. The broad scale study area for cetaceans is shown in Volume 3, Figure 4.1, of the PEIR**.**

4.4.14 Seal Management Units (SMU) also refer to a geographical area which are defined based on the distribution of seal haul-out sites, for pragmatic reasons such as the ability to survey an SMU within one season, and the locations of jurisdictional boundaries (SCOS, 2022). SMUs are not explicit management divisions and should be combined appropriately when management is considered. The broad scale study area for seals is shown in Volume 3, Figure 4.2, of the PEIR.

4.4.15 The broad scale study area for sea turtles (Volume 3, Figure 4.3, of the PEIR) is the OSPAR Region III: Celtic Seas (OSPAR, 2022), in view of the wide-ranging distribution of sea turtles throughout the region.

Methodology for Baseline Studies

Desk Studies

4.4.16 A desk-based review of existing studies and datasets was undertaken to obtain information on marine mammals and sea turtles present in the broad scale and site-specific study areas. The data sources that have been collected and used to inform this assessment are summarised in **Table 4.13.**

Site-Specific Surveys

4.4.17 No site-specific surveys for marine mammal and sea turtle have been undertaken as there was sufficient information on the study area from existing sources.

Impact Assessment Methodology

Overview

4.4.18 The approach to determining the significance of effects is a two-stage process that involves defining the magnitude of the impact and the sensitivity of the receptor. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in Volume 1, Chapter 5: EIA methodology of the PEIR.

Receptor Sensitivity/Value

4.4.19 The criteria for defining sensitivity in this chapter are outlined in **Table 4.9** below. The definitions of value for marine mammal and sea turtle receptors are provided in **Table 4.10.**

4.4.20 It should be noted that high value and high sensitivity are not necessarily linked with a particular impact. A receptor could be of high value (e.g., an interest feature of a SAC) but have a low or negligible physical/ecological sensitivity to an impact and vice versa.

As all species of marine mammal and marine turtle are afforded a high degree of legislative protection, and are important internationally, they are all considered to be very high value (**Table 4.10**). Consequently, the concept of value is not considered within the definition of sensitivity. Rather, value is considered further in terms of suitable mitigation, if required.

Table 4.9: Sensitivity criteria for marine mammal and sea turtle receptors

Sensitivity	Definition
Very High	The species has very limited tolerance to sources of disturbance such as noise, prey disturbance and vessel movements
High	The species has limited tolerance to sources of disturbance such as noise, prey disturbance and vessel movements
Medium	The species has some tolerance to sources of disturbance such as noise, prey disturbance and vessel movements
Low	The species is generally tolerant to sources of disturbance such as noise, prey disturbance and vessel movements
Negligible	Negligible or no sensitivity to disturbance

Table 4.10: Value criteria for marine mammal and sea turtle receptors

Value	Definition
Very High	• An internationally designated site or candidate site (SPA, pSPA, SAC, cSAC, pSAC, Ramsar site etc.) or an area which the country agency has determined meets the published selection criteria for such designation, irrespective of whether or not it has yet been notified. • Internationally significant and viable areas of a habitat type listed in Annex I of the Habitats Directive or species on Annex II of the Habitats Directive. • Globally threatened species (i.e., Critically endangered or endangered on IUCN Red list) or species listed on Annex 1 of the Bern Convention.

Value	Definition
	• European Protected Species under Annex IV of the European Commission Habitats Directive • Regularly occurring populations of internationally important species that are rare or threatened in the UK or of uncertain conservation status. • A regularly occurring, nationally significant population/number of any internationally important species. • Habitat/species highly regarded for their important biodiversity, social/community value and/or economic value.
High	• A nationally designated site (SSSI, NNR, MNR, MCZ) or a discrete area, which the country conservation agency has determined meets the published selection criteria for national designation (e.g., SSSI selection guidelines) irrespective of whether or not it has yet been notified. • Regularly occurring, globally threatened species (i.e., Vulnerable or lower on IUCN Red list) or species listed on Annex 1 of the Bern Convention. • Previously UKBAP habitats and species; S41 species of NERC Act. • Habitat/species which have important biodiversity, social/community value and/or economic value.
Medium	• Significant populations of a regionally/county important species. • Habitat/species possess moderate biodiversity, social / community value and/or economic value.
Low	• Species are abundant, common or widely distributed. • Habitat/species have low biodiversity, social/community value and/or economic value.
Negligible	• Negligible or no value and/or economic value.

Magnitude of Impact

4.4.21 The criteria for defining magnitude in this chapter are outlined in **Table 4.11** below.

Table 4.11: Impact magnitude criteria for marine mammal and sea turtle receptors

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

Magnitude of impact	Definition
Negligible	Very slight change from the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site. Recovery to baseline levels from that change predicted to be rapid (i.e., no more than ca. six months) following cessation of the development activity.
No Change	The activity will have no interaction with the receptor.

4.4.22 The significance of the effect upon marine mammals and sea turtles has been determined by taking into account the sensitivity of the receptor and the magnitude of the impact. Value is not considered in this regard, as all species of marine mammal and marine turtle are defined as very high value. The method employed for this assessment is presented in **Table 4.12**Table 4.12. Where a range of significance levels is presented, the final assessment for each effect is based upon expert judgement.

4.4.23 In all cases, the evaluation of receptor sensitivity, impact magnitude and significance of effect has been informed by professional judgement and is underpinned by narrative to explain the conclusions reached.

4.4.24 For the purpose of this assessment, any effects with a significance level of minor or less are not considered to be significant in terms of the EIA Regulations.

Table 4.12: Assessment Matrix

Sensitivity of Receptor	Magnitude of Impact				
	No Change	**Negligible**	**Low**	**Medium**	**High**
Negligible	No Change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No Change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No Change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No Change	Minor	Minor or Moderate	Moderate or Major	Major
Very High	No Change	Minor	Moderate or Major	Major	Major

4.4.25 Where the magnitude of impact is ‘no change’, no effect would arise.

4.4.26 The definitions for significance of effect levels are described as follows.

- **Major:** These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category. Effects upon human receptors may also be attributed this level of significance.
- **Moderate:** These beneficial or adverse effects have the potential to be important and may influence the key decision-making process. The cumulative

effects of such factors may influence decision-making if they lead to an increase in the overall adverse or beneficial effect on a particular resource or receptor.

- **Minor:** These beneficial or adverse effects are generally, but not exclusively, raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the project.
- **Negligible:** No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.
- **No change:** No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Assumptions and Limitations of the Assessment

4.4.27 The noise levels generated by seabed obstacle clearance, mass flow excavation, dredging, cable burial, HDD, installation of rock protection and associated vessel movements have been predicted using a two-dimensional practical spreading model (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR). The model assumes that all receptors are exposed to the noise source for the entire duration of the activity (i.e. receptors are assumed to be stationary for the duration of the proposed operational activity, which was modelled as exposure to the source for a 24h period), which is highly unlikely for marine mammals and sea turtles as they are highly mobile animals.

4.4.28 The NMFS (2023) disturbance threshold for marine mammal species of 120 dB re 1 µPa (SPL_{rms}) for non-impulsive noise was used to determine the distance that disturbance might occur. This disturbance threshold does not consider the overall duration of the noise or its acoustic frequency distribution to account for species dependent hearing. It is considered very conservative and not necessarily a reflection of an adverse effect, but the onset at which behavioural responses may start to occur for certain sensitive species. In addition, ambient noise levels in the study area could exceed this value; therefore, it is an extremely precautionary approach to assessing disturbance. Further details are provided in Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR.

4.4.29 There are uncertainties associated with predicting the response of an animal to underwater noise and the number of animals potentially exposed to levels of noise that may result in an impact. The high spatial and temporal variation in marine mammal and sea turtle abundance and distribution in any area makes it difficult to predict how many animals may be present within the audible range of noisy activities. As a result, all methods for determining at-sea abundance and distribution suffer from a range of biases and uncertainties.

4.4.30 Limited empirical data are available to inform predictions relating to the extent to which animals may respond to noise. The current methods for predicting behavioural responses are based on received sound levels, but it is likely that factors other than noise levels alone will also influence the probability of response and the strength of response, such as previous experience, behavioural and physiological context, proximity to activities and the characteristics of the sound. Consequently, due to lack of empirical data, taking these factors into account when predicting a behavioural response is largely qualitative.

4.4.31 A qualitative approach was used for the assessment of disturbance to marine mammals and sea turtles from the Proposed Development construction, operational and decommissioning activities.

4.5 Baseline Environment

Desk Study

4.5.1 Information on marine mammals and sea turtles within the study area was collected through a detailed review of existing studies and datasets. These desk study sources are summarised in **Table 4.13**.

Table 4.13: Summary of marine mammal and sea turtle desk study sources

Title	Source / Primary affiliation	Year of publication	Author
Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys	SCANS-IV	2023	Gilles *et al.*
Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys	SCANS-III	2021	Hammond *et al*.
Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys	SCANS-III	2022	Lacey *et al.*
Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management	SMRU	2022	Carter *et al.*
Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles	SMRU	2020	Carter *et al.*
Updated seal usage maps: the estimated at-sea distribution of grey and harbour seal	Marine Scotland	2017	Russell *et al.*
Atlantic Array Offshore Wind Farm: Environmental Statement Volume 1: Offshore Chapter 9: Marine Mammals	Channel Energy	2013	Channel Energy Ltd
Scientific advice to government on matters relating to the management of UK seal populations.	SCOS	2021; 2022; 2023	SCOS
Phase II Data Analysis of Joint Cetacean Protocol Data Resource	JNCC	2016	Paxton *et al*.
Distribution maps of cetacean and seabird populations in the North-East Atlantic	MERP	2020	Waggitt *et al.*
Modelled Distributions and Abundance of Cetaceans and Seabirds of Wales and Surrounding Waters	NRW	2023	Evans and Waggitt
Seaquest Southwest Annual Report 2022	Cornwall Wildlife Trust	2022	Seaquest Southwest
Citizen science data to assess the vulnerability of bottlenose dolphins to human impacts along England's South Coast	Animal Conservation	2023	Corr *et al.*
Grey and harbour seals in France: Distribution at sea, connectivity and trends in abundance at haulout sites	Deep-Sea Research Part II	2017	Vincent *et al.*
MPA mapper	JNCC	2020	JNCC
Atlas of Cetacean distribution in north-west European Waters	JNCC	2003	Reid *et al.*

Title	Source / Primary affiliation	Year of publication	Author
The State of Cetaceans 2023	ORCA	2023	ORCA
WDCS/Greenpeace Survey Report: Small cetaceans along the coasts of Wales and Southwest England	WDCS and Greenpeace	2003	de Boer and Simmonds
Recent Sightings	Sea Watch Foundation	2023	Sea Watch Foundation
Assessing harbour porpoise populations in south-west Wales, data issues and implications for conservation and management	University of Wales Trinity St Savid	2016	Oakley *et al.*
Atlas of the Marine Mammals of Wales	Sea Watch Foundation	2012	Baines and Evans
OSPAR Assessment Portal: State Assessment 2022 – Leatherback turtle	OSPAR	2022	OSPAR
Annex 1 to Initial Assessment : Marine Environment. EU Project Grant No: EASME/EMFF/2015/1.2.1.3/03/SI2.742089. Supporting Implementation of Maritime Spatial Planning in the European Northern Atlantic (SIMNORAT)	EU Commission	2018	Morel *et al.*
Jellyfish aggregations and leatherback turtle foraging patterns in a temperate coastal environment	Ecology	2006	Houghton *et al.*
Long-term insights into marine turtle sightings, strandings and captures around the UK and Ireland	Marine Environmental Monitoring	2020	*Botterell et al.*
British & Irish Marine Turtle Strandings & Sightings Annual Report 2020	Marine Environmental Monitoring	2023	Penrose and Westfield

4.5.2 Desk study results are summarised succinctly within the key receptors table (**Table 4.15**).

4.5.3 The baseline assessment provides an informative and appropriate account of the species of marine mammals and sea turtles within the site-specific and Management Units (MU) Study Areas.

Identification of designated sites

4.5.4 All designated sites within the study area with relevant qualifying interest features that could be affected by the Proposed Development are set out in **Table 4.14**.

Table 4.14: Designated sites and relevant qualifying interests

Designated Site	Distance to the Proposed Development Site	Relevant Qualifying Interest
Bristol Channel Approaches SAC	0 km	Harbour porpoise *Conservation objective 3 also states 'The condition of supporting habitats and processes, and the availability of prey is maintained'*
Lundy SAC	3.6 km	Grey seal
Isles of Scilly Complex SAC	32 km	Grey seal

Site-Specific Surveys

4.5.5 No site-specific surveys have been carried out for marine mammals and sea turtles, and the baseline environmental assessment was a desk-based exercise.

Future Baseline Conditions

4.5.6 The EIA process will consider the existing baseline conditions within the species-specific broad scale study areas, and future baseline conditions (as far as reasonably practicable), in accordance with the methodology set out in Section 5: EIA Methodology, of the Scoping Report.

4.5.7 Cable laying in UK waters will be undertaken in several campaigns. Pre-lay works may commence in 2027, with cable lay campaigns beginning in 2028. Existing data are considered appropriate to characterise the project baseline for the construction period.

4.5.8 There is some inherent uncertainty associated with the baseline environment over the course of the proposed 50 year operational lifetime of the project. However, in the context of a large degree of natural variability associated with limited or no long term data sets on marine mammals and / or sea turtles, the current baseline characterisation is considered sufficient to assess potential operational phase impacts against.

4.5.9 Broadly speaking, any future baseline will include consideration of any proposed marine protected areas becoming designated over the lifetime of the project, based on current knowledge, as well as climate change effects.

4.5.10 Changes in species populations are likely to occur due to climate change, independent of the Proposed Development being constructed or not. The main impacts are geographic range shifts, reduction in suitable habitats, food web alterations and increased prevalence of disease. Around the UK, evidence of range shift is increasing, with a shift north by some warmer water species (Martin *et al*., 2023). In particular, the rate of any potential future climate induced marine mammals and sea turtle baseline change is hard to predict. Baseline conditions are likely to exhibit some degree of change over time independent of the Proposed Development.

Key Receptors

4.5.11 **Table 4.15** identifies the marine mammal and sea turtle receptors taken forward into the assessment, together with their value (considering conservation objectives) and their sensitivity (to impacts).

Table 4.15: Key receptors taken forward to assessment

Receptor	Description	Sensitivity and Value
Harbour porpoise *Phocoena phocoena*	Abundant and widespread in waters off the south west of England and throughout the Irish Sea, where they are the most frequently recorded cetacean species. There is an estimated population of 16,777 individuals (Coefficients of variation (CV)=0.2; 95% Confidence Interval (CI)=11,216-25,096) within the Celtic and Irish Seas MU (IAMMWG, 2023). The harbour porpoise density estimate for SCANS blocks CS-B and CS-C is 0.0587 (CV=0.399) and 0.0157 (CV=0.506) animals/km², respectively (Gilles *et al*., 2023). Within the Bristol Channel Approaches SAC, there is an estimated harbour porpoise density of 0.58 animals/km² (Oakley *et al*., 2016). The overall trend in conservation status of harbour porpoise within UK waters is unknown due to insufficient data to establish a population trend (JNCC, 2019a).	The sensitivity of the receptor is medium. The value of the receptor is very high.
Common dolphin *Delphinus delphis*	Occur throughout waters off the south west of England and throughout the Irish Sea, with preference to continental shelf waters. There is an estimated population of 57,417 (CV=0.32; 95% CI=30,850-106,863) individuals within the Celtic and Greater North Seas MU. The common dolphin density estimate for SCANS blocks CS-B and CS-C is 1.0310 (CV=0.244) and 0.8410 (CV=0.264) animals/km², respectively (Gilles *et al.,* 2023). The current conservation status and short-term trends for common dolphin within UK waters are unknown, due to insufficient data for the species (JNCC, 2019b).	The sensitivity of the receptor is low. The value of the receptor is very high.
Bottlenose dolphin *Tursiops truncatus*	Bottlenose dolphins are a resident species in the UK and are regularly recorded in coastal areas including along the coast of the south west of England (Corr *et al*., 2023; SWF, 2024). There is an estimated population of 3,573 individuals (CV=0.35; 95% CI=1,851-6,898) within the Offshore Channel, Celtic Seas & south west England MU. The bottlenose dolphin density estimate for SCANS blocks CS-B and CS-C is 0.0599 (CV=0.402) and 0.4195 (CV=0.406) animals/km², respectively (Gilles *et al*., 2023). The current conservation status and short-term trends for bottlenose dolphin within UK waters are unknown, due to insufficient data for the species (JNCC, 2019c).	The sensitivity of the receptor is low. The value of the receptor is very high.
Risso's dolphin *Grampus griseus*	Risso's dolphins are present year-round in the UK, where they inhabit both offshore, shelf waters and inshore coastal waters (Hague *et al*., 2020). They are frequently recorded throughout coastal and offshore areas of the Irish Sea. There is an estimated population of 8,686 (CV=0.63; 95% CI=2,810-26,852) individuals within	The sensitivity of the receptor is low. The value of the receptor is very high.

Receptor	Description	Sensitivity and Value
	the Celtic and Greater North Seas MU. The Risso's dolphin density estimate for SCANS blocks CS-B and CS-C is 0.0425 (CV=0.736) and 0.0057 (CV=1.004) animals/km², respectively (Gilles *et al*., 2023). The current conservation status and short-term trends for Risso's dolphin within UK waters are unknown due to insufficient data (JNCC, 2019d).	
Minke whale *Balaenoptera acutorostrata*	Minke whales are the most abundant baleen whale in UK waters and are commonly recorded off the coast of south west England (Hague *et al*., 2020; SWF, 2024). An increase in sightings are recorded seasonally throughout spring and summer. There is an estimated population of 10,266 (CV=0.26; 95% CI=6,210-17,042) individuals within the Celtic and Greater North Seas MU. The minke whale density estimate for SCANS blocks CS-B and CS-C is 0.0016 (CV=1.128) and 0.0079 (CV=0.822) animals/km², respectively (Gilles *et al.,* 2023). The current conservation status and short-term trends for minke whales within UK waters is unknown due to insufficient data (JNCC, 2019e).	The sensitivity of the receptor is low. The value of the receptor is very high.
Grey seal *Halichoerus grypus*	Grey seals have a wide distribution and regularly occur off the south west of England with peaks in recordings during moult and breeding periods. The at sea distribution (relative UK population density) estimate of grey seal from haulouts in the south west of England ranges from 0-0.01% (Carter *et al.,* 2022). Pup production within the south west of England, including estimates for the Isles of Scilly and Lundy, is estimated at 450 in the most recent annual count (SCOS, 2023). Grey seals in the UK have been assessed as having a favourable conservation status with an improving conservation status trend (JNCC, 2019f).	The sensitivity of the receptor is low. The value of the receptor is very high.
Leatherback turtle *Dermochelys coriacea*	Leatherback turtles have a wide distribution and have regularly been observed within European waters where their habitat of preference is oceanic waters (Morel *et al*., 2018). They occur in greater numbers in the UK over the summer and autumn months between June and October, with most sightings, strandings and incidental captures of the species occurring in the west of the UK and Ireland, and in the English Channel (Botterell *et al*., 2020). They have regularly been observed in waters off the south west of England. For leatherback turtles, there is a lack of information on density, abundance and fine-scale distribution in the OSPAR maritime area, including the south west of England region. The overall trend in conservation status of leatherback turtles within UK waters is unknown and there is no evidence on which to base an assessment of conservation status (JNCC, 2019g).	The sensitivity of the receptor is negligible. The value of the receptor is very high.

4.6 Key Parameters for Assessment

Maximum Design Scenario

4.6.1 The maximum design scenarios identified in **Table 4.16** have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the Project Design Envelope provided in Volume 1, Chapter 3: Project Description, of the PEIR. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (e.g., different infrastructure layout), to that assessed here be taken forward in the final design scheme. Therefore, this comprises a conservative assessment of a worst case scenario.

Table 4.16: Maximum design scenario considered for the assessment of potential impacts

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D in-situ	D remove		
Increased disturbance by anthropogenic noise - from ground condition surveys, seabed preparation, route clearance, cable lay, and burial activities. Includes similar construction type activities where required during operational and decommissioning phases	Yes	No	Yes	No	Yes	**Construction phase** • Cable installation activities will be undertaken on a 24 hour/7-day basis • Pre-lay, burial and protection activities will progress broadly in parallel with cable lay and burial a few days apart • The precise number of vessels to be used is to be determined, however, it is expected that four trenching vessels, two pre-installation vessels, two rock placement vessels, one CLV (two for brief periods during changeovers), and 20 guard vessels stationed every 10 nautical miles. **Operational phase- repair activities** • During the Operational phase inspection surveys will be undertaken by a single survey vessel up to once a year for the first 5 years, and then every 5 years for the remainder of the operational life of the cables (anticipated 50 years). • Repair works (cable cut, recovery, and burial activities) assumed similar to construction phase (noting on a localised scale). **Decommissioning phase – removal activities** • Cable deburial and removal works assumed similar to construction phase in terms of activities and vessel types.	This is based on the maximum number of vessels stated within Chapter 3 Project Description Offshore. The maximum number of vessels and associated vessel operations represents the maximum potential for noise disturbance.
Increased vessel disturbance	Yes	No	Yes	No	Yes	**Construction phase** • Cable installation activities will be undertaken on a 24 hour/7-day basis • Pre-lay, burial and protection activities will progress broadly in parallel with cable lay and burial a few days apart • The precise number of vessels to be used is to be determined, however, it is expected that four trenching vessels, two pre-	This is based on the maximum number of vessels stated within Chapter 3 Project Description Offshore. The maximum number of vessels and associated vessel movement

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D in-situ	D remove		
						installation vessels, two rock placement vessels, one CLV (two for brief periods during changeovers), and 20 guard vessels stationed every 10 nautical miles. **Operational phase repair activities** • During the Operational phase inspection surveys will be undertaken by a single survey vessel up to once a year for the first 5 years, and then every 5 years for the remainder of the operational life of the cables (anticipated 50 years). • Repair works (cable cut, recovery, and burial activities) assumed similar to construction phase (noting on a localised scale). **Decommissioning phase – removal activities** • Cable deburial and removal works assumed similar to construction phase in terms of activities and vessel types.	represents the maximum potential for noise disturbance.

[1] C=Construction phase, Op=Operational phase, Op_{repair}=Operational phase repair activities, $D_{in\text{-}situ}$=Decommissioning phase assuming cable de-energised and left in-situ, D_{remove}=Decommissioning phase assuming cable removed

4.7 Mitigation Measures Adopted as Part of the Proposed Development

4.7.1 As part of the project design process, a number of designed-in mitigation measures have been proposed to reduce the potential for impacts on marine mammals and sea turtles (**Table 4.17**). This approach has been employed in order to demonstrate commitment to measures by including them in the design of the Project, and have therefore been considered in the assessment presented in **sections 4.8** and **4.9**, below. These measures are considered standard industry practice for this type of development. Assessment of sensitivity, magnitude and therefore significance includes implementation of these measures.

4.7.2 The mitigation measures proposed as part of the Proposed Development include the following types of mitigation:

- Primary (inherent) mitigation – measures included as part of the Proposed Development design. The Institute of Environmental Management and Assessment (IEMA) describes these as '*modifications to the location or design of the development made during the pre-application phase that are an inherent part of the Proposed Development and do not require additional action to be taken*'. This includes modifications arising through the iterative design process. These measures will be secured through the consent itself, through the description of the Proposed Development and the parameters secured in the DCO and/or marine licences. For example, a reduction in footprint or height.
- Secondary (foreseeable) mitigation. IEMA describes these as '*actions that will require further activity in order to achieve the anticipated outcome'*. These include measures required to reduce the significance of environmental effects (such as lighting limits) and may be secured through an environmental management plan.
- Tertiary (inexorable) mitigation. IEMA describes these as '*actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects'*. It may be helpful to secure such measures through the Offshore Construction Environmental Management Plan (an outline Offshore CEMP is provided as PEIR Volume 1, Appendix 3.3, which will continue to be developed and submitted as part of the DCO application)..

4.7.3 A Marine Mammal Mitigation Protocol (MMMP) was proposed as part of the Scoping report due to the potential for inspection surveys to include geophysical survey equipment. As the applicant will conduct separate environmental permitting for these surveys, an assessment of the impacts of these activities have not been considered in the PEIR. Consequently, a MMMP is no longer needed due to it being only required by regulatory bodies when conducting activities that produce impulsive noise sources (i.e. seismic surveys, piling and UXO clearance).

Table 4.17: Mitigation measures adopted as part of the Proposed Development

Measure Adopted	How the Measure Will be Secured
Primary mitigation	
N/A	
Secondary mitigation	
N/A	
Tertiary mitigation	
Offshore Construction Environmental Management Plan (CEMP)	An Offshore CEMP will detail the best practice approach to offshore activities and would implement those measures and environmental commitments identified in the EIA. The following measures will be included in the Offshore CEMP: marine pollution prevention; waste management; marine invasive species; and dropped object procedures. An Outline Offshore CEMP will form part of the DCO (with a final Offshore CEMP finalised by offshore contractor).
Marine Pollution Contingency Plan (MPCP)	An MPCP will be produced as part of the Offshore CEMP and will include measures to minimise the impact of any events as well as compliance with the International Convention for the Prevention of Pollution from Ships (MARPOL). MPCP will be a pre-requisite contractor requirement – secured via final Offshore CEMP.
Vessel Management Plan (VMP)	The VMP will confirm the types and numbers of vessels that would be engaged on the Proposed Development and consider vessel coordination including indicative transit route planning. Pre-requisite contractor requirement – secured via final Offshore CEMP.

4.8 Preliminary Assessment of Construction Effects

4.8.1 The impacts of the construction of the Proposed Development have been assessed. A summary of the preliminary potential impacts arising from the construction phase of the Proposed Development are listed in **Table 4.16**, along with the maximum design scenario against which each impact has been assessed.

4.8.2 A description of the potential effect on receptors caused by the following impacts is given below:

- Disturbance from anthropogenic noise; and
- Increased vessel disturbance.

Disturbance from anthropogenic noise

4.8.3 This impact assessment focusses on elevations in underwater noise as a result of seabed preparation, route clearance, cable lay and burial activities, as these activities have the greatest potential for generating underwater noise and having an impact on marine mammals and sea turtles.

4.8.4 Sound propagates though the water in a series of pressure waves. These waves comprise alternating compressions (positive pressure variations) and rarefactions (negative pressure fluctuations). Due to these changes in pressure, the unit for measuring sound is usually referenced to the Pascal (Pa) and due to the medium of water, underwater sound is referenced to 1 micro Pa (µPa). The decibel (dB) is a relative unit used to express the ratio of two values of acoustic power and is typically expressed as ten times the logarithm in base 10.

4.8.5 There are different metrics which can be used as measures of underwater sound pressure. Key metrics used in this report are as follows:

- Sound pressure level (SPL): The maximum sound pressure during a stated time interval. A peak sound pressure may arise from a positive or negative sound pressure. This quantity is typically useful as a metric for a pulsed waveform;
- Root mean square SPL (SPL_{rms}): The square root of the mean square pressure, where the mean square pressure is the time integral of squared sound pressure over a specified time interval divided by the duration of the time interval;
- Sound exposure level (SEL): a measure of the sound pressure squared over a stated period of time or noise event and is normalised to one second; and
- Cumulative SEL (SEL_{cum}): representative of the total acoustic energy of a noise source taking place across 24-hours.

4.8.6 A number of studies have provided suggestions for exposure limits for marine mammals, but the precautionary threshold of injury presented in Southall et al. (2007), later updated in 2019, are advised to be followed for impact assessments (JNCC, 2020). Noise exposure criteria are typically represented by dual exposure metrics including the frequency weighted SEL (expressed in dB re. µPa2–s or µPa2s) and the unweighted SPL (expressed in units relative to 1 µPa in water; ISO 18406, 2017; Juretzek et al., 2021). The terms ‘weighted’ and ‘unweighted’ relate to hearing sensitivities (e.g. frequencies of sound detectable to an individual) of marine fauna and are traditionally based on species audiograms. **Table 4.18** presents the generalised hearing ranges, as highlighted in Southall et al. (2019), for the relevant marine mammal species.

Table 4.18: Marine mammal hearing ranges (Southall *et al*, 2019)

Functional Hearing Group	Relevant Species	Generalised hearing ranges
Very High Frequency (VHF) cetacean	Harbour porpoise	275 Hz to 160 kHz
High Frequency (HF) cetacean	Bottlenose dolphin, Risso’s dolphin, common dolphin	150 Hz to 160 kHz
Low Frequency (LF) cetacean	Minke whale	7 Hz to 35 kHz
Phocid (in water) (PCW)	Grey seal	50 Hz to 86 kHz

4.8.7 Impacts to marine mammals from underwater noise range from changes in behaviour and masking that affect communication and listening space, and/or locating prey (Basran *et al*., 2020; Dunlop, 2016; Erbe *et al*., 2016; Heiler *et al*., 2016; Pine *et al*., 2019; Pirotta *et al*., 2012; Wisniewska *et al*., 2018),

displacement and disturbance (Brandt *et al*., 2011; Culloch *et al*., 2016; Graham *et al*., 2019; Pirotta *et al*., 2014; Stone *et al*., 2017), or injury and mortality (Reichmuth *et al*., 2019; Schaffeld *et al*., 2019).

4.8.8 Auditory injury in marine mammals occurs at permanent threshold shift (PTS) onset, where the hearing sensitivity is reduced after noise exposure with no hearing recovery in the impacted frequencies (Tougaard, 2021). PTS can occur instantaneously (via impulsive noise sources such as pile-driving) or cumulatively (i.e. exposed to the sound source over an extended period). The level of injury depends on the duration, frequency and intensity of the sound source and received level. Whilst PTS is considered a permanent effect, the most likely response of an animal exposed to noise levels that could induce PTS is to flee the ensonified area. Therefore, animals exposed to these noise levels are likely to actively avoid hearing damage by moving away from the area.

4.8.9 Another auditory effect is described as temporary threshold shift (TTS) in hearing where an individual experiences a temporary increase in the threshold of hearing (i.e. the minimum intensity needed for a sound to be audible) at a specific frequency that returns to its pre-exposure baseline over time (Tougaard, 2021).

4.8.10 Underwater noise also has the potential to impact sea turtles if the frequency is within their hearing range (**Table 4.19**). Popper et al. (2014) noted that sea turtles can experience mortality and potential mortal injury when exposed to noise levels greater than 210 dB re 1 μPa² s (weighted SELcum) or 207 dB re 1μPa (unweighted SPLpeak). However, the effects of noise on sea turtles are largely unknown due to a lack of information on hearing capabilities and responses to sound (Dow Piniak et al., 2012).

Table 4.19: Sea turtle hearing range (Popper *et al*, 2014)

Hearing group	Generalised hearing ranges
Sea turtles	50–1,200 Hz

4.8.11 This impact assessment will focus on behavioural disturbance to underwater noise from construction activities (non-impulsive noise sources).

Sensitivity of the Receptor

Harbour porpoise

4.8.12 Harbour porpoises are particularly vulnerable to disturbance, with the main impact being loss of foraging opportunities (Nabe-Nielsen *et al*., 2018). They are small cetaceans which makes them susceptible to heat loss and as a result, requires them to forage frequently to maintain a high metabolic rate with little energy remaining for fat storage (Rojano-Doñate *et al*., 2018; Wisniewska *et al*., 2016). Therefore, there is a risk of changes to their overall fitness if they are displaced from high-quality foraging grounds or if their foraging efficiency is disturbed, and they are unable to find alternative suitable foraging grounds that will provide sufficient food to meet their metabolic needs. However, results from studies using Digital Acoustic Recording Tags (DTAGs) suggest that harbour porpoise are able to respond to short-term reductions in food intake and may have some resilience to disturbance (Wisniewska *et al*., 2016).

4.8.13 Most studies on the response of harbour porpoise to underwater noise have focused on piling activities, with Benhemma-Le Gall *et al.* (2021) analysing other

construction activities (jacket and turbine installation). In this study, harbour porpoise displacement was observed up to 4 km from construction / maintenance vessels and up to 12 km from pile-driving activities (Benhemma-Le Gall *et al*., 2021).

4.8.14 Dredging activities have been shown to cause harbour porpoise displacement within a radius of 5 km around the dredging location (Verboom, 2014). Diederichs *et al*. (2010) noted there was short term avoidance (~3 hours) at distances of up to 600 m from a trailing suction hopper dredger, but no significant long-term impacts. Modelling potential impacts of dredging of a port expansion predicted a disturbance range of 400 m, with a more conservative approach predicting avoidance of harbour porpoise up to 5 km (McQueen *et al*. 2020).

4.8.15 A monitoring study in North West Ireland investigating the effects of construction-related activity, including but not limited to seismic surveys, multi-beam surveys, remotely operated vehicle (ROV) surveys, dredging, back filling, rock trenching, rock placement, rock breaking, pipe laying and umbilical laying, during the construction of a gas pipeline found a reduction in occurrence of harbour porpoise as a result of these construction-related activities in the area (Culloch *et al.*, 2016).

4.8.16 The presence of vessels has been shown to deter and disturb harbour porpoise out of the area before any non-piling construction activities start (Brand *et al* 2018). Further information on vessel disturbance is covered in the subsequent impact discussion – Increased vessel disturbance.

4.8.17 Modelling conducted as part of the Greenlink Interconnector project for disturbance from cable laying installation, concluded that all marine mammals are vulnerable to disturbance, but the ZoI is small (130 m from activities; Greenlink, 2019).

4.8.18 A review of potential effects of various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging, used in the offshore wind farm industry concluded that it would be “highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals” (BEER and DEFRA 2008). As a result, harbour porpoises are considered to be of high adaptability, reasonable tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **medium**.

Bottlenose Dolphin

4.8.19 There is limited information on the response of bottlenose dolphin to non-impulsive noise sources, with most studies focusing on impulsive noise sources such as pile driving and seismic surveys utilising airguns.

4.8.20 A study analysing the impacts of dredging on bottlenose dolphins, found that higher intensities of dredging caused bottlenose dolphin to spend less time in the area; however, this effect was only temporary (Pirotta *et al.*, 2013). Another study determined that response varied depending on the site, with dolphins either remaining or being absent (Marley *et al.*, 2017), which suggests that the response may be context specific (i.e. some sites being ecologically more important than others).

4.8.21 There is potential for behavioural disturbance due to underwater noise to result in disruption in foraging and resting activities and an increase in travel and energetic

costs (Marley *et al.*, 2017; Pirotta *et al.*, 2015), although evidence suggests that this will occur on a small spatial and temporal scale. Furthermore, New *et al.* (2013) showed that while there is potential for disturbance events to affect bottlenose dolphin behaviour and health (which could then impact vital rates and population dynamics), individuals are able to compensate for immediate behavioural responses to disturbances caused by vessel activity. This suggests that they have some capability to adapt their behaviour and tolerate certain levels of temporary disturbance. As a result, bottlenose dolphins are considered to be of high adaptability, reasonable tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **low**.

Risso's Dolphin

4.8.22 There is limited information on the response of Risso's dolphin to underwater noise, with those few studies focusing on impulsive noise sources such as seismic surveys.

4.8.23 A study on the effects of seismic operations in UK waters showed no response by Risso's dolphin to seismic airguns (Stone *et al*., 2017). During controlled experiments where Risso's dolphin were exposed to simulated military sonar (received levels between 100-140 dB re 1µPa SPL_{rms}), no clear behavioural response was recorded (Southall *et al.,* 2011).

4.8.24 The lack of information available for the impacts of non-impulsive activities on Risso's dolphin makes it challenging to assess the sensitivity of this species. Based on the evidence available, considering that impact ranges from impulsive noise sources are generally greater than non-impulsive, and giving consideration to other delphinid species where more relevant studies exist, Risso's dolphins are considered to be of high adaptability, reasonable tolerance, high recoverability, and of very high value. The sensitivity of the receptor is **low**.

Common Dolphin

4.8.25 There is limited information on the response of common dolphin to underwater noise, with those few studies focusing on impulsive noise sources such as seismic surveys.

4.8.26 A monitoring study in north west Ireland investigating the effects of construction-related activity, including but not limited to seismic surveys, multi-beam surveys, ROV surveys, dredging, back filling, rock trenching, rock placement, rock breaking, pipe laying and umbilical laying, during the construction of a gas pipeline found no changes in occurrence of common dolphin as a result of these construction related activities in the area (Culloch *et al.*, 2016).

4.8.27 The lack of information available for the impacts of non-impulsive activities on common dolphin makes it challenging to assess the sensitivity of this species. However, there is evidence to suggest that common dolphins are able to adjust their whistle characteristics to account for masking as a result of anthropogenic noise (Papale *et al.*, 2015), suggesting some tolerance and adaptability. As a result, common dolphins are considered to be of high adaptability, reasonable tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **low**.

Minke Whale

4.8.28 There is limited information on the response of minke whale to underwater noise. A study on the behavioural sensitivity of minke whale reactions to sonar signals showed that they displayed prolonged avoidance, increase in swim speed directly away from the source, and cessation of feeding for a received SPL of 146 dB re 1µPa and long-term (6 hour) avoidance of the area for a received SPL of 158 dB re 1µPa (Sivle *et al*., 2015). A study detailing minke whale responses to the Lofitech 'seal scarer' ADD showed minke whale within 500 m and 1,000 m of the source (SPL of 204 dB re 1 µPa at 1 m) exhibiting responses of increased swim speeds and movement away from the source (McGarry *et al.,* 2017).

4.8.29 A monitoring study in north west Ireland investigating the effects of construction-related activity, including but not limited to seismic surveys, multi-beam surveys, ROV surveys, dredging, back filling, rock trenching, rock placement, rock breaking, pipe laying and umbilical laying, during the construction of a gas pipeline found a reduction in occurrence of minke whale as a result of these construction related activities in the area (Culloch *et al.*, 2016).

4.8.30 Minke whales are seasonal migrants to UK waters, where they forage on pelagic schooling fish during the summer months (Whooley, 2016). Therefore, it is expected that risk of disturbance to this species is reduced during spring, autumn and winter months.

4.8.31 While information on the behavioural responses of minke whale to non-impulsive underwater noise is limited, it is anticipated that minke whale will be able to tolerate temporary displacement from foraging areas due to their large size and capacity for energy storage. As a result, minke whales are considered to be of high adaptability, reasonable tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **low**.

Grey Seal

4.8.32 There is limited information on the response of grey seal to underwater noise. Studies in the Netherlands collected telemetry data from 20 grey seals in 2014 during the construction of the Luchterduinen wind farm and from 16 grey seals in 2015 during the construction of the Gemini wind farm (Aarts *et al.*, 2018). The most common response suggested a change in behaviour from foraging to horizontal movement, although various other responses were recorded including, altered surfacing and diving behaviour, changes in swim direction, and no response (Aarts *et al.*, 2018). Data from this study also showed that seals returned to the area on subsequent trips, despite receiving multiple exposures. Construction activities during an offshore windfarm installation have a much greater risk of disturbance and injury compared to cable installation due to the impulsive noise sources such as impact pile driving.

4.8.33 The source level of dredging has been described to vary between SPL 172-190 dB re 1 µPa at 1 m with a frequency range of 45 Hz to 7 kHz (Verboom 2014). It is expected that the underwater noise generated by dredging will be below the PTS-onset threshold (Todd *et al.,* 2015) and thus the risk of injury is unlikely, though disturbance may occur. An acoustic modelling study on the effects of dredging sound on aquatic life, reported that, for pinnipeds displacement could be caused to individuals up to ranges between 400 m to 5 km from site (as reflected, in part by the variation in frequency and sound pressure depending on the equipment modelled; McQueen *et al*., 2020).

4.8.34 During an expert elicitation workshop in 2018, it was concluded that grey seals were considered to have a reasonable ability to compensate for missed foraging

opportunities due to disturbance from underwater noise given their generalist diet, adequate fat stores, mobility, and life history (Booth *et al*., 2019). In general, experts agreed that grey seal would be more robust to the effects of disturbance than harbour seals as they have larger energy store and are more generalist in their diet and more adaptable in their foraging strategies (Booth *et al*., 2019). Experts also agreed that moderate-high levels of repeated disturbance would be required for any effect on grey seal fertility rates (Booth *et al*., 2019).

4.8.35 Grey seals are highly adaptable to a changing environment. They can adjust their metabolic rate and foraging strategies and can compensate for lost opportunities due to their generalist diet, mobility, and adequate fat stores (Smout *et al.*, 2014; Stansbury *et al.*, 2015). They are also able to tolerate periods of fasting as part of their life history because of their large body size and thick layer of blubber (i.e. more energy reserve; Pomeroy *et al.*, 1999). In addition, they are wide ranging and can travel large distances (up to 488 km; Carter *et al.*, 2022) between different haul-out and foraging regions, although the typical foraging distance is approximately 100 km (Carter *et al.,* 2022; SCOS, 2023). As a result, grey seals are considered to be of high adaptability, reasonable to high tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **low**.

Leatherback Turtle

4.8.36 In the past, it was argued that sea turtles were incapable of detecting sound; however, recent evidence shows that they can hear low-frequency sounds indicating that their hearing range overlaps with noise from vessels (and other activities noted in **Table 4.20** (Díaz *et al.,* 2024)). There is limited information on the response of sea turtle to underwater noise and the effects are largely unknown due to the general lack of information on hearing capabilities and responses to sound (Dow Piniak *et al.,* 2012; Holtz *et al*., 2021; Popper *et al*., 2014). However, behavioural responses have been recorded in reaction to marine traffic (Díaz *et al.,* 2024; Tyson *et al.,* 2017) underwater explosions and seismic airguns (Nelms *et al.,* 2016; Holtz *et al*., 2021).

4.8.37 Sea turtles including leatherback turtles are believed to use sound for navigation, foraging and predator detection and avoidance and for general environmental awareness. Increased exposure to underwater noise in the environment may therefore impact sea turtle behaviour and ecology (Erbe and Thomas, 2022).

4.8.38 Díaz *et al.,* (2024) note that sea turtles increase time travelling and scanning for food or predators with an increase exposure to vessel noise; however, when sea turtles were on the seabed, scanning behaviour returned to baseline levels with or without vessel disturbance. This may indicate that sea turtles did not detect them at this depth or do not consider vessels as a threat when on the seabed or in deeper water away from the surface. This behavioural response may relate to other behaviour; as sea turtles also rest and sleep at the seabed and this behaviour may be why approaching vessels are either not responded to, or not detected.

4.8.39 Popper *et al.* (2014) describes sea turtle sound exposure guidelines for activities including continuous noise exposure including shipping. There was no evidence presented which suggested mortality or potential mortal injury to sea turtle from shipping noise.

4.8.40 Leatherback turtles are seasonal migrants to UK waters with a preference for more oceanic areas during summer and autumn months. No breeding or nesting sites are found within OSPAR maritime regions.

4.8.41 Based on the evidence available, leatherback turtles are considered to be of high adaptability, reasonable tolerance, high recoverability, and of very high value. The sensitivity of the receptor is **negligible**.

Magnitude of Impact

4.8.42 Project activities that are expected to operate at frequencies within the hearing range of the marine mammal and sea turtle receptors are provided in Table 4.20.

Table 4.20: Operating frequencies of different activities. Source: Volume 3, Appendix 4.1: Underwater Noise Assessment

Activity	Operating Frequency (Hz)	SPL_{rms} dB re 1µP @1m
Seabed clearance	80 – 2,000	178 – 183
Mass Flow Excavation	80 – 2,000	162 – 167
Dredging	50 – 3,000	183 – 188
Cable Burial – water jetting	20 – 4,000	188 – 193
Cable Burial – mechanical cutter	50 – 3,000	183 – 188
HDD	10 – 10,000	143 - 160
Installation of rock protection	100 – 4,000	188
Associated vessel movements – tug	50 – 2,000	172
Associated vessel movements – cable lay vessel	20 – 4,000	188

4.8.43 Underwater noise modelling (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR) has been undertaken to assess the potential impacts on marine mammals as a result of the different activities involved in the Proposed Development. Impact ranges for marine mammals were calculated using the Southall *et al.* (2019) non-impulsive criteria (**Table 4.21**). Sea turtles were not assessed in the underwater modelling.

4.8.44 The largest PTS-onset impact range (weighted cumulative sound exposure level (SEL_{cum} over 24 hours)) is predicted for cable burial by water jetting and is estimated to be less than 780 m for minke whale (low frequency cetacean) and less than 690 m for harbour porpoise (very high frequency cetacean; **Table 4.21**). All other activities have predicted impact ranges less than 500 m from the source for all marine mammal receptors. These ranges are considered precautionary as it was assumed that individuals would be stationary within these ranges for a period of 24-hours. This is unlikely to occur as marine mammals and sea turtles have been shown to flee or move away from noisy activities and are highly mobile, as described in the species-specific sections above.

4.8.45 Assuming a lower worst-case swimming speed of 1.5 m/s for all marine mammal species (including both adults and juveniles), and on the basis of the worst-case impact range as described above (780m), the maximum time that it would take the most sensitive receptor (LF cetaceans, such as minke whales) to leave the centre of the impact zone (i.e. the sound source) during operation of the noisiest activity (water-jetting for cable burial) would be nine minutes. The swim speed and exposure calculations assume that the receptor is starting from the immediate vicinity of the noise source, which is highly unlikely. It also does not consider the

fact that the sound source is also moving, and that as distance between source and receiver (i.e. animal) increases, the impact radius would also decrease as the animal is exposed to less noise (i.e. the noise reduces with increasing distance from the source). These factors all demonstrate that the underwater noise modelling is extremely precautionary.

4.8.46 Due to the precautionary approach to the impact range predictions and the precautionary contextual calculations regarding receptors travelling away from the noise emitting activities, it is considered highly unlikely that PTS onset will occur for any of the FHGs as a result of the Proposed Development.

Table 4.21: Summary of the modelled PTS-onset impact ranges for marine mammals. Source: Volume 3, Appendix 4.1: Underwater Noise Assessment

Activity	Impact ranges (m)			
	LF cetaceans	HF cetaceans	VHF cetaceans	PCW
Thresholds: SEL_{24hr}, dB re 1 μPa^2s	199	198	172	201
Seabed clearance	<170	<10	<150	<90
Mass Flow Excavation	<20	Not reached	<20	<10
Dredging	<360	<20	<320	<200
Cable Burial – water jetting	<780	<50	<690	<420
Cable Burial – mechanical cutter	<370	<20	<320	<200
HDD	<10	Not reached	<10	Not reached
Installation of rock protection	<390	<30	<340	<210
Associated vessel movements – tug	<40	<10	<30	<20
Associated vessel movements – cable lay vessel	<370	<20	<320	<200

Harbour porpoise

4.8.47 Construction activities are expected to operate at frequencies within the hearing range of harbour porpoise (**Table 4.18**).

4.8.48 The activity with the highest sound source is cable burial (water jetting). The distance over which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR). It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary, and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and only for certain highly sensitive species. Furthermore, it is important to note that ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion. A study by Merchant *et*

al. (2016) measured underwater ambient noise levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.8.49 Furthermore, harbour porpoise are unlikely to remain in close proximity to the activities, due to their highly mobile nature and typical aversion behaviour to vessels (Brand *et al*., 2018).

4.8.50 Taking into account the above, harbour porpoises are considered to be at low risk of any adverse behavioural responses.

4.8.51 Fixed EDRs are advised within JNCC (2020) guidance to account for a radii of effect from noise impacts generated by pin-piling, conductor piling, piling under noise abatement and geophysical surveys. These distances account for the main impact ranges found within a variety of studies, but they do not account for all deterrence or disturbance in the associated area nor represent the limit at which effects can be detected. None of the recommended EDRs account for non-impulsive sound sources, which would have a lower impact radius than any geophysical surveys, with respect to underwater noise.

4.8.52 In the absence of an EDR for the project activities, the precautionary EDR of 5 km for 'other geophysical surveys' was used in this assessment, as there is potential to disturb and/or displace harbour porpoise present in the Offshore Cable Corridor, due to noise disturbance during the construction phase of the Proposed Development.

4.8.53 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the harbour porpoise receptor is highly mobile and has a large distribution range within the Celtic and Irish Seas MU.

4.8.54 The cable burial progress is around 50 to 400 m per hour. The ROV will move slowly along the cable route and while animals may avoid the area while the activity takes place, they are expected to return once it has passed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.8.55 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Bottlenose Dolphin

4.8.56 Construction activities are expected to operate at frequencies within the hearing range of bottlenose dolphin (**Table 4.18**).

4.8.57 The activity with the highest sound source is cable burial (water jetting). The distance over which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR).

4.8.58 It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary, and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and only for certain highly sensitive species. Furthermore, it is important to note that

ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion. A study by Merchant *et al.* (2016) measured underwater ambient noise levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.8.59 A review of potential effects of various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging, used in the offshore wind farm industry concluded that it would be "highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals" (BEER and DEFRA 2008).

4.8.60 Taking into account the above, bottlenose dolphins are considered to be at low risk of any adverse behavioural responses

4.8.61 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the bottlenose dolphin receptor is highly mobile and has a large distribution range within the Offshore Channel MU and Celtic Sea and South West England MU.

4.8.62 The cable burial progress will be around 50 to 400 m per hour. The ROV will move slowly along the cable route and while animals may avoid the area while the activity takes place, they are expected to return once it has passed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.8.63 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Risso's Dolphin

4.8.64 Construction activities are expected to operate at frequencies within the hearing range of Risso's dolphin (**Table 4.18**).

4.8.65 The activity with the highest sound source is cable burial (water jetting). The distance over which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR).

4.8.66 It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary, and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and only for certain highly sensitive species. Furthermore, it is important to note that ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion. A study by Merchant *et al.* (2016) measured underwater ambient noise levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.8.67 A review of potential effects of various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods

themselves including jetting, rock ripping, and dredging, used in the offshore wind farm industry concluded that it would be “highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals” (BEER and DEFRA 2008).

4.8.68 Taking into account the above, Risso’s dolphins are considered to be at low risk of any adverse behavioural responses.

4.8.69 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the Risso’s dolphin receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.8.70 The cable burial progress is around 50 to 400 m per hour. The ROV will move slowly along the cable route and while animals may avoid the area while the activity takes place they are expected to return once it has passed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.8.71 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Common Dolphin

4.8.72 Construction activities are expected to operate at frequencies within the hearing range of common dolphin (**Table 4.18**).

4.8.73 The activity with the highest sound source is cable burial (water jetting). The distance over which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR).

4.8.74 It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary, and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and only for certain highly sensitive species. Furthermore, it is important to note that ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion. A study by Merchant *et al.* (2016) measured underwater ambient noise levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.8.75 A review of potential effects of various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging, used in the offshore wind farm industry concluded that it would be “highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals” (BEER and DEFRA 2008).

4.8.76 Taking into account the above, common dolphins are considered to be at low risk of any adverse behavioural responses.

4.8.77 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range

of impact. The impact would also be expected to be temporary. Furthermore, the common dolphin receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.8.78 The cable burial progress is around 50 to 400 m per hour. The ROV will move slowly along the cable route and while animals may avoid the area while the activity takes place they are expected to return once it has passed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.8.79 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Minke Whale

4.8.80 Construction activities are expected to operate at frequencies within the hearing range of minke whale (**Table 4.18**).

4.8.81 Activities with the highest sound source is cable burial (water jetting). The distance which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR).

4.8.82 It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary, and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and only for certain highly sensitive species. Furthermore, it is important to note that ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion.. A study by Merchant *et al.* (2016) measured underwater ambient noise levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.8.83 A review of potential effects of various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging, used in the offshore wind farm industry concluded that it would be “highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals” (BEER and DEFRA 2008).

4.8.84 Taking into account the above, minke whales are considered to be at low risk of any adverse behavioural responses.

4.8.85 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the minke whale receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.8.86 The cable burial progress is around 50 to 400 m per hour. The ROV will move slowly along the cable route and while animals may avoid the area while the activity takes place, they are expected return once it has passed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.8.87 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Grey Seal

4.8.88 Construction activities are expected to operate at frequencies within the hearing range of grey seal (**Table 4.18**).

4.8.89 The activity with the highest sound source is cable burial (water jetting). The distance which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR).

4.8.90 It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary, and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and only for certain highly sensitive species. Furthermore, it is important to note that ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion. A study by Merchant *et al.* (2016) measured underwater ambient noise levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.8.91 A review of potential effects of various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging, used in the offshore wind farm industry concluded that it would be “highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals” (BEER and DEFRA 2008).

4.8.92 Taking into account the above, grey seals are considered to be at low risk of any adverse behavioural responses.

4.8.93 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small to medium given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the grey seal receptor is highly mobile and has a large distribution range within the South West England SMU and Wales SMU.

4.8.94 The cable burial progress will be around 50 to 400 m per hour. The ROV will move slowly along the cable route and while animals may avoid the area while the activity takes place, they are expected to return once it has passed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.8.95 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Leatherback Turtle

4.8.96 Construction activities are expected to operate at frequencies within the hearing range of leatherback turtles (**Table 4.19**).

4.8.97 The activity with the highest sound source is cable burial (water jetting). The distance which disturbance to sea turtles may occur from these types of activities is unknown due to the limited information available on sea turtle acoustic thresholds and sound level exposure which may induce stress or behavioural changes (Nelms *et al.,* 2016; Popper *et al.,* 2014; Taormina *et al.,* 2018).

4.8.98 Salas *et al.* (2023) researched noise-induced TTS in an aquatic turtle with an assumed similar hearing range as leatherback turtle and concluded that the mean TTS onset was reached at 160 dB re 1 μPa^2 s SEL (note this value is not directly comparable to SPLs highlighted in other sections of this report, no SPLs were available from the study). Other studies investigating response to seismic surveys noted an avoidance reaction to impulsive sounds between 166-179 dB re 1µPa at 1 m, but TTS or PTS could not be determined from these studies (Moein *et al*., 1995; McCauley *et al*., 2000).

4.8.99 Behavioural changes have been observed in sea turtles as a result of approaching vessels (when audible or visible; Díaz *et al.,* 2024), indicating that turtles will swim away from vessels when they are detected.

4.8.100 Leatherback turtles are seasonal migrants to UK waters with a preference for more oceanic areas, during summer and autumn months. No breeding or nesting sites are found within OSPAR maritime regions. Leatherback turtles are observed in the OSPAR Region III MU in small numbers, either solo or in a pair (O'Donnell *et al.,* 2018; 2021).

4.8.101 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, leatherback turtles are mobile and have a large distribution range within the OSPAR Region III MU.

4.8.102 The cable burial progress will be around 50 to 400 m per hour. The ROV will move slowly along the cable route and while animals may avoid the area while the activity takes place, they are expected to return once it has passed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.8.103 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Significance of the Effect

Harbour porpoise

4.8.104 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.8.105 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **medium**. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Bottlenose Dolphin

4.8.106 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.8.107 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.8.108 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible or minor** adverse significance, which is not significant in EIA terms.

Risso's Dolphin

4.8.109 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.8.110 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.8.111 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible or minor** adverse significance, which is not significant in EIA terms.

Common Dolphin

4.8.112 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.8.113 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.8.114 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible or minor** adverse significance, which is not significant in EIA terms.

Minke Whale

4.8.115 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.8.116 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.8.117 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Grey Seal

4.8.118 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.8.119 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.8.120 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Leatherback Turtle

4.8.121 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.8.122 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **negligible**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Further Mitigation

4.8.123 The significance of effect from disturbance to marine mammals and sea turtles from underwater noise as a result of construction activities is not significant in EIA terms. Therefore, no additional mitigation to the already embedded measures (**Table 4.17**) are considered necessary. No significant adverse residual effects have been predicted in respect of marine mammals or sea turtles.

Future Monitoring

4.8.124 The significance of effect from disturbance to marine mammals and sea turtles from underwater noise as a result of construction activities is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

Increased vessel disturbance

4.8.125 Increased vessel movement during the construction phase of the Proposed Development has the potential to result in a range of impacts on marine mammals and sea turtles. These include avoidance behaviour or displacement due to increased vessel presence, and in the case of marine mammals, masking of vocalisations or changes in vocalisation rate due to increased underwater noise.

4.8.126 The area surrounding the Proposed Development experiences a relatively high level of vessel traffic due to the presence of a number of ports and harbours in the region and their links to international shipping routes. Within the Shipping and Navigation Study Area (5 nm radius around the Offshore Cable Corridor), there was an average of approximately 89 vessels recorded per day, with approximately 72 vessels per day recorded crossing the Offshore Cable Corridor. The busiest day recorded 112 vessels within the study area. Cargo vessels made up the largest percentage of vessel traffic at 59%, followed by tankers at 25% and fishing vessels at 16% (See Volume 3, Chapter 5: Shipping and Navigation, of the PEIR, for further information).

Sensitivity of the Receptor

Harbour Porpoise

4.8.127 Harbour porpoises are particularly vulnerable to anthropogenic disturbance, with the main impact being loss of foraging opportunities (Nabe-Nielsen *et al.,* 2018).

They are small cetaceans which makes them susceptible to heat loss and as a result, requires them to forage frequently in order to maintain a high metabolic rate with little energy remaining for fat storage (Rojano-Doñate *et al*., 2018; Wisniewska *et al*., 2016). Therefore, there is a risk of changes to their overall fitness if they are displaced from high-quality foraging grounds or if their foraging efficiency is disturbed, and they are unable to find alternative suitable foraging grounds that will provide sufficient food to meet their metabolic needs. However, results from studies using DTAGs suggest that harbour porpoises are able to respond to short-term reductions in food intake and may have some resilience to disturbance (Wisniewska *et al*., 2016).

4.8.128 Harbour porpoises have a high frequency generalised hearing range (275 Hz–160 kHz) with a peak in hearing sensitivity between 100-125 kHz (Morell *et al.,*2021). Vessels generally emit low frequency noise, where large vessels are typically up to 10 kHz and small vessels are typically up to 40 kHz (Duarte *et al.,* 2021). These frequencies overlap with the hearing frequencies of harbour porpoise but are lower than the species' peak hearing sensitivity. Roberts *et al*. (2019) observed that harbour porpoise presence, resting and feeding behaviour reduced in response to increasing vessel frequencies. Frequent, lower-level noise exposures can cause masking and behavioural disruption that may be hard to detect but can have cumulative long-term effects on populations (Tougaard *et al*., 2015).

4.8.129 Statistical modelling of various collective datasets found harbour porpoise density in UK waters were typically lower in areas that had increased vessel activity (Heinänen and Skov, 2015).

4.8.130 Wisniewska *et al*. (2018) collected telemetry data to study the change in foraging rates of harbour porpoise in response to vessel noise in coastal waters in the inner Danish waters and Belt seas. The results found that occasional high-noise levels coincided with vigorous fluking, bottom diving, interrupted foraging and even cessation of echolocation, leading to significantly fewer prey capture attempts at received levels greater than 96 dB re 1 µPa (16 kHz third octave; Wisniewska *et al*., 2018).

4.8.131 Land-based surveys were conducted to examine the surfacing behaviour of harbour porpoise in relation to vessel traffic in Swansea Bay (Oakley *et al*., 2017). The study found a significant correlation between harbour porpoise sightings and the number of vessels present, with 26% of interactions observed considered to be negative (animals moving away or prolonged diving) when vessels were up to 1 km away (Oakley *et al*., 2017). The proximity of the vessel was found to be an important factor, with the greatest response occurring at 200 m from the vessel (Oakley *et al*., 2017). Smaller motorised vessels (jet ski, speed boat, small fishing vessels) were associated with more negative behaviours than large cargo ships, although larger ships were less common in the area (Oakley *et al*., 2017).

4.8.132 Harbour porpoises show a quick recovery time from being disturbed by vessel traffic and resume foraging activities shorty after disruption, with little cost to fitness. Harbour porpoises may also become habituated where construction vessel movements are regular and predictable (Wisniewska *et al*. 2018).

4.8.133 Based on the above, harbour porpoises are considered to be of reasonable adaptability, limited tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **low**.

Bottlenose Dolphin

4.8.134 Studies on the interactions of bottlenose dolphins with vessels have shown various responses. In the Moray Firth, a passive acoustic monitoring study showed that the presence of vessels resulted in a short-term reduction in foraging activity by 49%, with animals resuming foraging after the vessel had travelled through the area, suggesting that disturbance was limited to the time the vessel was physically present (Pirotta *et al*., 2015). However, dolphin behavioural disturbance was temporary and foraging activities quickly resumed as boats moved away This was the first study to conclusively show that boat physical presence, not just noise, plays a large role in disturbance of bottlenose dolphins. A number of studies have shown behavioural effects to include disruption of socialisation and resting behaviours and changes in vocalisation patterns (Koroza and Evans, 2022; Lusseau, 2003; Pellegrini *et al*., 2021; Pirotta *et al*., 2015). Repeated disruptions may result in an overall reduced energy intake.

4.8.135 In a modelling study by Lusseau *et al.* (2011), it was predicated that increased vessels movements associated with offshore wind development in the Moray Firth did not have a negative effect on the local population of bottlenose dolphins, although it did note that foraging may be disrupted by disturbance from vessels.

4.8.136 Bottlenose dolphin can tolerate vessel disturbance, particularly in areas where vessel traffic has always been high (Pirotta *et al*., 2013). For example, during the construction works of an oil pipeline in Broadhaven Bay, north west Ireland, the presence of bottlenose dolphin was positively correlated with overall vessel number (Anderwald *et al*., 2013). However, it was unclear whether the bottlenose dolphins were attracted to the vessels themselves or to particularly high prey concentrations within the study area at the time (Anderwald *et al*., 2013).

4.8.137 Bottlenose dolphins have capability to adapt their behaviour and tolerate certain levels of temporary disturbance, including temporary increases in vessel disturbance. In Cardigan Bay, UK, bottlenose dolphins have shown neutral and even positive response towards some vessels, which was related to vessel type and speed (Gregory and Rowden, 2001). Richardson (2015) investigated the effect of disturbance on bottlenose dolphin community structure in Cardigan Bay, UK, and found that group size was significantly smaller in areas of high vessel traffic. There is, however, evidence of habituation to boat traffic and therefore a slight increase may not result in high levels of disturbance.

4.8.138 Based on the above, bottlenose dolphins are considered to be of high adaptability, reasonable tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **low**.

Risso's Dolphin

4.8.139 There is limited information on the behavioural response of Risso's dolphin to increased vessel disturbance. However, several studies have shown that vessel traffic can affect the behaviour, activity, energy budgets, habitat use, and reproductive success of dolphin species (Bejder *et al.*, 2006; Lusseau, 2003; 2004; 2007).

4.8.140 Risso's dolphin have been recorded being active in the surface of the water and rarely bow riding, but often swimming alongside vessels and surfing the waves (Seawatch Foundation, 2012). Risso's dolphin in the Azores have been recorded showing aversion behaviours in the presence of vessels and altering resting patterns during times of high vessel activity (Visser *et al.,* 2011). When more than

five vessels were present in the vicinity, Risso's dolphins spent significantly less time resting and socialising. Reduced resting and socialising rates could impact energy reserves and reproductive success (Visser *et al*., 2011). In the Ionian Sea, a study on the impacts of cetacean watching vessels on behavioural activities of Risso's dolphins observed a neutral response to the presence of the vessel during 81.3% of sightings (Bellomo *et al.*, 2021).

4.8.141 As limited information exists on the behavioural response of Risso's dolphins to construction-related vessels, studies on the impact of cetacean watching vessels on Risso's dolphin behaviour have been presented as a proxy to inform this assessment. However, it is important to note that disturbance effects from cetacean watching vessels are direct, whilst those from construction vessels would be indirect as interactions are unlikely to be deliberate or targeted to dolphin groups.

4.8.142 Based on the above, Risso's dolphins are considered to be of high adaptability, reasonable tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **low**.

Common Dolphin

4.8.143 Common dolphins have been recorded changing their behaviour during periods of increased vessel traffic, for example, in the presence of tour boats common dolphin foraging behaviour was disrupted resulting in a 10% decrease of foraging activity (Stockin *et al*., 2008).

4.8.144 On a fine-temporal scale, an increase in vessel presence was reported to have a strong negative influence on occurrence of common dolphin within a bay on the north west coast of Ireland (Culloch *et al.,* 2016). Common dolphins have also been observed to avoid eco-tourism vessels which, in turn, was shown to disrupt foraging and resting behaviours (Meissner *et al*., 2015; Neumann and Orams 2006; Stockin *et al*., 2008). Once disrupted, dolphins took at least twice as long to return to foraging as compared to control conditions (vessels >300 m away from dolphins; Meissner *et al.,* 2015). The study also found that the probability of common dolphins starting to forage while engaged in travelling in the presence of cetacean watching vessels decreased by two thirds (Meissner *et al*., 2015). Common dolphin foraging tactics include cooperative herding of prey (Neumann and Orams, 2003), therefore it is possible that the behavioural changes of some individuals within a group, as a result of approaching vessels, could be compromising the success of the overall foraging event (Meissner *et al*., 2015).

4.8.145 Despite the negative influence of vessel traffic reported in Culloch *et al*. (2016), it was also reported that no long-term population level effects were a result of increased vessel traffic.

4.8.146 As limited information exists on the behavioural response of common dolphins to construction-related vessels, studies on the impact of cetacean watching vessels on common dolphin behaviour have also been presented as a proxy to inform this assessment. However, it is important to note that disturbance effects from cetacean watching vessels are direct, whilst those from construction vessels would be indirect/coincident as interactions are unlikely to be deliberate or targeted to dolphin groups.

4.8.147 Based on the above, common dolphins are considered to be of reasonable adaptability, reasonable tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **low**.

Minke Whale

4.8.148 A study into the response of minke whales to construction-related vessel traffic in Broadhaven Bay, north west Ireland found a significant negative correlation between the presence of minke whale and both the number of overall vessels and the number of utility vessels (those emitting lower frequency noise but moving around more than construction vessels), suggesting that minke whale were displaced from the area, most likely due to vessel presence and/or disturbance (Anderwald *et al.,* 2013).

4.8.149 Repeated behavioural disturbances can result in longer term consequences for individual minke whale survival and reproduction (Christiansen, Rasmussen and Lusseau, 2013). Baleen whales are likely to be more sensitive to slower moving vessels emitting lower frequency noise as is evidenced in Anderwald *et al*. (2013).

4.8.150 In the presence of vessels, minke whale have been recorded performing shorter dives and increased sinuous movements, which ultimately reduced foraging activity (Christiansen, Rasmussen and Lusseau, 2013). A reduction in foraging could result in decreased energy availability, which could impact calving success.

4.8.151 It is expected that minke whales are more sensitive to low frequency sounds (Nowacek *et al.*, 2007) such as those produced by slow moving vessels, although limited information exists on the behavioural response of minke whales to construction-related vessels. Studies on the impact of whale watching vessels on minke whale behaviour have therefore been presented as a proxy to inform this assessment, although it is important to note that disturbance effects from whale watching vessels are direct, whilst those from construction vessels would be indirect/coincident.

4.8.152 Based on the above, minke whales are considered to be of reasonable adaptability, reasonable tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **low**.

Grey Seal

4.8.153 There is limited information on the response of grey seal to increased vessel presence, particularly in relation to construction vessels. Grey seals rely heavily on sound for communication, orientation, navigation, to locate predators and foraging, and auditory disruption may affect their survival rates (Feng *et al*., 2016; Southall *et al.,* 2000). Grey seals are particularly vulnerable to disturbance by vessels which have a low frequency sound output, as seal vocalisations are relatively low frequency and are therefore at risk of being masked (Britton, 2012).

4.8.154 Grey seals are particularly sensitive to disturbance in regions where vessel traffic overlaps with productive coastal waters (Robards *et al*., 2016). Vessel disturbance may be particularly detrimental to grey seal if it changes their haul-out patterns or reduces the time they are able to spend resting or nursing pups during the breeding season.

4.8.155 Britton (2012) recorded a significant correlation between boat speed and the distance at which hauled-out grey seals on the Isle of Man showed alert behaviour. A similar association was also observed between boat speed and movement and flushing response (entering the water) although this was not tested. The duration of the boat interaction was, however, found to be important, with flushing occurring in all vessel interactions lasting four minutes or longer (Britton, 2012).

4.8.156 Grey seals have been shown to respond to vessel traffic, however, they are frequently observed in areas of high vessel activity, particularly in coastal areas in close approximation to haul-out sites (Jones *et al*., 2017). Grey seals have a broad hearing range of 50 Hz – 86 kHz and have reportedly responded to small (~2 kHz) and large (~0.25 kHz) vessels at approximately 400 m (Southall *et al.,* 2019; Thomsen *et al.,* 2006). Anderwald *et al.* (2013) found that the presence of grey seals was significantly negatively correlated with the overall number of vessels and the number of utility vessels (i.e. those emitting lower frequency noise but moving around more than construction vessels) suggesting that grey seal were avoiding the area.

4.8.157 While grey seals are not likely to experience damage to auditory systems from vessel noise, the presence of vessels has the potential to alter surfacing and diving behaviour (Trigg, 2019). The type of vessel is also reflected in grey seal response, as grey seals can become habituated to vessel presence, particularly wildlife watching or fishing, however vessels which are not regularly occurring in an area are known to cause displacement from an area (SCOS, 2023).

4.8.158 Based on the above, grey seals are considered to be of reasonable adaptability, reasonable tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **low**.

Leatherback Turtle

4.8.159 Knowledge of collision occurrences are limited to stranding events and show evidence of major, life-threatening injuries such as carapace fractures or deep cuts on the head, flippers and carapace (Pasanisi *et al.,* 2022). Risk of collision is high for sea turtles as they surface to breathe, bask (to rewarm after a cold deep dive), forage, rest and mate (in shallow waters; Pasanisi *et al.,* 2022). High vessel speeds increase the risk of collision and likely reduces the probability of an animal perceiving the vessel approaching them. As noted in Schoeman *et al.* (2020), vessels travelling under 4 knots decreased the probability of lethal injury in sea turtles by 60% and individuals were more likely to flee from an approaching vessel when speeds are reduced to 2 knots.

4.8.160 DeRuiter and Doukara (2012) described loggerhead turtle *Caretta caretta* behavioural response to airgun sound exposure, which included diving, however as control data were not available, it is not certain that diving behaviour was in response to sound exposure, and vessel presence may also have played a role in any behavioural responses.

4.8.161 Weir (2007) observed the behaviour of 240 sea turtles of at least three species (olive ridley *Lepidochelys olivacea*, leatherback and loggerhead turtles) during airgun surveys off Angola and did not detect a behavioural response of the turtles when airguns were active. Approximately 80% of the turtles remained at the surface, yet almost all turtles dove in response to being in close proximity (~10 m) of the vessel or surface floats associated with the airgun array.

4.8.162 Based on the above, leatherback turtles are considered to be of high adaptability, reasonable tolerance, high recoverability, and of very high value. The sensitivity of the receptor is **negligible**.

Magnitude of Impact

4.8.163 During the construction phase, for assessment purposes it is assumed that a maximum of 30 vessels will be involved in operations at any one time (in reality all

vessels would not be deployed simultaneously). It is expected that four trenching vessels, two pre-installation vessels, two rock placement vessels, one CLV (two for brief periods during changeovers), and 20 guard vessels stationed every 10 nautical miles, will be used over the duration of the construction phase. A maximum of two jack ups/multi-cat vessels would be required for offshore works.

4.8.164 Disturbance to marine mammals by vessels will be driven by a combination of underwater noise and the physical presence of the vessel itself (Pirotta *et al.*, 2015). It is not simple to identify individual drivers of vessel disturbance, therefore, it is assessed in general terms, covering both disturbance from vessel presence and underwater noise.

4.8.165 The physical presence of vessels, not just noise, has the potential to disturb marine mammals, however few studies have identified vessel presence as a specific driver of disturbance (Pirotta *et al*., 2015). The impact of vessel noise, however, has been widely reported on.

4.8.166 Noise levels from construction vessels will result in an increase in non-impulsive, continuous sounds primarily from propellers, thrusters, cavitation and various rotating machinery (e.g., power generation, pumps) in the vicinity of the Proposed Development. The main drivers influencing the magnitude of potential impact with respect to noise disturbance from vessels are vessel type, speed, and ambient noise levels (Wilson *et al.*, 2007). Disturbance from vessel noise is likely to occur only when vessel noise associated with the construction exceeds the background ambient noise level.

4.8.167 Due to differences in vessel design and maintenance, source levels can vary widely across various vessel classes. Vessel noise levels typically have a peak operating frequency range of between 20 and 4000 Hz for tug and CLVs. Studies on these types of vessels have reported SPL_{rms} of 172 and 188 dB re 1 µPa at 1m, respectively (Richardson *et al*., 1995; Wyatt, 2008). Slower transiting speeds reduces the source levels for most vessel classes (MacGillvary and de Jong, 2021). Transit speeds for CLVs are typically 10-12 knots but tend to transit at 6 knots during cable laying (Rapp, 2014). In general, support and supply vessels (typical range of vessel length from bow to stern: 50-100 m) are expected to have broadband source levels in the range 165-180 dB re 1µPa, with the majority of energy below 1 kHz (OSPAR, 2009). Large commercial vessels (typical vessel length of >100 m) produce relatively loud and predominantly low frequency sounds, with the strongest energy concentrated below several hundred hertz (OSPAR, 2009).

4.8.168 The coastal areas and immediate surrounding waters of the Proposed Development already experience a relatively high amount of vessel traffic. Therefore, the increase in vessel activity as a result of construction is not considered a novel impact for marine mammals or sea turtles present in the area.

Harbour porpoise

4.8.169 The reported distance between cetaceans and vessels from which behavioural responses are observed varies, with reports suggesting that harbour porpoise respond to both small (~2 kHz) and large (~0.25 kHz) vessels at approximately 400 m (Thomsen *et al.* 2006). In addition, a study on the impacts of construction-related activities at Beatrice and Moray East offshore windfarms showed that harbour porpoises are displaced by offshore windfarm construction vessels (Benhemma-Le Gall *et al.*, 2021). Types of construction-related vessels that were assessed in this study included offshore service vessels for pile driving and

jacket/turbine installation, guard vessels, crew-transfer vessels, and port service craft (Benhemma-Le Gall *et al.*, 2021). The median construction-related vessel density across the Moray Firth during the study period was 1.4 vessels/km^2. PAM data from the site showed that the hourly occurrence of porpoise detections declined within 2 km of construction vessels, but that no response was observed out to 4 km, suggesting that responses declined within increasing distance to vessels (Benhemma-Le Gall *et al.*, 2021).

4.8.170 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the harbour porpoise receptor is highly mobile and has a large distribution range within the Celtic and Irish Seas MU.

4.8.171 Furthermore, Heinänen and Skov (2015) suggested that harbour porpoise density was significantly lower in areas with vessel transit rates of greater than 20,000 vessels/year (80 per day within an area of 5 km^2). Comparatively, vessel traffic in the Study Area averages 89 vessels per day (see Volume 3, Chapter 5: Shipping and Navigation of the PEIR).

4.8.172 Throughout the construction of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals and sea turtles.

4.8.173 While the presence of vessels in the area may cause displacement and/or changes in behaviour, harbour porpoise are likely to return to the area quickly and resume pre-disturbance behaviours.

4.8.174 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al.* (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that are likely to be disturbed (Findlay *et al.*, 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction decreased mean source levels by 18 dB (Findlay *et al.*, 2023).

4.8.175 The impact of disturbance to harbour porpoise from vessel activities is considered to result in a small proportion of the population affected, to occur frequently throughout the construction phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.8.176 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Bottlenose Dolphin

4.8.177 Bottlenose dolphin response to different types of vessel traffic has been reported in a number of studies, and behavioural effects have included disruption of socialisation and resting behaviours, changes in vocalisation patterns and reduced foraging activity (Koroza and Evans, 2022; Lusseau, 2003; Pellegrini *et al.,* 2021; Pirotta *et al*., 2015).

4.8.178 Across the UK, there are marine and coastal wildlife watching codes which advise members of the public and tourism how best to act around marine life to limit disturbance (NatureScot, 2017; Wild Seas Wales, 2024). Private recreational vessels (e.g. speed boats, small motorboats and kayaks) are found to break these codes of conduct most often, introducing more pressure on marine wildlife through disturbance (Koroza and Evans, 2022). However, research on an increase of commercial vessels in response to the construction of an offshore wind farm found that bottlenose dolphin response to disturbance is not biologically significant (New *et al.,* 2013).

4.8.179 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the bottlenose dolphin receptor is highly mobile and has a large distribution range within the Offshore Channel MU and Celtic Sea and South West England MU.

4.8.180 Throughout the construction of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals and sea turtles.

4.8.181 While the presence of vessels in the area may cause displacement and/or changes in behaviour, bottlenose dolphins are likely to return to the area quickly and resume pre-disturbance behaviours.

4.8.182 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al*. (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise swath halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that are likely to be disturbed (Findlay *et al*., 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB (Findlay *et al.,* 2023).

4.8.183 Therefore, the impact of disturbance to bottlenose dolphin from vessel activities is considered to result in a small proportion of the population affected, to occur frequently throughout the construction phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.8.184 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Risso's Dolphin

4.8.185 The reported distance between cetaceans and vessels from which behavioural responses are observed varies, however information on Risso's dolphin response distance to vessels is limited.

4.8.186 Nevertheless, the area of disturbance as a result of the project activities identified above is predicted to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the Risso's dolphin receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.8.187 Throughout the construction of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals and sea turtles.

4.8.188 While the presence of vessels in the area may cause displacement and/or changes in behaviour, Risso's dolphins are likely to return to the area quickly and resume pre-disturbance behaviours.

4.8.189 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al*. (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise swath halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that are likely to be disturbed (Findlay *et al*., 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB (Findlay *et al.,* 2023).

4.8.190 Therefore, the impact of disturbance to Risso's dolphin from vessel activities is considered to result in a small proportion of the population affected, to occur frequently throughout the construction phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.8.191 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Common Dolphin

4.8.192 The reported distance between cetaceans and vessels from which behavioural responses are observed varies, however information on common dolphin response distance to vessels is limited.

4.8.193 Nevertheless, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the common dolphin receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.8.194 Throughout the construction of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals and sea turtles.

4.8.195 While the presence of vessels in the area may cause displacement and/or changes in behaviour, common dolphins are likely to return to the area quickly and resume pre-disturbance behaviours.

4.8.196 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al*. (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise swath halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that

are likely to be disturbed (Findlay *et al*., 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB (Findlay *et al*., 2023).

4.8.197 Therefore, the impact of disturbance to common dolphins from vessel activities is considered to result in a small proportion of the population affected, to occur frequently throughout the construction phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.8.198 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Minke Whale

4.8.199 The reported distance between cetaceans and vessels from which behavioural responses are observed varies, and information on minke whale response distance to vessels is limited.

4.8.200 Nevertheless, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the minke whale receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.8.201 Throughout the construction of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals and sea turtles.

4.8.202 While the presence of vessels in the area may cause displacement and/or changes in behaviour, minke whales are likely to return to the area quickly and resume pre-disturbance behaviours.

4.8.203 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al*. (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise swath halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that are likely to be disturbed (Findlay *et al*., 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB (Findlay *et al.,* 2023).

4.8.204 Therefore, the impact of disturbance to minke whale from vessel activities is considered to result in a small proportion of the population affected, to occur frequently throughout the construction phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.8.205 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Grey Seal

4.8.206 The reported distance between seals and vessels from which behavioural responses are observed varies. This variation depends on whether individuals are hauled-out or at sea, the type of vessel, the vessel activity, and its speed and predictability of transit.

4.8.207 At haul-out sites, grey seals commonly enter the water and display alert behaviour when disturbed by boats and cruise ships approaching between 100 and 830 m (Andersen *et al*. 2012; Tripovich *et al*. 2012; Jansen *et al*. 2015). It is worth noting, that no haul-out sites are located within the study area.

4.8.208 There is limited information about the at-sea behavioural response of seals to non-impulsive noise sources such as shipping. Whilst at-sea, when exposed to shipping noise of 122 dB re 1 µPa (received SPL), telemetry studies indicate an increased descent rate of benthic and shallow dives in adult grey seals (Trigg, 2019). These quick descent dives are often a response to a stressor, which could impact the animal's fitness by increasing energy demands and reducing foraging opportunities if disturbance was persistent (Mikkelsen *et al*. 2019).

4.8.209 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the grey seal receptor is highly mobile and has a large distribution range within the South West England SMU and Wales SMU.

4.8.210 Throughout the construction of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals.

4.8.211 While the presence of vessels in the area may cause displacement and/or changes in behaviour, grey seals are likely to return to the area quickly and resume pre-disturbance behaviours.

4.8.212 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al*. (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise swath halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that are likely to be disturbed (Findlay *et al*., 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB (Findlay *et al*., 2023).

4.8.213 Therefore, the impact of disturbance to grey seal from vessel activities from vessel activities is considered to result in a small proportion of the population affected, to occur frequently throughout the construction phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.8.214 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Leatherback Turtle

4.8.215 The reported distance between sea turtles and vessels from which behavioural responses are observed varies depending on the vessel speed and activity, the following two examples studied behavioural effects in response to airgun sound exposure, with Weir (2007) reporting evasive diving within 10 m of the vessel and DeRuiter and Doukara (2012) reporting behavioural change over 100 m from the vessel. Considering these varieties in behavioural changes to vessels and authors of the studies noting uncertainty if the response was due to auditory cue or the physical presence of the vessels themselves, it is uncertain how turtles would react to construction vessels offshore.

4.8.216 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, leatherback turtles are mobile and have a large distribution range within the OSPAR Region III MU.

4.8.217 Throughout the construction of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of sea turtles.

4.8.218 While the presence of vessels in the area may cause displacement and/or changes in behaviour, leatherback turtles are likely to return to the area quickly and resume pre-disturbance behaviours.

4.8.219 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al.* (2023) which demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB.

4.8.220 Therefore, the impact of disturbance to leatherback turtle from vessel activities considered to result in a small proportion of the population affected, to occur frequently throughout the construction phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.8.221 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible**.

Significance of the Effect

Harbour porpoise

4.8.222 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.8.223 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Bottlenose Dolphin

4.8.224 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.8.225 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Risso's Dolphin

4.8.226 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the use of tourism and private vessels as a proxy in the absence of research concerning construction related traffic.

4.8.227 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.8.228 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Common Dolphin

4.8.229 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the use of tourism and private vessels as a proxy in the absence of research concerning construction related traffic.

4.8.230 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.8.231 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Minke Whale

4.8.232 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the use of tourism and private vessels as a proxy in the absence of research against construction related traffic.

4.8.233 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.8.234 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Grey Seal

4.8.235 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. The majority of research investigating grey seal behaviour to vessel disturbance focusses on behaviour at haul-out sites rather than the offshore environment. This uncertainty has been addressed through expert elicitation on knowledge of grey seal at-sea behaviour and scale of the Proposed Development.

4.8.236 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.8.237 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Leatherback Turtle

4.8.238 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the use of tourism and private vessels as a proxy in the absence of research concerning construction related traffic.

4.8.239 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.8.240 Overall, the magnitude of the impact is **negligible,** and the sensitivity of the receptor is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.

Further Mitigation

4.8.241 The significance of effect from disturbance to marine mammals and sea turtles from increased vessel disturbance during construction activities is not significant in EIA terms. Therefore, no additional mitigation to the embedded measures already identified in **Table 4.17** are considered necessary. No significant adverse residual effects have been predicted with respect to marine mammals or sea turtles.

Future Monitoring

4.8.242 The significance of effect from disturbance to marine mammals and sea turtles from increased vessel disturbance during construction activities is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

4.9 Preliminary Assessment of Operational Effects

4.9.1 The impacts of the operational phase of the Proposed Development have been assessed. The potential preliminary impacts arising from the operational phase of

the Proposed Development are listed in **Table 4.16,** along with the maximum design scenario against which each impact has been assessed.

4.9.2 The only identified operational phase impacts with relevance to marine mammals and sea turtles are associated with survey and repair activities as needed; therefore, for the vast majority of the operational phase there are not expected to be any effects on marine mammals or sea turtles.

4.9.3 A description of the potential effect on receptors caused by each identified potential impact is given below:

- Disturbance from anthropogenic noise; and
- Increased vessel disturbance.

Disturbance from anthropogenic noise

4.9.4 This impact assessment focusses on elevations in underwater noise as a result of repair works (cable cut, recovery and burial activities), as these activities have the greatest potential for impact on marine mammals and sea turtles. No underwater noise will result from the normal operation of the cable; however, periodic surveys and repairs to the cable will be required. These surveys and repairs will involve similar activities to those detailed for the construction phase, although in much more limited areas.

4.9.5 Inspection surveys (which may include geophysical survey equipment such as Multibeam echosounder (MBES), Sidescan sonar (SSS) and Magnetometer) have not been included in this assessment. These inspection surveys will be similar to the pre-construction geophysical survey and will be undertaken initially up to once a year for the first 5 years, and then approx. once every 5 years thereafter. On each occasion, Xlinks will conduct a risk assessment, complete the necessary environmental permitting and licensing requirements, consult with SNCBs and undertake appropriate supporting assessments as required, to assess impacts on marine mammals and sea turtles.

4.9.6 Sound propagates through the water in a series of pressure waves. These waves comprise of alternating compressions (positive pressure variations) and rarefactions (negative pressure fluctuations). Due to these changes in pressure, the unit for measuring sound is usually referenced to the Pascal (Pa) and due to the medium of water, underwater sound is referenced to 1 micro Pa (µPa). The decibel (dB) is a relative unit used to express the ratio of two values of acoustic power and is typically expressed as ten times the logarithm in base 10.

4.9.7 There are different metrics which can be used as measures of underwater sound pressure. Key metrics used in this report are as follows:

- Sound pressure level (SPL): The maximum sound pressure during a stated time interval. A peak sound pressure may arise from a positive or negative sound pressure. This quantity is typically useful as a metric for a pulsed waveform;
- Root mean square SPL (SPL_{rms}): The square root of the mean square pressure, where the mean square pressure is the time integral of squared sound pressure over a specified time interval divided by the duration of the time interval;
- Sound exposure level (SEL): a measure of the sound pressure squared over a stated period of time or noise event and is normalised to one second; and

- Cumulative SEL (SEL_{cum}): representative of the total acoustic energy of a noise source taking place across 24-hours.

4.9.8 A number of studies have provided suggestions for exposure limits for marine mammals, but the precautionary threshold of injury presented in Southall *et al.* (2007), later updated in 2019, are advised to be followed for impact assessments (JNCC, 2020). Noise exposure criteria are typically represented by dual exposure metrics including the frequency weighted SEL (expressed in dB re. μPa^2–s or μPa^2s) and the unweighted SPL (expressed in units relative to 1 µPa in water; ISO 18406, 2017; Juretzek *et al.,* 2021). The terms 'weighted' and 'unweighted' relate to hearing sensitivities (e.g. frequencies of sound detectable to an individual) of marine fauna and are traditionally based on species audiograms. **Table 4.22** presents the generalised hearing ranges, as highlighted in Southall *et al.* (2019), for the relevant marine mammal species.

Table 4.22: Marine mammal hearing ranges (Southall *et al*, 2019)

Functional Hearing Group	Relevant Species	Generalised hearing ranges
Very High Frequency (VHF) cetacean	Harbour porpoise	275 Hz to 160 kHz
High Frequency (HF) cetacean	Bottlenose dolphin, Risso's dolphin, common dolphin	150 Hz to 160 kHz
Low Frequency (LF) cetacean	Minke whale	7 Hz to 35 kHz
Phocid (in water) (PCW)	Grey seal	50 Hz to 86 KHz

4.9.9 Impacts to marine mammals from underwater noise range from changes in behaviour and masking that affect communication and listening space, and/or locating prey (Basran *et al*., 2020; Dunlop, 2016; Erbe *et al*., 2016; Heiler *et al*., 2016; Pine *et al*., 2019; Pirotta *et al*., 2012; Wisniewska *et al*., 2018), displacement and disturbance (Brandt *et al*., 2011; Culloch *et al*., 2016; Graham *et al*., 2019; Pirotta *et al*., 2014; Stone *et al*., 2017), injury and mortality (Reichmuth *et al*., 2019; Schaffeld *et al*., 2019).

4.9.10 Auditory injury in marine mammals occurs at permanent threshold shift (PTS) onset, where the hearing sensitivity is reduced after noise exposure with no hearing recovery in the impacted frequencies (Tougaard, 2021). PTS can occur instantaneously (via impulsive noise sources such as pile-driving) or cumulatively (i.e. exposed to the sound source over an extended period). The level of injury depends on the duration, frequency and intensity of the sound source and received level. Whilst PTS is considered a permanent effect, the most likely response of an animal exposed to noise levels that could induce PTS is to flee the ensonified area. Therefore, animals exposed to these noise levels are likely to actively avoid hearing damage by moving away from the area.

4.9.11 Another auditory effect is described as temporary threshold shift (TTS) in hearing where an individual experiences a temporary increase in the threshold of hearing (i.e. the minimum intensity needed for a sound to be audible) at a specific frequency that returns to its pre-exposure baseline over time (Tougaard, 2021).

4.9.12 Underwater noise also has the potential to impact sea turtles if the frequency is within their hearing range (

4.9.13 **Table** 4.23). Popper *et al*. (2014) noted that sea turtles can experience mortality and potential mortal injury when exposed to noise levels greater than 210 dB re 1 µPa² s (weighted SEL_{cum}) or 207 dB re 1µPa (unweighted SPL_{peak}). However, the effects of noise on sea turtles are largely unknown due to a lack of information on hearing capabilities and responses to sound (Dow Piniak *et al*., 2012).

Table 4.23: Sea turtle hearing range (Popper *et al*, 2014)

Hearing group	Generalised hearing ranges
Sea turtles	50–1,200 Hz

4.9.14 This impact assessment will focus on behavioural disturbance to underwater noise from operational phase (repair) activities, which are all classed as non-impulsive noise sources.

Sensitivity of receptor

Harbour Porpoise

4.9.15 Harbour porpoise sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **medium**.

Bottlenose Dolphin

4.9.16 Bottlenose dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **low**.

Risso's Dolphin

4.9.17 Risso's dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **low**.

Common Dolphin

4.9.18 Common dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **low**.

Minke Whale

4.9.19 Minke whale sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **low**.

Grey Seal

4.9.20 Grey seal sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **low**.

Leatherback Turtle

4.9.21 Leatherback turtle sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **negligible.**

Magnitude of impact

4.9.22 Project activities that may occur during cable maintenance and repair (Operational-repair) that are expected to operate at frequencies within the hearing range of the marine mammal and sea turtle receptors are provided in
4.9.23 **Table 4.24**.

Table 4.24: Operating frequencies of different activities. Source: Volume 3, Appendix 4.1: Underwater Noise Assessment

Activity	Operating Frequency (Hz)	SPL_{rms} dB re 1µP @1m
Seabed clearance	80 – 2,000	178 – 183
Mass Flow Excavation	80 – 2,000	162 – 167
Dredging	50 – 3,000	183 – 188
Cable Burial – water jetting	20 – 4,000	188 – 193
Cable Burial – mechanical cutter	50 – 3,000	143 – 160
Installation of rock protection	100 – 4,000	188
Associated vessel movements – tug	50 – 2,000	172
Associated vessel movements – cable lay vessel	20 – 4,000	188

4.9.24 Underwater noise modelling (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR) has been undertaken to assess the potential impacts on marine mammals as a result of the different activities involved in the Proposed Development. Impact ranges for marine mammals were calculated using the Southall *et al.* (2019) non-impulsive criteria (**Table 4.25**). Sea turtles were not assessed in the underwater modelling.

4.9.25 The largest PTS-onset impact range (weighted cumulative sound exposure level (SEL_{cum} over 24 hours)) is predicted for cable burial by water jetting (worst case assumption that water jetting activities are undertaken during operational-repair phase activities) and is estimated to range less than 780 m for minke whale (low frequency cetacean) and less than 690 m for harbour porpoise (very high frequency cetacean; **Table 4.25**). All other activities have predicted impact ranges less than 500 m from the source for all marine mammal receptors. These ranges are considered precautionary as it was assumed that individuals would be stationary within these ranges for a period of 24-hours. This is unlikely to occur as marine mammals and sea turtles have been shown to flee or move away from noisy activities and are highly mobile, as described in the species-specific sections above.

4.9.26 Assuming a lower (worst-case) swimming speed of 1.5 m/s for all marine mammal species (including both adults and juveniles), and on the basis of the worst-case impact range as described above (780m), the maximum time that it would take the most sensitive receptor (LF cetaceans, such as minke whales) to leave the centre of the impact zone (i.e. the sound source) during operation of the noisiest activitiy (water-jetting for cable burial) would be nine minutes. The swim speed and

exposure calculations assume that the receptor is starting from the immediate vicinity of the noise source, which is highly unlikely. It also does not consider the fact that the sound source is also moving, and that as distance between source and receiver (i.e. animal) increases, the impact radius would also decrease as the animal is exposed to less noise (i.e. the noise reduces with increasing distance from the source). These factors all demonstrate that the underwater noise modelling is extremely precautionary.

4.9.27 Due to the precautionary approach to the impact range predictions and the precautionary contextual calculations regarding receptors travelling away from the noise emitting activities, it is considered highly unlikely that PTS onset will occur for any of the FHGs as a result of the Proposed Development.

Table 4.25: Summary of the modelled PTS-onset impact ranges for marine mammals. Source: Technical Appendix: Underwater Noise Assessment

Activity	Impact ranges (m)			
	LF cetaceans	HF cetaceans	VHF cetaceans	PCW
Thresholds: SEL_{cum}, dB re 1 μPa^2s	199	198	172	201
Seabed clearance	<170	<10	<150	<90
Mass Flow Excavation	<20	Not reached	<20	<10
Dredging	<360	<20	<320	<200
Cable Burial – water jetting	<780	<50	<690	<420
Cable Burial – mechanical cutter	<370	<20	<320	<200
HDD	<10	Not reached	<10	Not reached
Installation of rock protection	<390	<30	<340	<210
Associated vessel movements – tug	<40	<10	<30	<20
Associated vessel movements – cable lay vessel	<370	<20	<320	<200

Harbour porpoise

4.9.28 During the operational phase, maintenance activities are expected to operate at frequencies within the hearing range of harbour porpoise (**Table 4.24**).

4.9.29 The activity with the highest sound source is cable burial (water jetting). The distance which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR).

4.9.30 It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary, and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and

only for certain highly sensitive species. Furthermore, it is important to note that ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion.. A study by Merchant *et al.* (2016) measured underwater ambient noise levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.9.31 Furthermore, harbour porpoise are unlikely to remain in close proximity to the activities, due to their highly mobile nature and typical aversion behaviour to vessels (Brand *et al*., 2018).

4.9.32 Taking into account the above, harbour porpoises are considered to be at low risk of any adverse behavioural responses.

4.9.33 Fixed EDRs are advised within JNCC (2020) guidance to account for a radii of effect from noise impacts generated by pin-piling, conductor piling, piling under noise abatement and geophysical surveys. These distances account for the main impact ranges found within a variety of studies, but they do not account for all deterrence or disturbance in the associated area nor represent the limit at which effects can be detected. None of the recommended EDRs account for non-impulsive sound sources, which would have a lower impact radius than any geophysical surveys, with respect to underwater noise.

4.9.34 In the absence of an EDR for the project activities, the precautionary EDR of 5 km for ‘other geophysical surveys’ was used in this assessment, as there is potential to disturb and/or displace harbour porpoise present in the Offshore Cable Corridor, due to noise disturbance during the operational phase of the Proposed Development.

4.9.35 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be highly temporary, with repair works anticipated to be of short duration. Furthermore, the harbour porpoise receptor is highly mobile and has a large distribution range within the Celtic and Irish Seas MU.

4.9.36 Repair work would be highly localised to a specific area of the cable route. While animals may avoid the area while the repair takes place, they are expected to return once works are completed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.9.37 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Bottlenose Dolphin

4.9.38 During the operational phase, maintenance activities are expected to operate at frequencies within the hearing range of bottlenose dolphin (**Table 4.24**).

4.9.39 The activity with the highest sound source is cable burial (water jetting). The distance which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR).

4.9.40 It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary,and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and only for certain highly sensitive species. Furthermore, it is important to note that ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion.. A study by Merchant *et al.* (2016) measured underwater ambient noise levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.9.41 A review of potential effects of various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging, used in the offshore wind farm industry concluded that it would be “highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals” (BEER and DEFRA 2008).

4.9.42 Taking into account the above, bottlenose dolphins are considered to be at low risk of any adverse behavioural responses.

4.9.43 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be highly temporary, with repair works anticipated to be of short duration. Furthermore, the bottlenose dolphin receptor is highly mobile and has a large distribution range within the Offshore Channel MU and Celtic Sea and South West England MU.

4.9.44 Repair work would be highly localised to a specific area of the cable route. While animals may avoid the area while the repair takes place, they are expected to return once works are completed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.9.45 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Risso’s Dolphin

4.9.46 During the operational phase, maintenance activities are expected to operate at frequencies within the hearing range of Risso’s dolphin (**Table 4.24**).

4.9.47 The activity with the highest sound source is cable burial (water jetting). The distance which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR).

4.9.48 It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary,and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and only for certain highly sensitive species. Furthermore, it is important to note that ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion. A study by Merchant *et al.* (2016) measured underwater ambient noise

levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.9.49 A review of potential effects of various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging, used in the offshore wind farm industry concluded that it would be “highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals” (BEER and DEFRA, 2008).

4.9.50 Taking into account the above, Risso’s dolphins are considered to be at low risk of any adverse behavioural responses.

4.9.51 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be highly temporary, with repair works anticipated to be of short duration. Furthermore, the Risso’s dolphin receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.9.52 Repair work would be highly localised to a specific area of the cable route. While animals may avoid the area while the repair takes place, they are expected to return once works are completed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.9.53 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Common Dolphin

4.9.54 During the operational phase, maintenance activities are expected to operate at frequencies within the hearing range of common dolphin (**Table 4.24**).

4.9.55 The activity with the highest sound source is cable burial (water jetting). The distance which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR).

4.9.56 It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary,and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and only for certain highly sensitive species. Furthermore, it is important to note that ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion . A study by Merchant *et al.* (2016) measured underwater ambient noise levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.9.57 A review of potential effects of various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging, used in the offshore wind farm industry concluded that it would be “highly unlikely that cable installation

would produce noise at a level that would cause a behavioural reaction in marine mammals" (BEER and DEFRA 2008).

4.9.58 Taking into account the above, common dolphins are considered to be at low risk of any adverse behavioural responses,

4.9.59 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be highly temporary, with repair works anticipated to be of short duration. Furthermore, the common dolphin receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.9.60 Repair work would be highly localised to a specific area of the cable route. While animals may avoid the area while the repair takes place, they are expected to return once works are completed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.9.61 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Minke Whale

4.9.62 During the operational phase, maintenance activities are expected to operate at frequencies within the hearing range of minke whale (**Table 4.24**).

4.9.63 The activity with the highest sound source is cable burial (water jetting). The distance which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR).

4.9.64 It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary, and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and only for certain highly sensitive species. Furthermore, it is important to note that ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion.. A study by Merchant *et al.* (2016) measured underwater ambient noise levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.9.65 A review of potential effects of various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging, used in the offshore wind farm industry concluded that it would be "highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals" (BEER and DEFRA 2008).

4.9.66 Taking into account the above, minke whales are considered to be at low risk of any adverse behavioural responses.

4.9.67 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be highly temporary, with repair

works anticipated to be of short duration. Furthermore, the minke whale receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.9.68 Repair work would be highly localised to a specific area of the cable route. While animals may avoid the area while the repair takes place, they are expected to return once works are completed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.9.69 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Grey Seal

4.9.70 During the operational phase, maintenance activities are expected to operate at frequencies within the hearing range of grey seal (**Table 4.24**).

4.9.71 The activity with the highest sound source is cable burial (water jetting). The distance which disturbance to marine mammals might occur from this type of activity has been calculated as 73.6 km, based on a behavioural disturbance threshold of 120 dB SPL_{rms} for all species (Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR).

4.9.72 It should be noted that the behavioural disturbance threshold of 120 dB SPL_{rms}, is very precautionary, and does not necessarily represent the onset of an adverse behavioural response. It is likely that the onset of any adverse behavioural responses will take place at a significantly smaller range from the source, and only for certain highly sensitive species. Furthermore, it is important to note that ambient noise levels in the areas where work is proposed could be close to or exceed this value, and hence highlights the very precautionary nature of this criterion. A study by Merchant *et al.* (2016) measured underwater ambient noise levels in different locations in the North Sea ranging from 80 to 120 dB re 1µPa. Furthermore, it assumes that the receptor would remain within this range for a 24-hour period, as the model does not account for movement / fleeing response.

4.9.73 A review of potential effects of various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging, used in the offshore wind farm industry concluded that it would be “highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals” (BEER and DEFRA 2008).

4.9.74 Taking into account the above, grey seals are considered to be at low risk of any adverse behavioural responses.

4.9.75 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small to medium given the anticipated local spatial range of impact. The impact would also be expected to be highly temporary, with repair works anticipated to be of short duration. Furthermore, the grey seal receptor is highly mobile and has a large distribution range within the South West England SMU and Wales SMU.

4.9.76 Repair work would be highly localised to a specific area of the cable route. While animals may avoid the area while the repair takes place, they are expected to return once works are completed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.9.77 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Leatherback Turtle

4.9.78 During the operational phase, maintenance activities are expected to operate at frequencies within the hearing range of leatherback turtles (**Table 4.24**).

4.9.79 The activity with the highest sound source is cable burial (water jetting). The distance which disturbance to sea turtles may occur from these types of activities is unknown due to the limited information available on sea turtle acoustic thresholds and sound level exposure which may induce stress or behavioural changes (Nelms *et al.,* 2016; Popper *et al.,* 2014; Taormina *et al.,* 2018).

4.9.80 Salas *et al.* (2023) researched noise-induced TTS in an aquatic turtle with an assumed similar hearing range as leatherback turtle and concluded that the mean TTS onset was reached at 160 dB re 1 μPa^2 s SEL (note this value is not directly comparable to SPLs highlighted in other sections of this report, no SPLs were available from the study). Other studies investigating response to seismic surveys noted an avoidance reaction to impulsive sounds between 166-179 dB re 1µPa at 1 m, but TTS or PTS could not be determined from these studies (Moein *et al*., 1995; McCauley *et al*., 2000).

4.9.81 Behavioural changes have been observed in sea turtles as a result of approaching vessels (when audible or visible; Díaz *et al.,* 2024), indicating that turtles will swim away from vessels when they are detected.

4.9.82 Leatherback turtles are seasonal migrants to UK waters with a preference for more oceanic areas, during summer and autumn months. No breeding or nesting sites are found within OSPAR maritime regions. Leatherback turtles are observed in the OSPAR Region III MU in small numbers, either solo or in a pair (O'Donnell *et al.,* 2018; 2021)

4.9.83 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be highly temporary, with repair works anticipated to be of short duration. Furthermore, leatherback turtles are mobile and have a large distribution range within the OSPAR Region III MU.

4.9.84 Repair work would be highly localised to a specific area of the cable route. While animals may avoid the area while the repair takes place, they are expected to return once works are completed. The current level of shipping and ambient sound within the Celtic Sea is not expected to increase significantly from the presence of the Proposed Development vessels.

4.9.85 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Significance of effect

Harbour porpoise

4.9.86 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.9.87 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **medium**. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Bottlenose Dolphin

4.9.88 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.9.89 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.9.90 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Risso's Dolphin

4.9.91 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.9.92 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.9.93 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Common Dolphin

4.9.94 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.9.95 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.9.96 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Minke Whale

4.9.97 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.9.98 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.9.99 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Grey Seal

4.9.100 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.9.101 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.9.102 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Leatherback Turtle

4.9.103 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.9.104 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **negligible**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Further Mitigation

4.9.105 The significance of effect from disturbance to marine mammals and sea turtles from underwater noise as a result of activities during the operational phase is not significant in EIA terms. Therefore, no additional mitigation, beyond the embedded measures identified in **Table 4.17,** are considered necessary. No significant adverse residual effects have been predicted in respect of marine mammals or sea turtles.

Future Monitoring

4.9.106 The significance of effect from disturbance to marine mammals and sea turtles from underwater noise as a result of activities during the operational phase is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

Increased vessel disturbance

4.9.107 Increased vessel movement during the operational phase of the Proposed Development has the potential to result in a range of impacts on marine mammals and sea turtles. These include avoidance behaviour or displacement due to increased vessel presence, and in the case of marine mammals, masking of vocalisations or changes in vocalisation rate due to increased underwater noise.

4.9.108 A single survey vessel will conduct inspection surveys once a year during the first five years, and then approximately once every five years for the remainder of the operational life of the cables.

4.9.109 Repair works (cable cut, recovery, and burial activities) might also be required, which, adopting a precautionary approach is assumed to involve similar numbers of vessels as per the construction phase, albeit for a short period of time. This is very likely to be an overestimate, particularly as e.g. the number of guard vessels required would be much reduced.

4.9.110 Vessel movements during the operational phase of the Proposed Development has the potential to result in a range of impacts on marine mammal and sea turtle receptors. These include avoidance behaviour or displacement due to increased vessel presence, and in the case of marine mammals, masking of vocalisations or changes in vocalisation rate due to increased underwater noise.

4.9.111 The area surrounding the Proposed Development experiences a relatively high level of vessel traffic due to the presence of a number of ports and harbours in the region and their links to international shipping routes. Within the Shipping and Navigation Study Area (5 nm beyond the Offshore Cable Corridor), there was an average of approximately 89 vessels recorded per day, with approximately 72 vessels per day recorded crossing the Offshore Cable Corridor. The busiest day recorded 112 vessels. Cargo vessels made up the largest percentage of vessel traffic at 59%, followed by tankers at 25% and fishing vessels at 16%. (See Chapter 5: Shipping and Navigation of the PEIR for further information).

Sensitivity of receptor

Harbour porpoise

4.9.112 Harbour porpoise sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Bottlenose Dolphin

4.9.113 Bottlenose dolphin sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Risso's Dolphin

4.9.114 Risso's dolphin sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Common Dolphin

4.9.115 Common dolphin sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Minke Whale

4.9.116 Minke whale sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Grey Seal

4.9.117 Grey seal sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Leatherback Turtle

4.9.118 Leatherback turtle sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **negligible**.

Magnitude of impact

4.9.119 Vessels used in the operational phase of the Proposed Development, for maintenance activities have the potential to cause disturbance to marine mammals and sea turtles. The small number (approx. one vessel) and infrequent nature of operational phase inspection surveys is a negligible change relative to baseline vessel numbers. With respect to repair works (if necessary) a precautionary estimate of vessel number is adopted i.e. it is assumed that a similar number of vessels will be present as per the construction phase, albeit for a much reduced / shorter period of time. (This is very likely to be an overestimate, particularly as e.g. the number of guard vessels required would be much reduced compared to the main construction phase.)

4.9.120 Disturbance to marine mammals by vessels will be driven by a combination of underwater noise and the physical presence of vessels itself (Pirotta *et al.*, 2015). It is not simple to identify individual drivers of vessel disturbance, therefore, it is assessed in general terms, covering both disturbance from vessel presence and underwater noise.

4.9.121 The physical presence of vessels, not just noise, has the potential to disturb marine mammals, however few studies have identified vessel presence as a specific driver of disturbance (Pirotta *et al*., 2015). The impact of vessel noise, however, has been widely reported on.

4.9.122 Noise levels from maintenance vessels will result in an increase in non-impulsive, continuous sounds primarily from propellers, thrusters, cavitation and various rotating machinery (e.g. power generation, pumps) in the vicinity of the Proposed Development. The main drivers influencing the magnitude of potential impact with respect to noise disturbance from vessels are vessel type, speed and ambient noise levels (Wilson *et al.*, 2007). Disturbance from vessel noise is likely to occur only when vessel noise associated with the maintenance exceeds the background ambient noise level.

4.9.123 Due to differences in vessel design and maintenance, source levels can vary widely across various vessel classes. Vessel noise levels typically have a peak operating frequency range of between 20 and 4000 Hz for tug and CLVs. Studies on these types of vessels have reported SPL_{rms} of 172 and 188 dB re 1 µPa at 1m, respectively (Richardson *et al*., 1995; Wyatt, 2008). Slower transiting speeds reduces the source levels for most vessel classes (MacGillvary and de Jong, 2021). Transit speeds for CLVs are typically 10-12 knots but tend to transit at 6 knots during cable laying (Rapp, 2014). In general, support and supply vessels (typical range of vessel length from bow to stern: 50-100 m) are expected to have broadband source levels in the range 165-180 dB re 1µPa, with the majority of energy below 1 kHz (OSPAR, 2009). Large commercial vessels (typical vessel length of >100 m) produce relatively loud and predominately low frequency sounds, with the strongest energy concentrated below several hundred hertz (OSPAR, 2009).

4.9.124 The coastal areas and immediate surrounding waters of the Proposed Development already experience a relatively high amount of vessel traffic. Therefore, the increase in vessel activity as a result of maintenance activities during the operational phase is not considered a novel impact for marine mammals or sea turtles present in the area.

Harbour Porpoise

4.9.125 The reported distance between cetaceans and vessels from which behavioural responses are observed varies, with reports suggesting that harbour porpoise respond to both small (~2 kHz) and large (~0.25 kHz) vessels at approximately 400 m (Thomsen et al. (2006). In addition, a study on the impacts of construction-related activities at Beatrice and Moray East offshore windfarms showed that harbour porpoises are displaced by offshore windfarm construction vessels (Benhemma-Le Gall *et al*., 2021). Types of construction-related vessels that were assessed in this study included offshore service vessels for pile driving and jacket/turbine installation, guard vessels, crew-transfer vessels, and port service craft (Benhemma-Le Gall *et al*., 2021). The median construction-related vessel density across the Moray Firth during the study period was 1.4 vessels/km^2. PAM data from the site showed that the hourly occurrence of porpoise detections declined within 2 km of construction vessels, but that no response was observed out to 4 km, suggesting that responses declined within increasing distance to vessels (Benhemma-Le Gall *et al*., 2021).

4.9.126 Considering this, the area of disturbance from the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the harbour porpoise receptor is highly mobile and has a large distribution range within the Celtic and Irish Seas MU.

4.9.127 Furthermore, Heinänen and Skov (2015) suggested that harbour porpoise density was significantly lower in areas with vessel transit rates of greater than 20,000 vessels/year (80 per day within an area of 5 km^2). Comparatively, vessel traffic in the Study Area averages 89 vessels per day (see Volume 3, Chapter 5 Shipping and Navigation chapter).

4.9.128 Throughout the operational phase of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals and sea turtles.

4.9.129 While the presence of vessels in the area may cause displacement and/or changes in behaviour, harbour porpoise are likely to return to the area quickly and resume pre-disturbance behaviours.

4.9.130 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al*. (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that are likely to be disturbed (Findlay *et al.,* 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction decreased mean source levels by 18 dB (Findlay *et al*., 2023).

4.9.131 Therefore, the impact of disturbance to harbour porpoise from vessel activities is considered to result in a small proportion of the population affected, to occur highly infrequently throughout the operational phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.9.132 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Bottlenose Dolphin

4.9.133 Bottlenose dolphin response to different types of vessel traffic has been reported on in a number of studies, and behavioural effects have included disruption of socialisation and resting behaviours, changes in vocalisation patterns and reduced foraging activity (Koroza and Evans, 2022; Lusseau, 2003; Pellegrini *et al.,* 2021; Pirotta *et al.,* 2015).

4.9.134 Across the UK, there are marine and coastal wildlife watching codes which advises members of the public and tourism how best to act around marine life to limit disturbance (NatureScot, 2017; Wild Seas Wales, 2024). Private recreational vessels (e.g. speed boats, small motorboats and kayaks) are found to break these codes of conduct most often, introducing more pressure on marine wildlife through disturbance (Koroza and Evans, 2022). However, research on an increase of commercial vessels in response to the construction of an offshore wind farm found that bottlenose dolphin response to disturbance is not biologically significant (New *et al.,* 2013).

4.9.135 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the bottlenose dolphin receptor is highly mobile and has a large distribution range within the Offshore Channel MU and Celtic Sea and South West England MU.

4.9.136 Throughout the operational phase of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals and sea turtles.

4.9.137 While the presence of vessels in the area may cause displacement and/or changes in behaviour, bottlenose dolphins are likely to return to the area quickly and resume pre-disturbance behaviours.

4.9.138 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al*. (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise swath halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that are likely to be disturbed (Findlay *et al.,* 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB (Findlay *et al*., 2023).

4.9.139 Therefore, the impact of disturbance to bottlenose dolphin from vessel activities is considered to result in a small proportion of the population affected, to occur highly infrequently throughout the operational phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.9.140 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Risso's Dolphin

4.9.141 The reported distance between cetaceans and vessels from which behavioural responses are observed varies, however information on Risso's dolphin response distance to vessels is limited.

4.9.142 Nevertheless, the area of disturbance as a result of the project activities identified above is predicted to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the Risso's dolphin receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.9.143 Throughout the operational phase of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals and sea turtles.

4.9.144 While the presence of vessels in the area may cause displacement and/or changes in behaviour, Risso's dolphins are likely to return to the area quickly and resume pre-disturbance behaviours.

4.9.145 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al*. (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise swath halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that are likely to be disturbed (Findlay *et al*., 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB (Findlay *et al.,* 2023).

4.9.146 Therefore, the impact of disturbance to Risso's dolphin from vessel activities is considered to result in a small proportion of the population affected, occur highly infrequently throughout the operational phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.9.147 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Common Dolphin

4.9.148 The reported distance between cetaceans and vessels from which behavioural responses are observed varies, however information on common dolphin response distance to vessels is limited.

4.9.149 Nevertheless, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the common dolphin receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.9.150 Throughout the operational phase of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals and sea turtles.

4.9.151 While the presence of vessels in the area may cause displacement and/or changes in behaviour, common dolphins are likely to return to the area quickly and resume pre-disturbance behaviours.

4.9.152 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al*. (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise swath halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that are likely to be disturbed (Findlay *et al.,* 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB (Findlay *et al.,* 2023).

4.9.153 Therefore, the impact of disturbance to common dolphins from vessel activities is considered to result in a small proportion of the population affected, to occur highly infrequently throughout the operational phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.9.154 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Minke Whale

4.9.155 The reported distance between cetaceans and vessels from which behavioural responses are observed varies, however information on minke whale response distance to vessels is limited.

4.9.156 Nevertheless, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the minke whale receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.9.157 Throughout the operational phase of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals and sea turtles.

4.9.158 While the presence of vessels in the area may cause displacement and/or changes in behaviour, minke whales are likely to return to the area quickly and resume pre-disturbance behaviours.

4.9.159 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al.* (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise swath halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that are likely to be disturbed (Findlay *et al.,* 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels,

with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB (Findlay *et al*., 2023).

4.9.160 Therefore, the impact of disturbance to minke whale from vessel activities is considered to result in a small proportion of the population affected, to occur highly infrequently throughout the operational phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.9.161 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Grey Seal

4.9.162 The reported distance between seals and vessels from which behavioural responses are observed varies. This variation depends on whether individuals are hauled-out or at sea, the type of vessel, the vessel activity, and its speed and predictability of transit.

4.9.163 At haul-out sites, grey seals commonly enter the water and display alert behaviour when disturbed by boats and cruise ships approaching between 100 and 830 m (Andersen *et al*. 2012; Tripovich *et al*. 2012; Jansen *et al*. 2015). It is worth noting, that no haul-out sites are located within the study area.

4.9.164 There is limited information about the at-sea behavioural response of seals to non-impulsive noise sources such as shipping. Whilst at-sea, when exposed to shipping noise of 122 dB re 1 µPa (received SPL), telemetry studies indicate an increased descent rate of benthic and shallow dives in adult grey seals (Trigg, 2019). These quick descent dives are often a response to a stressor, which could impact the animal's fitness by increasing energy demands and reducing foraging opportunities if disturbance was persistent (Mikkelsen *et al*. 2019).

4.9.165 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, the grey seal receptor is highly mobile and has a large distribution range within the South West England SMU and Wales SMU.

4.9.166 Throughout the operational phase of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals and sea turtles.

4.9.167 While the presence of vessels in the area may cause displacement and/or changes in behaviour, grey seals are likely to return to the area quickly and resume pre-disturbance behaviours.

4.9.168 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay et al. (2023) which predicted that, when animals were exposed to vessels at a given distance with both a 20% and a 50% reduction in speed, all potential noise impacts were reduced. At a 20% reduction in speed, the vessel noise swath halved, reducing the average number of animals exposed by 50% and therefore reducing the number of animals that are likely to be disturbed (Findlay *et al.,* 2023). In addition, the study demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB (Findlay *et al*., 2023).

4.9.169 Therefore, the impact of disturbance to grey seal from vessel activities is considered to result in a small proportion of the population affected, to occur highly infrequently throughout the operational phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.9.170 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Leatherback Turtle

4.9.171 The reported distance between sea turtles and vessels from which behavioural responses are observed varies depending on the vessel speed and activity, the following two examples studied behavioural effects in response to airgun sound exposure, with Weir (2007) reporting evasive diving within 10 m of the vessel and DeRuiter and Doukara (2012) reporting behavioural change over 100 m from the vessel. Considering these varieties in behavioural changes to vessels and authors of the studies noting uncertainty if the response was due to auditory cue or the physical presence of the vessels themselves, it is uncertain how turtles would react to construction vessels offshore.

4.9.172 Considering this, the area of disturbance as a result of the project activities identified above is considered to be small given the anticipated local spatial range of impact. The impact would also be expected to be temporary. Furthermore, leatherback turtles are mobile and have a large distribution range within the OSPAR Region III MU.

4.9.173 Throughout the operational phase of the Proposed Development, the VMP will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of sea turtles.

4.9.174 While the presence of vessels in the area may cause displacement and/or changes in behaviour, leatherback turtles are likely to return to the area quickly and resume pre-disturbance behaviours.

4.9.175 The proposed implementation of a VMP will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause disturbance. This is supported by vessel simulation modelling by Findlay *et al.* (2023) which demonstrated that moderate slowdowns strongly reduce vessel source levels, with a 20% reduction in speed decreasing mean source levels by 6 dB and a 50% speed reduction will decrease mean source levels by 18 dB (Findlay *et al.,* 2023).

4.9.176 Therefore, the impact of disturbance to leatherback turtle from vessel activities is considered to result in a small proportion of the population affected, to occur highly infrequently throughout the operational phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

4.9.177 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible**.

Significance of effect

Harbour Porpoise

4.9.178 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects, from increased vessel disturbance are unlikely.

4.9.179 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Bottlenose Dolphin

4.9.180 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.9.181 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Risso's Dolphin

4.9.182 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the use of tourism and private vessels as a proxy in the absence of research against maintenance related traffic.

4.9.183 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.9.184 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Common Dolphin

4.9.185 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the use of tourism and private vessels as a proxy in the absence of research against maintenance related traffic.

4.9.186 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.9.187 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Minke Whale

4.9.188 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been

addressed through the use of tourism and private vessels as a proxy in the absence of research against maintenance related traffic.

4.9.189 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.9.190 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Grey Seal

4.9.191 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. The majority of research investigating grey seal behaviour to vessel disturbance focusses on behaviour at haul-out sites rather than the offshore environment. This uncertainty has been addressed through expert elicitation on knowledge of grey seal at-sea behaviour and scale of the Proposed Development.

4.9.192 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.9.193 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Leatherback Turtle

4.9.194 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the use of tourism and private vessels as a proxy in the absence of research against maintenance related traffic.

4.9.195 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.9.196 Overall, the magnitude of the impact is **negligible,** and the sensitivity of the receptor is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.

Further Mitigation

4.9.197 The significance of effect from disturbance to marine mammals and sea turtles from increased vessel disturbance during the operational phase is not significant in EIA terms. Therefore, no additional mitigation, beyond those embedded measures identified in **Table 4.17,** is considered necessary. No significant adverse residual effects have been predicted with respect of marine mammals or sea turtles.

Future Monitoring

4.9.198 The significance of effect from disturbance to marine mammals and sea turtles from increased vessel disturbance during the operational phase is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

Potential Changes to the Assessment as a Result of In-Combination Climate Impacts

4.9.199 The future marine mammal species' population trajectories are difficult to predict because monitoring at the appropriate temporal and spatial scales does not exist at present.

4.9.200 The potential impacts of anthropogenic-induced climate change on marine mammal populations are poorly understood, largely due to difficulties in obtaining sufficient evidence (Evans and Bjørge, 2013). In UK and Irish waters, the main potential impact is range shifts as species try to remain within preferred thermal habitats and/or in response to changes in prey abundance and distribution because of increasing sea temperatures (Simmonds and Elliott, 2008; MacLeod, 2009; Lambert *et al*., 2011). Marine mammal species most likely to be affected in the future are those that have relatively narrow habitat requirements, including shelf species such as harbour porpoise and minke whale. If a northward range shift were to occur, these species may experience increased pressure because of reduced available habitat (Evans and Bjørge, 2013).

4.9.201 There is no clear evidence that climate change has directly affected grey seal to date, although it is likely to be a key driver of seal population declines in the future (Evans and Bjørge, 2013). Resident grey seals at the Cornish Seal Sanctuary underwent an early moult in August 2023 (compared to December-April) suspectedly due to seasonal weather changes resulting from climate change (Cornish Seal Sanctuary, 2023).

4.9.202 In addition, sea level rise and increase in storm frequency and associated wave surges could result in changes to physical habitats. This could affect the availability of seal haul-out sites and breeding locations in caves or low-lying coasts which may be modified or lost as a result, in turn this could lead to increased pup mortality (Gazo *et al.,* 2000; Lea *et al*., 2009).

4.9.203 Susceptibility of marine mammal species to disease and contaminants could also be impacted because of climate change as it has the potential to increase pathogen development and survival rates, disease transmission, and host susceptibility (Harvell *et al*., 2002; Hoegh-Guldberg and Bruno, 2010). Higher temperatures may also stress species and increase their susceptibility to some diseases (Lafferty *et al*., 2004). This is supported by an increase in reports of diseases affecting marine organisms, including marine mammals, worldwide (Burek *et al*., 2008; Harvell *et al*., 2002; Lafferty *et al*., 2004; Van Bressem *et al*., 2009).

4.9.204 Sea turtle populations have shown reactions to warming sea temperatures since the 1980s. Temperature is an important factor in determining the sex of an individual, if the egg incubates above 29°C then the individual will become female and cooler temperatures produce males (Laloë *et al.,* 2017; Rivas *et al.,* 2019). This means that as temperatures rise, there will be more females in the population and although males can mate with more than one female during the breeding season, too few males could threaten population viability. Sea turtle eggs also

have a narrow range for nest survival rates, where eggs only develop successfully within a thermal range of 25-35°C. This means that if temperatures continue to rise, then more sea turtle nests will fail.

4.9.205 Increasing temperatures are also causing polar ice sheets and glaciers to melt more rapidly which results in rising sea levels. Studies have shown that rising sea levels have caused an increase in nest water content which has negatively influenced offspring survival (Martins *et al.,* 2022), particularly reducing the male hatchling production. Increases in sea levels also reduces the area of beach above the high tide line where nests are buried, this increases competition for nesting space.

4.9.206 Species responses to climate change are complex and sensitivities are likely exacerbated by anthropogenic pressures such as construction, pollution, and fishing (Poloczanska *et al*., 2016), which also influences the distribution and abundance of marine mammal populations.

4.9.207 Considering current information on climate change effects, it is difficult to predict at what timescale any of these additional climate change influences will take place. However, with the current proposed programme where pre-lay works begin in 2027, the current baseline characterisation is deemed fully relevant to the entire construction phase.

4.9.208 Furthermore, the impacts on marine mammals and sea turtles that may arise from climate change induced pressures will occur irrespective of the Proposed Development. Given the predicted scale of operational and decommissioning effects (as assessed against the current baseline), there is unlikely to be any change in the associated future significance (from minor or negligible) due to climate change.

4.9.209 All Proposed Development effects on marine mammals and sea turtles encompassing in-combination climate change influence will, therefore, be of negligible or minor adverse significance, which is not significant in EIA terms.

4.10 Preliminary Assessment of Decommissioning Effects

4.10.1 The impacts of the decommissioning phase of the Proposed Development have been assessed. The potential preliminary impacts arising from the decommissioning phase of the Proposed Development are listed in **Table 4.16,** along with the maximum design scenario against which each impact has been assessed.

4.10.2 Current best practice, and the least environmentally damaging option, is to de-energise the cable, disconnect it from the system, and secure it in place to be left *in-situ*, thereby avoiding unnecessary seabed disturbance.

4.10.3 However, other options may include the requirement for full or partial removal of the cables. The methods for removal, where the cable is buried, would be broadly similar to those used for installation with the potential for the cables to be removed by direct pulling, rather than de-burial. The requirement for any removal could also apply to other infrastructure installed as part of the project i.e. cable protection.

4.10.4 The potential impacts arising from the decommission phase of the Proposed Development will be subject to appropriate consenting requirements and EIA at the time.

4.10.5 A description of the potential effect on receptors caused by each identified potential impact is given below:

- Disturbance from anthropogenic noise; and
- Increased vessel disturbance.

Disturbance from anthropogenic noise

4.10.6 Similarly, to the construction phase, elevations in underwater noise as a result of cable removal activities have greatest potential for generating underwater noise and having an impact on marine mammals and sea turtles.

4.10.7 The operating frequencies of the different activities are described in section 4.8 and are summarised in Table 4.20.

4.10.8 This impact assessment will focus on behavioural disturbance as a result of underwater noise from decommissioning activities (non-impulsive noise sources).

Sensitivity of the Receptor

Harbour Porpoise

4.10.9 Harbour porpoise sensitivity to disturbance from anthropogenic noise is described in **section 4.8**.The sensitivity of the receptor is **medium**.

Bottlenose Dolphin

4.10.10 Bottlenose dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **low**.

Risso's Dolphin

4.10.11 Risso's dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **low**.

Common Dolphin

4.10.12 Common dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **low**.

Minke Whale

4.10.13 Minke whale sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **low**.

Grey Seal

4.10.14 Grey seal sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **low**.

Leatherback Turtle

4.10.15 Leatherback turtle sensitivity to disturbance from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **negligible.**

Magnitude of impact

4.10.16 Project activities that may occur during the decommissioning phase are expected to operate at frequencies within the hearing range of the marine mammal and sea turtle receptors are provided in Table 4.20.

4.10.17 As cable removal is a similar process to the construction phase activities relating to cable laying, the magnitude of impact is expected to be similar (worst case) to those assessed in the construction phase.

Harbour Porpoise

4.10.18 The magnitude of impact to harbour porpoise from anthropogenic noise is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Bottlenose Dolphin

4.10.19 The magnitude of impact to bottlenose dolphin from anthropogenic noise is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Risso's Dolphin

4.10.20 The magnitude of impact to Risso's dolphin from anthropogenic noise is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Common Dolphin

4.10.21 The magnitude of impact to common dolphin from anthropogenic noise is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Minke Whale

4.10.22 The magnitude of impact to minke whale from anthropogenic noise is described in **section 4.8**. The sensitivity of the receptor is **low**.

Grey Seal

4.10.23 The magnitude of impact to grey seal from anthropogenic noise is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Leatherback Turtle

4.10.24 The magnitude of impact to leatherback turtle from anthropogenic noise is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Significance of the Effect

Harbour porpoise

4.10.25 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.10.26 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **medium**. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Bottlenose Dolphin

4.10.27 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.10.28 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.10.29 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Risso's Dolphin

4.10.30 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.10.31 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.10.32 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Common Dolphin

4.10.33 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.10.34 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.10.35 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Minke Whale

4.10.36 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.10.37 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.10.38 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Grey Seal

4.10.39 The uncertainty in the level of significance has been addressed through the adoption of precautionary behavioural thresholds.

4.10.40 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.10.41 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Leatherback Turtle

4.10.42 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from anthropogenic noise are unlikely.

4.10.43 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **negligible**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Further Mitigation

4.10.44 The significance of effect from disturbance to marine mammals and sea turtles from underwater noise as a result of decommissioning activities is not significant in EIA terms. Therefore, no additional mitigation to the already embedded measures (**Table 4.17**) are considered necessary. No significant adverse residual effects have been predicted in respect of marine mammals or sea turtles.

Future Monitoring

4.10.45 The significance of effect from disturbance to marine mammals and sea turtles from underwater noise as a result of decommissioning activities is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

Increased vessel disturbance

4.10.46 Increased vessel movement during the decommissioning phase of the Proposed Development has the potential to result in a range of impacts on marine mammals and sea turtles. These include avoidance behaviour or displacement due to

increased vessel presence, and in the case of marine mammals, masking of vocalisations or changes in vocalisation rate due to increased underwater noise.

4.10.47 The area surrounding the Proposed Development experiences a relatively high level of vessel traffic due to the presence of a number of ports and harbours in the region and their links to international shipping routes. Within the Shipping and Navigation Study Area (5 nm greater than the Offshore Cable Corridor), there was an average of approximately 89 vessels recorded per day, with approximately 72 vessels per day recorded crossing the Offshore Cable Corridor. The busiest day recorded 112 vessels. Cargo vessels made up the largest percentage of vessel traffic at 59%, followed by tankers at 25% and fishing vessels at 16% (See Volume 3, Chapter 5: Shipping and Navigation, of the PEIR, for further information).

Sensitivity of receptor

Harbour porpoise

4.10.48 Harbour porpoise sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Bottlenose Dolphin

4.10.49 Bottlenose dolphin sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Risso's Dolphin

4.10.50 Risso's dolphin sensitivity to increased vessel disturbance is described in **section 4.8.** The sensitivity of the receptor is **low**.

Common Dolphin

4.10.51 Common dolphin sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Minke Whale

4.10.52 Minke whale sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Grey Seal

4.10.53 Grey seal sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Leatherback Turtle

4.10.54 Leatherback turtle sensitivity to increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **negligible**.

Magnitude of impact

4.10.55 During the decommissioning phase, for assessment purposes it is assumed that the same number and type of vessels is present as during the construction phase.

4.10.56 As cable removal is a similar process to construction activities the magnitude of impact is expected to be similar (worst case) to those assessed in the construction phase.

Harbour Porpoise

4.10.57 The magnitude of impact to harbour porpoise from increased vessel disturbance is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Bottlenose Dolphin

4.10.58 The magnitude of impact to bottlenose dolphin from increased vessel disturbance is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Risso's Dolphin

4.10.59 The magnitude of impact to Risso's dolphin from increased vessel disturbance is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Common Dolphin

4.10.60 The magnitude of impact to common dolphin from increased vessel disturbance is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Minke Whale

4.10.61 The magnitude of impact to minke whale from increased vessel disturbance is described in **section 4.8**. The sensitivity of the receptor is **low**.

Grey Seal

4.10.62 The magnitude of impact to grey seal from increased vessel disturbance is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low**.

Leatherback Turtle

4.10.63 The magnitude of impact to leatherback turtle from increased vessel disturbance is described in **section 4.8**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible**.

Significance of effect

Harbour Porpoise

4.10.64 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects, from increased vessel disturbance are unlikely.

4.10.65 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible or minor** adverse significance, which is not significant in EIA terms.

Bottlenose Dolphin

4.10.66 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects, from increased vessel disturbance are unlikely.

4.10.67 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible or minor** adverse significance, which is not significant in EIA terms.

Risso's Dolphin

4.10.68 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the use of tourism and private vessels as a proxy in the absence of research against maintenance related traffic.

4.10.69 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.10.70 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Common Dolphin

4.10.71 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the use of tourism and private vessels as a proxy in the absence of research against maintenance related traffic.

4.10.72 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.10.73 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Minke Whale

4.10.74 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been

addressed through the use of tourism and private vessels as a proxy in the absence of research against maintenance related traffic.

4.10.75 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.10.76 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Grey Seal

4.10.77 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. The majority of research investigating grey seal behaviour to vessel disturbance focusses on behaviour at haul-out sites rather than the offshore environment. This uncertainty has been addressed through expert elicitation on knowledge of grey seal at-sea behaviour and scale of the Proposed Development.

4.10.78 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.10.79 Overall, the magnitude of the impact is **low,** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

Leatherback Turtle

4.10.80 For the reasons discussed at sensitivity of the receptor above, there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the use of tourism and private vessels as a proxy in the absence of research against maintenance related traffic.

4.10.81 Although behavioural responses may occur, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from increased vessel disturbance are unlikely.

4.10.82 Overall, the magnitude of the impact is **negligible,** and the sensitivity of the receptor is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.

Further Mitigation

4.10.83 The significance of effect from disturbance to marine mammals and sea turtles from increased vessel disturbance during the decommissioning phase is not significant in EIA terms. Therefore, no additional mitigation, beyond those embedded measures identified in **Table 4.17,** is considered necessary. No significant adverse residual effects have been predicted with respect of marine mammals or sea turtles.

Future Monitoring

4.10.84 The significance of effect from disturbance to marine mammals and sea turtles from increased vessel disturbance during the decommissioning phase is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

4.11 Cumulative Effects Assessment

4.11.1 The Cumulative Effects Assessment (CEA) takes into account the impact associated with the Proposed Development together with other projects and plans. The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see Volume 1, Appendix 5.3: CEA screening matrix, of the PEIR). Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

4.11.2 The marine mammal and sea turtle CEA methodology has followed the methodology set out in Volume 1, Chapter 5: EIA Methodology of the PEIR. As part of the assessment, all projects and plans considered alongside the Proposed Development have been allocated into 'tiers' reflecting their current stage within the planning and development process.

- Tier 1
  - Under construction
  - Permitted application
  - Submitted application
  - Those currently operational that were not operational when baseline data were collected, and/or those that are operational but have an ongoing impact
- Tier 2
  - Scoping report has been submitted
- Tier 3
  - Scoping report has not been submitted
  - Identified in the relevant Development Plan
  - Identified in other plans and programmes.

4.11.3 This tiered approach is adopted to provide a clear assessment of the Proposed Development alongside other projects, plans and activities.

4.11.4 The specific projects, plans and activities scoped into the CEA, are outlined in **Table 4.26**.

Table 4.26: List of cumulative developments considered within the CEA

Project	Status	Distance from Proposed Development (nearest point, km)	Description	Dates of Construction (if available)	Dates of Operation (if available)	Overlap with the Proposed Development?
Tier 1						
Celtic Interconnector	Permitted	0 – Crosses offshore cable corridor	700 MW high-voltage direct current submarine power cable under construction between the southern coast of Ireland and the north-west coast of France. The UK elements of the Celtic Interconnector comprise: • A submarine cable within the UK EEZ approximately 211 km in length placed on or beneath the seabed. It passes approximately 30km west of the Isles of Scilly and approximately 75 km west of Land's End, but does not enter UK Territorial Waters. • Secondary rock protection using rock placement (if required), where target depth of cable lowering is not fully achieved or at cable crossings, with a linear extent of between 0 km and 80 km or 0 to 270 tonnes. • A fibre optic link shall be laid along the cable route for operational control, communication and telemetry purposes.	2024	2027	Not within construction phase but will overlap during operational phase

Project	Status	Distance from Proposed Development (nearest point, km)	Description	Dates of Construction (if available)	Dates of Operation (if available)	Overlap with the Proposed Development?
			It is programmed that installation phase of the offshore route will commence in 2024, for it to become fully operational by 2027.			
White Cross Offshore Windfarm	Permitted	7.8 (with potential overlap with the indicative route corridor for the White Cross export cable)	Proposed offshore windfarm located in the Celtic Sea with a capacity of up to 100 MW. The Windfarm Site is located over 52 km off the North Cornwall and North Devon coast (west-north-west of Hartland Point), in a water depth of 60m – 80m. The Windfarm Site covers 50 km^2. The current wind turbine design envelope for the project is a WTG capacity of 12-24 MW, 6-8 three bladed horizontal axis turbines with a rotor diameter of 220-300 m. Construction is anticipated to commence in mid-2024 with the site anticipated to be operational by 2026.	2024	2026	Not within construction phase but will overlap during operational phase
Aqua Botanika Nearshore seaweed cultivation of native species	Pending	27.4	This is to be a kelp farm on ropes similar to successful kelp farms in Scotland, Northen Ireland, Britany, Faroe Islands, Norway and New England that all follow the same basic principles of buoys anchored to the seabed or to blocks in roughly 50-meter frequencies, main ropes connecting the buoys in each direction creating a grid. Growing ropes are then connected to main ropes to run parallel at 10-metre centres. Proposal is for multiple	2024	2025	Not within construction phase but will overlap during operational phase

Project	Status	Distance from Proposed Development (nearest point, km)	Description	Dates of Construction (if available)	Dates of Operation (if available)	Overlap with the Proposed Development?
			bays which equate to an area of 100 hectares. Aim to install the seeded lines, seabed anchors, buoys etc during the autumn of 2024 in order to grow the first crop during the winter and harvest in spring 2025.			
The TwinHub Floating Offshore Wind Demonstration Project	Under construction	29.5	Wave Hub Limited is seeking consent to construct and deploy two semisubmersible platforms with two turbines each in order to generate up to 32MW power from renewable floating offshore wind energy. The site already consists of existing cables and onshore infrastructure which was originally granted consent in 2007. No further work to existing infrastructure is anticipated. Assembly is planned to be completed and both platforms will be sequentially floated to site to the anchors and mooring lines during Q4 2024. Commissioning will take place during Q1 2025 with a commercial operation date in Q2 2025.	2024	2025	Not within construction phase but will overlap during operational phase
Tier 2						
No known proposed development is at this stage within the planning and development process in relation to cumulative impacts for marine mammal and sea turtle receptors.						
Tier 3						

Project	Status	Distance from Proposed Development (nearest point, km)	Description	Dates of Construction (if available)	Dates of Operation (if available)	Overlap with the Proposed Development?
Project Development Area (PDA) 3	Future planned development	0 – Crosses offshore cable corridor	PDA 3 sits within English Governance and is one of three suitable PDAs identified within the Celtic Sea for floating offshore wind development, each of which having a potential capacity of up to 1.5 GW. Currently in the early stages of the project, the schedule for PDA 3 is unknown, however pre-consent metocean surveys are planned for early 2024 and geotechnical investigations are planned for summer 2024.	Unknown	Unknown	Unknown at this stage
PDA 2	Future planned development	20.1	Project Development Area (PDA) 2 sits within Welsh and English Governance and is one of three suitable PDAs identified within the Celtic Sea for floating offshore wind development, each of which having a potential capacity of up to 1.5 GW. Currently in the early stages of the project, the schedule for PDA 2 is unknown, however, pre-consent metocean surveys are planned for early 2024 and geotechnical investigations are planned for summer 2024.	Unknown	Unknown	Unknown at this stage

4.11.5 The projects considered in the cumulative assessment are those activities which have not been included in the baseline environment for marine mammals and sea turtles, and where there was the potential for impacts to arise during the construction, operation and maintenance, or decommissioning phase of the Project. These projects include:

- Offshore energy developments;
- Cables and pipelines; and
- Marine aggregates.

4.11.6 At the time of writing this PEIR, no military, aviation, or coastal development projects within the ZoI were identified. Marine aggregate and dredging projects have been screened in for the impact of potential changes in the fish and shellfish community but screened out as a potential direct impact on marine mammals and sea turtles as direct effects are considered likely to be localised.

4.11.7 It should be noted that the CEA presented in this marine mammal and sea turtle chapter has been undertaken based on publicly available information presented in the Environmental Statements for the other projects. In undertaking the CEA for the Proposed Development, it is important to consider that it is less certain if projects and plans in Tier 3, which are not yet consented, may contribute to cumulative impacts with the Proposed Development. This is because some projects may not achieve approval or may not be built due to other factors (e.g. client withdrawal). The projects categorised under Tier 3 could not provide sufficient information to allow a robust assessment of the impacts on marine mammals and sea turtles; therefore, all Tier 3 projects have been scoped out of this assessment. No projects were identified under Tier 2 to be assessed within this CEA. Therefore, only projects identified under Tier 1 are included in this CEA.

4.11.8 A description of the significance of cumulative effects upon marine mammal and sea turtle receptors arising from construction and operation is given below.

Construction

Tier 1 Projects

4.11.9 All the projects listed under Tier 1 have an estimated construction programme starting in 2024 (**Table 4.27**:). There should therefore be no projects with overlapping construction periods in which case the risk of impact on marine mammal and sea turtle receptors is not higher than described in **section 4.8** and summarised below.

4.11.10 Marine mammals are considered to be of low vulnerability, to have high recoverability with respect to increased vessel disturbance, and medium potential for recovery with respect to disturbance from anthropogenic noise, and very high conservation value. The sensitivity of the receptor is therefore, considered to be medium.

4.11.11 Sea turtles are deemed to be of low vulnerability, high adaptability, reasonable tolerance, and high recoverability to increased vessel disturbance and disturbance from anthropogenic noise. The sensitivity of the receptor is therefore, considered to be negligible.

Table 4.27: Projected timelines of construction of CEA projects, and potential for overlap with the Proposed Development (up to and incl. 2028)

Tier	Project	2024				2025				2026				2027				2028			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Proposed Development																				
1	Celtic Interconnector																				
1	White Cross Offshore Windfarm																				
1	Aqua Botanika Nearshore seaweed cultivation																				
1	The TwinHub Floating Offshore Wind Demonstration Project																				

Table notes: Proposed development construction phase from 2028 onwards, with potential pre-lay works in late 2027 (light blue); red outline denotes construction period of the Proposed Development.

Operation and Maintenance

Tier 1 Projects

4.11.12 All Tier 1 projects highlighted in **Table 4.27**: (operational phase) will overlap with the Proposed Development's construction and operation phases. Due to the distance of the Tier 1 projects to the PEIR boundary, only the Celtic Interconnector project and White Cross export cable falls within the marine mammal and sea turtle ZoI and has potential for directly impacting marine mammal and sea turtle receptors. However, as the relevant Works for these projects relate to cabling the operational phase will likely involve similar aspects to the Proposed Development, such as inspection surveys (e.g. once a year for first five years, and then approximately every five years for the remainder of the operational life of the cables) and maintenance and repair (required in the event of a failure).

4.11.13 It is difficult to quantify the level of increased disturbance to marine mammal and sea turtle receptors resulting from increased vessel activity on a cumulative basis given the large temporal and spatial variation in vessel movements between projects and regions, coupled with the spatial and temporal variation in receptor movements across the region. Vessel routes to and from offshore windfarms and other projects will use existing vessel routes for pre-existing vessel traffic which marine mammals will be accustomed to. They may also have become habituated

to the volume of regular vessel movements and therefore the additional risk is confined predominantly to construction sites. Vessel movements within construction areas for both offshore windfarms and interconnector cables are likely to be limited and relatively slow, resulting in less risk to marine mammal and sea turtle receptors. In addition, most projects are likely to adopt vessel management plans in order to minimise any potential effects on marine mammals and sea turtles. Therefore, increases in disturbance from vessels from offshore energy projects are likely to be small and within the bounds of current shipping variability (insignificant in number compared to the baseline).

4.11.14 For all marine mammal and sea turtle receptors, the cumulative impact of increased disturbance from vessels is predicted to be of local spatial extent, intermittent (vessel activity will not be constant) and disturbance effects are expected to be temporary. Therefore, the magnitude of cumulative vessel disturbance is considered to be minor, indicating that the potential is for short-term and/or intermittent behavioural effects, with survival and reproductive rates very unlikely to be impacted to the extent that the population trajectory would be altered. It is anticipated that any animals displaced from the area will return when vessel disturbance has ended.

4.11.15 All other Tier 1 projects have been included for potential indirect impacts on prey species. Volume 3, Chapter 2: Fish and Shellfish Ecology of the PEIR notes that this area is important for various marine mammal prey species, such as mackerel (*Scomber scombrus*), herring (*Clupea harengus*) and sprat (*Sprattus sprattus*). Operation and maintenance activities associated with cable burial and offshore windfarms may have temporary displacement impacts on fish species (as assessed in relevant EIA reports). As potential impacts are assumed to be temporary and short-term within small spatial scales in comparison to receptor species wide ranging nature, the magnitude of cumulative displacement effects is considered to be minor.

Decommissioning

Tier 1 Projects

4.11.16 At the current stage of development, there is limited information on the various project's decommissioning programmes. However, it is anticipated that in general the decommissioning impacts would be similar in nature to those of construction but with a lower magnitude of effect. In addition, it is not confirmed at this time, if the Proposed Development will be decommissioned and cables removed, or decommissioned and cables left *in-situ.*

4.11.17 Offshore Development Plans are typically developed prior to decommissioning and follow the latest guidance, legislation, and technologies available at the time of preparation. There are two methods of decommissioning available for cable burial projects:

- De-energising the cable, disconnecting the cable and leaving the cable *in-situ*;
  - This method is currently considered as best practice as it has the least seabed disturbance; or
- Full or partial removal of cables;
  - Methods for removal are broadly similar to methods used for installation, but the cable and cable protection would be pulled onto a vessel and brought ashore to an appropriate waste treatment facility.

4.11.18 The cumulative impact of increased vessel disturbance has been assessed as minor for all receptors. The sensitivity of all marine mammal and sea turtle receptors to increased vessel disturbance is considered to be low.

4.12 Transboundary Effects

4.12.1 Transboundary effects are defined as those effects upon the receiving environment of other European Economic Area (EEA) states, whether occurring from the Proposed Development alone, or cumulatively with other projects in the wider area. The offshore elements of the Proposed Development (the Offshore Cable Corridor) extend to the edge of the UK EEZ, however the UK project forms just one section of the overall Morocco-UK cable route. The Applicant will seek separate consents for the works within other jurisdictions, with the intention that installation works (construction phase works) would be undertaken in a continuous fashion across jurisdiction boundaries.

4.12.2 A transboundary screening exercise was undertaken at Scoping (Appendix A of the Scoping Report), which identified that there was the potential for direct and indirect transboundary effects to occur in relation to marine mammals and sea turtles. Marine mammal and sea turtle receptors were therefore subject to transboundary assessment in the EIA. Transboundary screening is summarised below.

4.12.3 Direct impacts (on transboundary marine mammal and sea turtle receptors) may occur due to underwater noise generated during installation (construction phase), and due to an increase in vessel movements during construction, operation and decommissioning leading to increased disturbance risk to marine mammals. An indirect impact has also been identified due to changes in the availability of prey resources which could arise from transboundary impacts on fish and shellfish receptors.

4.12.4 Following JNCC (2020) guidance, a precautionary ZoI of 5 km has been assessed from the Proposed Development activities. Note that, the EDR distances account for the main impact range of an activity, but they do not account for all deterrence or disturbance in the associated area nor represent the limit at which effects may be detected.

4.12.5 The distance of the Proposed Development from the jurisdictional boundary of the nearest other states are as follows: France (0 km); Ireland (54 km); Guernsey (269 km); Jersey (299 km); and Spain (320 km). Underwater noise and vibration has been identified as an impact pathway for marine mammal and sea turtle receptors. Therefore, the Proposed Development's ZoI will directly overlap with Mers Celtiques Talus du golfe de Gascogne European protected site within French waters.

4.12.6 There is also potential for transboundary impacts on marine mammals due to the mobile nature of marine mammal species and the geographical scale of MUs, particularly where these extend beyond the limits of UK waters. For example, there are extreme examples of grey seals travelling large distances of up to 1,200 km, having been recorded crossing the English Channel moving from France to haul-out sites in the south west of the British Isles (Vincent *et al*., 2017).

4.12.7 There is a potential for transboundary impacts on sea turtles due to their highly mobile nature. Leatherback turtles travel large distances during seasonal migrations and have been recorded throughout the English Channel and wider European waters (Botterell *et al*., 2020).

4.12.8 Any transboundary impacts that do occur as a result of the Proposed Development are predicted to be short-term and intermittent, with the recovery of marine mammal populations to baseline levels following the completion of the work. Therefore, it is predicted to result in transboundary effects of minor or negligible adverse significance.

4.13 Inter-related Effects

4.13.1 Inter-relationships are the impacts and associated effects of different aspects of the Proposed Development on the same receptor. These are as follows:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the Proposed Development (construction, operation and maintenance), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three phases (e.g., construction noise effects from cable laying and operational and maintenance geophysical surveys).
- Receptor led effects: Assessment of the scope for all effects (including inter-relationships between environmental topics) to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on marine mammals and sea turtles, such as disturbance from anthropogenic activities (e.g. dredging or rock dumping) or increased vessel presence, may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects may be short-term, temporary or transient effects, or incorporate longer term effects.

4.13.2 A description of the likely interactive effects arising from the Proposed Development on OMU is provided in Volume 4, Chapter 5: Inter-related effects of the PEIR.

4.14 Summary of Impacts, Mitigation Measures and Monitoring

4.14.1 Information on marine mammals and sea turtles within the species specific broad-scale study areas was collected through desktop review. A subsequent assessment of potential effects on marine mammal and sea turtle receptors was carried out, giving consideration to potential impacts as a result of activities undertaken during the construction, operational and maintenance, and decommissioning phases of the Proposed Development.

4.14.2 **Table 4.28** presents a summary of the impacts, measures adopted as part of the Proposed Development and residual effects in respect to marine mammals and sea turtles. The impacts assessed were:

- Disturbance from underwater noise (e.g. cable laying, dredging, rock-dumping); and
- Disturbance from increased vessel presence.

4.14.3 Overall, it is concluded that there will be no significant effects arising from the construction, operation (and maintenance), or the decommissioning phases of the Proposed Development.

4.14.4 **Table 4.29** presents a summary of the potential cumulative impacts, mitigation measures and residual effects. The cumulative impacts assessed were:

- Disturbance from underwater noise (e.g. cable laying, dredging, rock-dumping); and
- Disturbance from increased vessel presence.

4.14.5 Overall, it is concluded that there will be no significant cumulative effects from the Proposed Development alongside other projects/plans.

4.14.6 Transboundary impacts on marine mammals and sea turtles have been identified in regard to effects of the Proposed Development:

- Disturbance from underwater noise (e.g. cable laying, dredging, rock-dumping); and
- Disturbance from increased vessel presence.

4.14.7 Overall, it is concluded that there will be no significant effects associated with Transboundary impacts on marine mammals and sea turtles.

Table 4.28: Summary of potential environmental effects

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Construction phase							
Harbour porpoise	Medium	Disturbance from anthropogenic noise	Short term	Low	Minor Adverse	Not significant	
Bottlenose dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	
Risso's dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	
Common dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	
Minke whale	Low	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	
Grey seal	Low	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	
Leatherback turtle	Negligible	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	

Harbour porpoise	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Bottlenose dolphin	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Risso's dolphin	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Common dolphin	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Minke whale	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Grey seal	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Leatherback turtle	Negligible	Increased vessel disturbance	Short term	Negligible	Negligible Adverse	Not significant	
Operational phase							
Harbour porpoise	Medium	Disturbance from anthropogenic noise	Short term	Low	Minor Adverse	Not significant	
Bottlenose dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	
Risso's dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	
Common dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	
Minke whale	Low	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	

Grey seal	Low	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	
Leatherback turtle	Negligible	Disturbance from anthropogenic noise	Short term	Low	Negligible or Minor Adverse	Not significant	
Harbour porpoise	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Bottlenose dolphin	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Risso's dolphin	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Common dolphin	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Minke whale	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Grey seal	Low	Increased vessel disturbance	Short term	Low	Negligible or Minor Adverse	Not significant	
Leatherback turtle	Negligible	Increased vessel disturbance	Short term	Negligible	Negligible Adverse	Not significant	

Table 4.29: Summary of potential cumulative environmental effects

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Construction phase							
Harbour porpoise	Medium	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Bottlenose dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Risso's dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Common dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Minke whale	Low	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Grey seal	Low	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Leatherback turtle	Negligible	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Harbour porpoise	Medium	Increased vessel disturbance	Short term	Low	Low	Not significant	

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Bottlenose dolphin	Low	Increased vessel disturbance	Short term	Low	Low	Not significant	
Risso's dolphin	Low	Increased vessel disturbance	Short term	Low	Low	Not significant	
Common dolphin	Low	Increased vessel disturbance	Short term	Low	Low	Not significant	
Minke whale	Low	Increased vessel disturbance	Short term	Low	Low	Not significant	
Grey seal	Low	Increased vessel disturbance	Short term	Low	Low	Not significant	
Leatherback turtle	Negligible	Increased vessel disturbance	Short term	Low	Low	Not significant	
Operational phase							
Harbour porpoise	Medium	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Bottlenose dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Risso's dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Common dolphin	Low	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Minke whale	Low	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Grey seal	Low	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Leatherback turtle	Negligible	Disturbance from anthropogenic noise	Short term	Low	Low	Not significant	
Harbour porpoise	Medium	Increased vessel disturbance	Short term	Low	Low	Not significant	
Bottlenose dolphin	Low	Increased vessel disturbance	Short term	Low	Low	Not significant	
Risso's dolphin	Low	Increased vessel disturbance	Short term	Low	Low	Not significant	
Common dolphin	Low	Increased vessel disturbance	Short term	Low	Low	Not significant	
Minke whale	Low	Increased vessel disturbance	Short term	Low	Low	Not significant	
Grey seal	Low	Increased vessel disturbance	Short term	Low	Low	Not significant	
Leatherback turtle	Negligible	Increased vessel disturbance	Short term	Low	Low	Not significant	

4.15 Next Steps

4.15.1 The impact assessment is based on criteria to assess the magnitude and sensitivity of marine mammals and sea turtles. These criteria may be refined for the ES.

4.15.2 A desk-based review is deemed sufficient to enable characterisation of the baseline and to allow a robust assessment of the potential impacts on marine mammals and sea turtles. No further environmental investigations (e.g. site-specific surveys) are considered to be required for incorporation into the ES.

4.15.3 Statutory and non-statutory consultations and ongoing engagement with relevant stakeholders will inform the marine mammal and sea turtle assessment presented within the ES.

4.15.4 Following the scoping opinion responses, the following impacts on marine mammal and sea turtle receptors will be assessed in the ES:

- the effect of the removal of hard substrate (where required) in the decommissioning phase – vessel interaction and risk of collision
- PTS and TTS (pending further consultations with NE and JNCC)
- EMF impacts on sea turtles only

4.16 References

Aarts, G., Brasseur, S. and Kirkwood, R. (2018), 'Behavioural response of grey seals to pile-driving', (Wageningen: Wageningen Marine Research).

Andersen, S., Teilmann, J., Dietz, R., Schmidt, N., and Miller, L. (2012) Behavioural responses of harbour seals to human-induced disturbances. Aquatic Conservation: Marine and Freshwater Ecosystems, 22 (1), 113–121.

Anderwald, P., Brandecker, A., Coleman, M., Collins, C., Denniston, H., Haberlin, M. D., O'Donovan, M., Pinfield, R., Visser, F. and Walshe, L. (2013), 'Displacement responses of a mysticete, an odontocete, and a phocid seal to construction-related vessel traffic', Endangered Species Research, 21.

Baines, M.E., and Evans, P.G.H. (2012), 'Atlas of the marine mammals of Wales', (Countryside Council for Wales).

Basran, C. J., Woelfing, B., Neumann, C. and Rasmussen, M. H. (2020), 'Behavioural Responses of Humpback Whales (Megaptera novaeangliae) to Two Acoustic Deterrent Devices in a Northern Feeding Ground off Iceland', Aquatic mammals, 46/6.

BEIS (2022), UK Offshore Energy Strategic Environmental Assessment. OESEA4 Environmental Report. D

Bejder, L., Samuels, A.M.Y., Whitehead, H.A.L., Gales, N., Mann, J., Connor, R., Heithaus, M., Watson-Capps, J.A.N.A., Flaherty, C. and Krützen, M. (2006). Decline in relative abundance of bottlenose dolphins exposed to long-term disturbance. *Conservation Biology*, *20*(6), pp.1791-1798.

Bellomo, S., Cipriano, G., Santacesaria, F.C., Fanizza, C., Crugliano, R., Pollazzon, V., Ricci, P., Maglietta, R. and Carlucci, R. (2021), October. Impact of cetacean watching vessels on Risso's dolphins behaviour in the Gulf of Taranto: Preliminary information to regulate dolphin watching. In *2021 International Workshop on Metrology for the Sea; Learning to Measure Sea Health Parameters (MetroSea)* (pp. 111-115). IEEE.

Benhemma-Le Gall, A., Graham, I. M., Merchant, N. D. and Thompson, P. M. (2021), 'Broad-Scale Responses of Harbor Porpoises to Pile-Driving and Vessel Activities During Offshore Windfarm Construction', Frontiers in Marine Science, 8.

BEER, and DEFRA. (2008). Review of cabling techniques and environmental effects applicable to the offshore wind farm industry. This report was prepared by consultants from Royal Haskoning and BOMEL Ltd

Booth, C. G., Heinis, F. and Harwood, J. (2019), 'Updating the Interim PcoD Model: Workshop Report – New transfer functions for the effects of disturbance on vital rates in marine mammal species'.

Botterell, Z. L. R., Penrose, R., Witt, M. J., and Godley, B. J. (2020), 'Long-term insights into marine turtle sightings, strandings and captures around the UK and Ireland (1910-2018)', Journal of the Marine Biological Association of the United Kingdom, 100/6: 869–877.

Brandt, M. J., Dragon, A. C., Diederichs, A., Bellmann, M. A., Wahl, V., Piper, W., Nabe-Nielsen, J. and Nehls, G. (2018), 'Disturbance of harbour porpoises during construction of the first seven offshore wind farms in Germany', Marine Ecology Progress Series, 596: 213-232.

Brandt, M. J., Diederichs, A., Betke, K. and Nehls, G. (2011), 'Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea', Marine Ecology Progress Series, 421: 205-216.

Britton, J. (2012) The Impact of Boat Disturbance on the Grey Seal, (*Halichoerus grypus*) around the Isle of Man. M.Sc. Thesis submitted to Bangor University.

Burek, K. A., Gulland, F. M. and O'Hara, T. M. (2008), 'Effects of climate change on Arctic marine mammal health', Ecological Applications, 18/2: 126-134.

Carter, M. I., Boehme, L., Duck, C. D., Grecian, J., Hastie, G. D., McConnell, B. J., Miller, D.L., Morris, C., Moss, S., Thompson, D., Thompson, P. and Russell, D. J. (2020), 'Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles: Report to BEIS', OESEA-16-76, OESEA-17-78 (Sea Mammal Research Unit: University of St. Andrews).

Carter, M. I., Boehme, L., Cronin, M. A., Duck, C. D., Grecian, W. J., Hastie, G. D.,

Jessopp, M., Matthiopoulos, J., McConnell, B. J., Miller, D. L. and Morris, C. D. (2022),

'Sympatric seals, satellite tracking and protected areas: habitat-based distribution

estimates for conservation and management', Frontiers in Marine Science.

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2. Chartered Institute of Ecology and Environmental Management, Winchester.

Channel Energy Ltd. (2013b), 'Atlantic Array Offshore Wind Farm: Environmental Statement Volume 1: Offshore Chapter 9: Marine Mammals', Document Reference 6.1.9.

Christiansen, F., Rasmussen, M., and Lusseau, D. (2013)' 'Whale watching disrupts feeding activities of minke whales on a feeding ground', Marine Ecology Progress Series 478: 239.

Christiansen, F., Bertulli, C. G., Rasmussen, M. H. and Lusseau, D. (2015), 'Estimating cumulative exposure of wildlife to non-lethal disturbance using spatially explicit capture–recapture models', The Journal of Wildlife Management, 79: 311-324.

Constantine, R., Brunton, D.H. and Dennis, T. (2004). Dolphin-watching tour boats change bottlenose dolphin (Tursiops truncatus) behaviour. *Biological conservation*, *117*(3), pp.299-307.

Copping, A. (2018). The State of Knowledge for Environmental Effects Driving Consenting/Permitting for the Marine Renewable Energy Industry. Ocean Energy Systems.

Cornish Seal Sanctuary. (2023). Confused Cornish seals give up on wash-out summer and start prepping for winter. Version & Available: https://sealsanctuary.sealifetrust.org/en/about-us/sanctuary-news/confused-cornish-seals-give-up-on-wash-out-summer-amid-changing-weather/

Corr, S., Dudley, R., Brereton, T., Clear, N., Crosby, A., Duncan, S., Evans, P.G.H., Jones,D., Sayer, S., Taylor, T., Tregenza, N., Williams, R., Witt, M.J. and Ingram, S.N. (2023),'Using citizen science data to assess the vulnerability of bottlenose dolphins to humanimpacts along England's South Coast'. Animal Conservation

Culloch, R. M., Anderwald, P., Brandecker, A., Haberlin, D., McGovern, B., Pinfield, R., Visser, F., Jessopp, M., and Cronin, M. (2016), 'Effect of construction-related activities and vessel traffic on marine mammals', Marine Ecology Progress Series, 549: 231-242.

Diederichs, A., G. Nehls, and M. J. Brandt. 2010. Does sand extraction near Sylt affect harbour porpoises? Wadden Sea Ecosystem No. 26 edition. Common Wadden Sea Secretariat, Wilhelmshaven, Germany.

De Boer, M.N. and Simmonds, M.P. (2003), 'WDCS/Greenpeace Survey Report Small cetaceans along the coasts of Wales and Southwest England'.

Department for Energy Security & Net Zero (2023a) Overarching National Policy Statement for Energy (NPS EN-1). Available at: https://assets.publishing.service.gov.uk/media/65bbfbdc709fe1000f637052/overarching-nps-for-energy-en1.pdf (Accessed: February 2024).

Department for Energy Security & Net Zero (2023b) National Policy Statement for Renewable Energy Infrastructure (NPS EN-3). Available at: https://assets.publishing.service.gov.uk/media/65a7889996a5ec000d731aba/nps-renewable-energy-infrastructure-en3.pdf (Accessed: February 2024).

Department for Energy Security & Net Zero (2023c) National Policy Statements for Electricity Networks Infrastructure (NPS EN-5). Available at: https://assets.publishing.service.gov.uk/media/65a78a5496a5ec000d731abb/nps-electricity-networks-infrastructure-en5.pdf (Accessed: February 2024).

Department for Levelling Up, Housing and Communities (2023) National Planning Policy Framework. Available at: https://www.gov.uk/guidance/national-planning-policy-framework (Accessed: February 2024).

Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government (2021) Planning Practice Guidance. https://www.gov.uk/government/collections/planning-practice-guidance

DeRuiter, S.L. and Doukara, K.L., 2012. Loggerhead turtles dive in response to airgun sound exposure. *Endangered Species Research*, *16*(1), pp.55-63.

Díaz, M.P., Kunc, H.P. and Houghton, J.D.R. (2024). Anthropogenic noise predicts sea turtle behavioural responses. Marine Pollution Bulletin, 198.

Dow Piniak W. E., Eckert, S. A., Harms, C. A. and Stringer, E. M. (2012), 'Underwater hearing sensitivity of the leatherback sea turtle (Dermochelys coriacea): Assessing the potential effect of anthropogenic noise'. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. OCS Study BOEM 2012-01156. 35pp.

Duarte, C.M., Chapuis, L., Collin, S.P., Costa, D.P., Devassy, R.P., Eguiluz, V.M., Erbe, C., Gordon, T.A., Halpern, B.S., Harding, H.R. and Havlik, M.N. (2021). The soundscape of the Anthropocene ocean. *Science*, *371*(6529), p.eaba4658.

Dunlop, R. A., Noad, M. J., McCauley, R. D., Scott-Hayward, L., Kniest, E., Slade, R., Paton, D. and Cato, D. H. (2017), 'Determining the behavioural dose–response relationship of marine mammals to air gun noise and source proximity', Journal of Experimental Biology, 220/16: 2878-2886.

Dunlop, R. A. (2016), 'The effect of vessel noise on humpback whale, Megaptera novaeangliae, communication behaviour', Animal Behaviour, 111: 13-21.

Dyndo, M., Wiśniewska, D.M., Rojano-Doñate, L. and Madsen, P.T. (2015). Harbour porpoises react to low levels of high frequency vessel noise. *Scientific reports*, *5*(1), p.11083.

Erbe, C. and Thomas, J. A. (2022), 'Exploring Animal Behavior Through Sound: Volume 1'

Erbe, C., Reichmuth, C., Cunningham, K., Lucke, K. and Dooling, R. (2016), 'Communication masking in marine mammals: A review and research strategy', Marine pollution bulletin, 103/1-2: 15-38.

Evans, P. G. and Bjørge, A. (2013), 'Impacts of climate change on marine mammals', MCCIP Science Review 2013: 134-148.

Evans, P. G. H. and Waggitt, J. J. (2023), 'Modelled Distributions and Abundance of Cetaceans and Seabirds of Wales and Surrounding Waters'. NRW Evidence Report, Report No: 646, 354 pp. Natural Resources Wales, Bangor.

Feng, C., Shapiro, G. I., Bennett, K. A., Ingram, S. N., Thompson, D., Vincent, C., Russell D. J. F., Embling, C. B. (2017), 'Shipping noise in a dynamic sea: a case study of grey seals in the Celtic Sea'. Mar Pollut Bull. 15;114(1):372-383.

Fernandez-Betelu, O., Graham, I. M., Brookes, K. L., Cheney, B. J., Barton, T. R. and Thompson, P. M. (2021), 'Far-Field Effects of Impulsive Noise on Coastal Bottlenose Dolphins', Frontiers in Marine Science, 8.

Findlay, C.R., Rojano-Doñate, L., Tougaard, J., Johnson, M.P. and Madsen, P.T. (2023). Small reductions in cargo vessel speed substantially reduce noise impacts to marine mammals. *Science Advances*, *9*(25), p.eadf2987.

Gazo, M., Aparicio, F., Cedenilla, M. A., Layna, J. F. and González, L. M. (2000), 'Pup survival in the Mediterranean monk seal (*Monachus monachus*) colony at Cabo Blanco Peninsula (Western Sahara-Mauritania), Marine Mammal Science, 16: 158-168.

Genesis. (2011). Review and Assessment of Underwater Sound Produced from Oil and Gas Sound Activities and Potential Reporting Requirements under the Marine Strategy Framework Directive. Report for the Department of Energy and Climate Change.

Gilles, A., Authier, M., Ramirez-Martinez, N. C., Araújo, H., Blanchard, A., Carlström, J., Eira, C., Dorémus, G., Fernández-Maldonado, C., Geelhoed, S. C. V., Kyhn, L., Laran, S., Nachtsheim, D., Panigada, S., Pigeault, R., Sequeira, M., Sveegaard, S., Taylor, N. L., Owen, K., Saavedra, C., Vázquez-Bonales, J.A., Unger, B., and Hammond, P. S. (2023). Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys. Final report published 29 September 2023. 64 pp

Graham, I. M., Merchant, N. D., Farcas, A., Barton, T. R., Cheney, B., Bono, S. and Thompson, P. M. (2019), 'Harbour porpoise responses to pile-driving diminish over time', Royal Society Open Science, 6/6: 190335.

Greenlink (2019) Greenlink Marine Environmental Impact Assessment Report – Ireland.

Gregory, P.R. and Rowden, A.A. (2001), 'Behaviour patterns of bottlenose dolphins (Tursiops truncatus) relative to tidal state, time-of-day, and boat traffic in Cardigan Bay, West Wales'. Aquatic Mammals, 27(2): 105-113.

Hague, E. L., Sinclair, R. R., and Sparling, C. E. (2020), 'Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters'. Scottish Marine and Freshwater Science Vol 11 No 12.

Heinänen, S. and Skov, H. (2015). The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area. JNCC Report No. 544, JNCC Peterborough.

Highways England, Transport Scotland, Welsh Government, Department for Infrastructure (2020) Design Manual for Roads and Bridges (DMRB) LA 104, Environmental assessment and monitoring, Revision 1, Available at: https://www.standardsforhighways.co.uk/prod/attachments/0f6e0b6a-d08e-4673-8691-cab564d4a60a?inline=true

Hammond, P. S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M. B., Scheidat, M, Teilmann, J., Vingada, J. and Øien, N. (2021), 'Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys'.

Harvell, C. D., Mitchell, C. E., Ward, J. R., Altizer, S., Dobson, A. P., Ostfeld, R. S. and Samuel, M. D. (2002), 'Climate warming and disease risks for terrestrial and marine biota', Science, 296/5576: 2158-2162.

Heiler, J., Elwen, S. H., Kriesell, H. J. and Gridley, T. (2016), 'Changes in bottlenose dolphin whistle parameters related to vessel presence, surface behaviour and group composition', Animal behaviour, 117: 167-177.

HM Government (2011) UK Marine Policy Statement. Available at: https://assets.publishing.service.gov.uk/media/5a795700ed915d042206795b/pb3654-marine-policy-statement-110316.pdf

Hoegh-Guldberg, O. and Bruno, J. F. (2010), 'The impact of climate change on the world's marine ecosystems', Science, 328/5985:1523-1528.

Holtz, B., Stewart, K.R. and Piniak, W.E., 2021. Influence of environmental and anthropogenic acoustic cues in sea-finding of hatchling leatherback (Dermochelys coriacea) sea turtles. *Plos one*, *16*(7), p.e0253770.

Houghton, J. D. R., Doyle, T. K., Wilson, M. W., Davenport, J., & Hays, G. C (2006), 'Jellyfish aggregations and leatherback turtle foraging patterns in a temperate coastal environment'. Ecology, 87/8: 1967–1972.

IAMMWG. (2023). Review of Management Unit boundaries for cetaceans in UK waters (2023). JNCC Report 734, JNCC, Peterborough, ISSN 0963-8091.

IEMA (2016) Environmental Impact Assessment. Guide to Delivering Quality Development. Available: https://www.iema.net/download-document/7014. Accessed: February 2024.

ISO 18406 (2017). Underwater acoustics—Measurement of radiated underwater sound from percussive pile driving. Version & Available: https://www.iso.org/standard/62407.html

Jansen, J. K., Brady, G. M., Ver Hoef, J. M., Boveng, P. L., Suydam, R., and Clark, C. (2015) Spatially Estimating Disturbance of Harbor Seals (Phoca vitulina). PLoS One, 10 (7), e0129798.

JNCC, Natural England and Countryside Council for Wales. (2010) The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area. Available: https://assets.publishing.service.gov.uk/media/5dea1d35e5274a06dee23a34/Draft_Guidance_on_the_Protection_of_Marine_European_Protected_Species_from_Injurt_and_Disturbance.pdf Accessed: February 2024

JNCC. (2019a), 'Conservation status assessment for the species: S1351 Harbour porpoise (*Phocoena phocoena*)', (European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018: United Kingdom).

JNCC. (2019b), 'Conservation status assessment for the species: S1350 Common dolphin (*Delphinus delphis*)', (European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018: United Kingdom).

JNCC. (2019c), 'Conservation status assessment for the species: S1349 Bottlenose dolphin (Tursiops truncatus)', (European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United

Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018: United Kingdom).

JNCC. (2019d), 'Conservation status assessment for the species: S2030 Risso's dolphin (Grampus griseus)', (European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018: United Kingdom).

JNCC. (2019e), 'Conservation status assessment for the species: S2618 Minke whale (Balaenoptera acutorostrata)', (European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018: United Kingdom).

JNCC. (2019f), 'Conservation status assessment for the species: S1364 Grey seal (Halichoerus grypus)', (European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018: United Kingdom).

JNCC. (2019g), 'Conservation status assessment for the species: S1223 Leatherback turtle (Dermochelys coriacea)', (European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018: United Kingdom).

JNCC (2020) Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (England, Wales & Northern Ireland). JNCC Report No. 654, JNCC, Peterborough, ISSN 0963-8091.

JNCC. (2020), 'MPA Mapper'. Available at: https://jncc.gov.uk/mpa-mapper/. [Accessed February 2024].

Jones, E., Hastie, G., Smout, S., Onoufriou, J., Merchant, N. D., Brookes, K. and Thompson, D. (2017), 'Seals and shipping: quantifying population risk and individual exposure to vessel noise', Journal of Applied Ecology 54: 1930-1940

Juretzek, C., Schmidt, B. and Boethling, M. (2021). Turning scientific knowledge into regulation: Effective measures for noise mitigation of pile driving. *J. Mar. Sci. Eng.* 9(8) pp819.

Kavanagh, A. S., Nykänen, M., Hunt, W., Richardson, N. and Jessopp, M. J. (2019), 'Seismic surveys reduce cetacean sightings across a large marine ecosystem', Scientific reports, 9/1.

Koroza, A., and Evans, P. G. H. (2022), 'Bottlenose Dolphin Responses to Boat Traffic Affected by Boat Characteristics and Degree of Compliance to Code of Conduct'. Sustainability, 14(9), 5185.

Lacey, C., Gilles, A., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M., Teilmann, J., Sveegaard, S., Vingada, J., Viquerat, S., Øien, N. and Hammond, P. (2022), 'Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys'.

Lafferty, K. D., Porter, J. W. and Ford, S. E. (2004), 'Are Diseases Increasing in the Ocean?', Annual Review of Ecology, Evolution, and Systematics, 35: 31-54.

4.16.1 Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S., and Podesta, M. (2001) Collisions between ships and whales. Marine Mammal Science, 17: 3-75.

Laloë, J.O., Cozens, J., Renom, B., Taxonera, A. and Hays, G.C. (2017). Climate change and temperature-linked hatchling mortality at a globally important sea turtle nesting site. *Global change biology*, *23*(11), pp.4922-4931.

La Manna, G., Manghi, M., Pavan, G., Lo Mascolo, F. and Sarà, G. (2013). Behavioural strategy of common bottlenose dolphins (Tursiops truncatus) in response to different kinds of boats in the waters of Lampedusa Island (Italy). *Aquatic Conservation: Marine and Freshwater Ecosystems*, *23*(5), pp.745-757.

Lambert, E., MacLeod, C.D., Hall, K., Brereton, T., Dunn, T.E., Wall, D., Jepson, P.D., Deaville, R. and Pierce, G.J. (2011). Quantifying likely cetacean range shifts in response to global climatic change: implications for conservation strategies in a changing world. *Endangered Species Research*, *15*(3), pp.205-222.

Lea, M.-A., Johnson, D., Ream, R., Sterling, J., Melin, S, and Gelatt, T. (2009), 'Extreme weather events influence dispersal of naive northern fur seals', Biology Letters, 5: 252-257.

Lusseau, D. (2002), 'Effects of Tour Boats on the Behavior of Bottlenose Dolphins: Using Markov Chains to Model Anthropogenic Impacts'. Conservation Biology, 17(6):1785 – 1793.

Lusseau, D. (2003). Male and female bottlenose dolphins Tursiops spp. have different strategies to avoid interactions with tour boats in Doubtful Sound, New Zealand. *Marine Ecology Progress Series*, *257*, pp.267-274.

Lusseau, D. and Higham, J.E.S. (2004). Managing the impacts of dolphin-based tourism through the definition of critical habitats: the case of bottlenose dolphins (Tursiops spp.) in Doubtful Sound, New Zealand. *Tourism Management*, *25*(6), pp.657-667.

Lusseau, D. and Bejder, L. (2007). The long-term consequences of short-term responses to disturbance experiences from whale watching impact assessment. *International Journal of Comparative Psychology*, *20*(2).

MacGillivray, A. and de Jong, C. (2021). A reference spectrum model for estimating source levels of marine shipping based on Automated Identification System data. *Journal of Marine Science and Engineering*, *9*(4), p.369.

MacLeod, C. D. (2009), 'Global climate change, range changes and potential implications for the conservation of marine cetaceans: a review and synthesis', Endangered Species Research, 7/2: 125-136.

Marley, S., Kent, C. S. and Erbe, C. (2017), 'Occupancy of bottlenose dolphins (Tursiops aduncus) in relation to vessel traffic, dredging, and environmental variables within a highly urbanised estuary', Hydrobiologia, 792: 243-263.

Martin, R.A., da Silva, C.R., Moore, M.P. and Diamond, S.E. (2023). When will a changing climate outpace adaptive evolution?. *Wiley Interdisciplinary Reviews: Climate Change*, *14*(6), p.e852.

Meissner, A. M., Christiansen, F., Martinez, E., Pawley, M. D. M., Orams, M. B., and Stockin, K. A. (2015), 'Behavioural Effects of Tourism on Oceanic Common Dolphins, Delphinus sp., in New Zealand: The Effects of Markov Analysis Variations and Current Tour Operator Compliance with Regulations'. PLoS ONE 10(1): e0116962.

McConnel, B.J., Fedak, M. A., Lovell, P. and Hammond, P.S. (1999). Movements and foraging areas of grey seals in the North Sea. Journal of Applied Ecology, 36:573-590.

McQueen, A. D., Suedek, B. C., de Jong, C., Thomsen, F. (2020) Ecological Risk Assessment of underwater sound from dredging operations. Integrated Environmental Assessment and Management 16:481-493.

McGarry, T., Boisseau, O., Stephenson, S. and Compton, R. (2017), 'Understanding the Effectiveness of Acoustic Deterrent Devices (ADDs) on Minke Whale (Balaenoptera acutorostrata), a Low Frequency Cetacean', Report for the Offshore Renewables Joint Industry Programme (ORJIP) Project 4, Phase 2. Prepared on behalf of the Carbon Trust.

Merchant, N. D.,Brookes, K.L., Faulkner, R.C., Bicknell, A.W.J., Godley, B.J. and Witt, M.J. (2016). Underwater Noise Levels in UK waters. Nature Scientific Reports 6, 36942

Mikkelsen, L., Johnson, M., Wisniewska, D. M., Neer, A. van, Siebert, U., Madsen, P. T., and Teilmann, J. (2019) Long term sound and movement recording tags to study natural behavior and reaction to ship noise of seals. Ecology and Evolution, 9 (5), 2588–2601.

MMO (2021) South West Inshore and South West Offshore Marine Plan, June 2021. Available at: https://assets.publishing.service.gov.uk/media/60f6f71ce90e0764cfc22a78/FINAL_South_West_Marine_Plan__1_.pdf

Morel, C., Gimard, A., Alloncle, N., Quintela, A., Lloret, A., Alves, F. L., Gomez, B. M., Buceta, J. L., Giret, O., Maarques, M., Plaza, M., Silva, A., and Sousa, L. (2020). Annex 1 to Initial Assessment: Marine Environment. EU Project Grant No.: EASME/EMFF/2015/1.2.1.3/03/SI2.742089. Supporting Implementation of Maritime Spatial Planning in the European Northern Atlantic (SIMNORAT). 171 pp.

Morell, M., IJsseldijk, L.L., Berends, A.J., Gröne, A., Siebert, U., Raverty, S.A., Shadwick, R.E. and Kik, M.J. (2021). Evidence of hearing loss and unrelated toxoplasmosis in a free-ranging harbour porpoise (Phocoena phocoena). *Animals*, *11*(11), p.3058.

Nabe-Nielsen, J., Van Beest, F., Grimm, V., Sibly, R., Teilmann, J. & Thompson, P. M. 2018. Predicting the impacts of anthropogenic disturbances on marine populations. Conservation Letters, e12563.

Natural England and JNCC (2022). Nature conservation considerations and environmental best practice for subsea cables for English inshore and UK offshore waters.

NatureScot (formerly Scottish Natural Heritage). (2017). The Scottish Marine Wildlife Watching Code.

Nelms, S.E., Piniak, W.E., Weir, C.R. and Godley, B.J. (2016). Seismic surveys and marine turtles: An underestimated global threat?. *Biological conservation*, *193*, pp.49-65.

Neumann, D. R., Orams, M. B. (2006), 'Impacts of ecotourism on short-beaked common dolphins (*Delphinus delphis*) in Mercury Bay, New Zealand'. Aquatic Mammals 32: 1–9.

New, L. F., Harwood, J., Thomas, L., Donovan, C., Clark, J. S., Hastie, G., Thompson, P. M., Cheney, B., Scott-Hayward, L. and Lusseau, D. (2013), 'Modelling the biological significance of behavioural change in coastal bottlenose dolphins in response to disturbance', Functional Ecology, 27/2: 314-322.

NMFS. (2018) "Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts." National Marine Fisheries Service (NOAA).

North Devon Biosphere (2024). North Devon Marine Nature Recovery Plan 2022 – 2027. Available: https://www.northdevonbiosphere.org.uk/uploads/1/5/4/4/15448192/revised_north_devon_marine_natre_recovery_plan.pdf

Nowacek, D. P., Thorne, L. H., Johnston, D. W. and Tyack, P. L. (2007), 'Responses of cetaceans to anthropogenic noise', Mammal Review, 37/2: 81-115.

Nowacek, S.M., Wells, R.S. and Solow, A.R. (2001). Short-term effects of boat traffic on bottlenose dolphins, Tursiops truncatus, in Sarasota Bay, Florida. *Marine Mammal Science*, *17*(4), pp.673-688.

Oakley, J. A., Jenkins, R. E., Thomas, T., Williams, A. T., and Phillips, M. R. (2016), 'Assessing harbour porpoise populations in south-west Wales, data issues and implications for conservation and management', Ocean & Coastal Management, 119: 45-57.

O'Donnell, C., O'Malley, M., Lynch, D., Mullins, E., Keogh, N., Power, J., Long, A., and Croot, P. (2018). Western European Shelf Pelagic Acoustic Survey (WESPAS) 10 June – 24 July, 2018. FEAS Survey Series: 2018/03. Marine Institute.

O'Donnell, C., O'Malley, M., Mullins, E., Connaughton, P., Keogh, N., Judge, J. and Croot, P. (2021). Western European Shelf Pelagic Acoustic Survey (WESPAS), 09 June – 20 July, 2021. FEAS Survey Series: 2021/03. Marine Institute, Galway, Ireland.

ORCA. (2023), 'The State of Cetaceans 2023'.

OSPAR. (2009), 'Overview of the impacts of anthropogenic underwater sound in the marine environment'. Report 441:2009.

OSPAR. (2022). Status Assessment 2022 - Leatherback turtle. Available: https://oap.ospar.org/en/ospar-assessments/committee-assessments/biodiversity-committee/status-assesments/leatherback-turtle/ Accessed: February 2024.

Papale, E., Gamba, M., Perez-Gil, M., Martin, V. M. and Giacoma, C. (2015), 'Dolphins adjust species-specific frequency parameters to compensate for increasing background noise', PLoS One, 10/4.

Pasanisi, E., Chimienti, M., Blasi, M.F., Maffucci, F. and Hochscheid, S. (2022). Ocean highways in the Western Mediterranean: Which are the areas with increased exposure to maritime traffic for loggerhead turtles?. *Frontiers in Marine Science*, *9*, p.1734.

Paxton, C., L. Scott-Hayward, M. Mackenzie, E. Rexstad, and L. Thomas. (2016), 'Revised Phase III Data Analysis of Joint Cetacean Protocol Data Resources'.

Pellegrini, A., Romeu, B., Ingram, S. N., and Daura-Jorge. (2021), 'Boat disturbance affects the acoustic behaviour of dolphins engaged in a rare foraging cooperation with fishers'. Anim. Conserv, 24: 613-625.

Penrose, R. S. and Westfield, M. J. B. (2023), 'British & Irish Marine Turtle Strandings & Sightings Annual Report 2020'. Ceredigion.

Pine, M. K., Schmitt, P., Culloch, R. M., Lieber, L. and Kregting, L. T. (2019), 'Providing ecological context to anthropogenic subsea noise: Assessing listening space reductions of marine mammals from tidal energy devices', Renewable and Sustainable Energy Reviews, 103: 49-57.

Pirotta, E., Merchant, N. D., Thompson, P. M., Barton, T. R. and Lusseau, D. (2015), 'Quantifying the effect of boat disturbance on bottlenose dolphin foraging activity', Biological Conservation, 181: 82-89.

Pirotta, E., Brookes, K. L., Graham, I. M. and Thompson, P. M. (2014), 'Variation in harbour porpoise activity in response to seismic survey noise', Biology letters, 10/5: 20131090.

Pirotta, E., Laesser, B.E., Hardaker, A., Riddoch, N., Marcoux, M. and Lusseau, D. (2013) Dredging displaces bottlenose dolphins from an urbanised foraging patch, Marine Pollution Bulletin, 74:396-402

Pirotta, E., Milor, R., Quick, N., Moretti, D., Di Marzio, N., Tyack, P., Boyd, I. and Hastie, G. (2012), 'Vessel noise affects beaked whale behavior: results of a dedicated acoustic response study'. PloS ONE, 7/8: e42535.

Pomeroy, P. P., Fedak, M. A., Rothery, P. and Anderson, S. (1999), 'Consequences of maternal size for reproductive expenditure and pupping success of grey seals at North Rona, Scotland', Journal of Animal Ecology, 68/2: 235-253.

Poloczanska, E.S., Burrows, M.T., Brown, C.J., García Molinos, J., Halpern, B.S., Hoegh-Guldberg, O., Kappel, C.V., Moore, P.J., Richardson, A.J., Schoeman, D.S. and Sydeman, W.J. (2016). Responses of marine organisms to climate change across oceans. *Frontiers in Marine Science*, p.62.

Popper, A.N., Hawkins, A.D, Fay, R.R, Mann, D.A., Bartol, S., Carlson, T.J. and Coombs, S. (2014) ASA S3/SC1.4 TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report Prepared by ANSI-Accredited Standards Committee S3/SC1 and Registered with ANSI. Springer.

Rapp, R.J. (2014). Cable laying and repair – cable ship operations. TE SubCom. Version & Available: http://www.sargassoseacommission.org/storage/documents/Cable_Installation_and_Maintenance_-_TE_SubCom_Sargasso_Sea_Final1.pdf

Reichmuth, C., Sills, J. M., Mulsow, J. and Ghoul, A. (2019), 'Long-term evidence of noise-induced permanent threshold shift in a harbor seal (Phoca vitulina)', The Journal of the Acoustical Society of America, 146/4: 2552-2561.

Reid, J.B., Evans, P.G.H. & Northridge, S.P. (2003), 'Atlas of Cetacean distribution in north-west European waters'. JNCC, Peterborough, ISBN 1 86107 550 2.

Richardson, W.J., Greene Jr., C.R., Malme, C.I. and Thompson, D.H. (1995). Marine mammals and Noise. New York: Academic Press. 576 pp.

Rivas, M.L., Esteban, N. and Marco, A. (2019). Potential male leatherback hatchlings exhibit higher fitness which might balance sea turtle sex ratios in the face of climate change. *Climatic Change*, *156*, pp.1-14.

Roberts, L., Collier, S., Law, S. and Gaion, A. (2019). The impact of marine vessels on the presence and behaviour of harbour porpoise (*Phocoena phocoena*) in the waters off Berry Head, Brixham (South West England). *Ocean & Coastal Management*, *179*, p.104860.

Rojano-Doñate, L., McDonald, B. I., Wisniewska, D. M., Johnson, M., Teilmann, J., Wahlberg, M., Højer-Kristensen, J. and Madsen, P. T. (2018), 'High field metabolic rates of wild harbour porpoises', Journal of Experimental Biology, 221/23: jeb185827.

Russell, D. J. F., Jones, E. L. and Morris, C. D. (2017). Updated Seal Usage Maps: Estimated at-sea Distribution of Grey and Harbour Seals. Scottish Marine and Freshwater Science Vol 8 No 25. pp. 25. DOI: 10.7489/2029-1

Sea Link (2023). Preliminary Environmental Information Report, Volume:1 Part 4 Offshore Scheme, Chapter 5 Marine Mammals. National Grid.

Schaffeld, T., Ruser, A., Woelfing, B., Baltzer, J., Kristensen, J. H., Larsson, J., Schnitzler, J. G. and Siebert, U. (2019), 'The use of seal scarers as a protective mitigation measure can induce hearing impairment in harbour porpoises', The Journal of the Acoustical Society of America, 146/6: 4288-4298.

Schoeman, R.P., Patterson-Abrolat, C. and Plön, S. (2020). A global review of vessel collisions with marine animals. *Frontiers in Marine Science*, *7*, p.292.

SCOS. (2021), 'Scientific Advice on Matters Related to the Management of Seal Populations: 2020'.

SCOS (2022), 'Scientific Advice on Matters Related to the Management of Seal Populations: 2021'.

SCOS (2023), 'Scientific Advice on Matters Related to the Management of Seal Populations: 2022'.

Sea Watch Foundation. (2024). Recent sightings: South-west England and South Wales. Available at: https://www.seawatchfoundation.org.uk/recentsightings/. [Accessed February 2024)].

Seaquest Southwest (2022), 'Seaquest Southwest Annual Report 2022'. Available at: https://www.cornwallwildlifetrust.org.uk/sites/default/files/2023-06/Seaquest%20report%202022%20final.pdf

Simmonds, M. P. and Eliott, W. J. (2008), 'Climate change and cetaceans: concerns and recent developments', Journal of the Marine biological Association of the United Kingdom, 89/1: 203-210.

Sinclair, R.R.; Kazer, S.; Ryder, M.; New, P. & Verfuss, U.K. (2023). Review and recommendations on assessment of noise disturbance for marine mammals. NRW Evidence Report No. 529, 143pp, Natural Resources Wales, Bangor.

Sivle, L. D., Kvadsheim, P. H., Curé, C., Isojunno, S., Wensveen, P. J., Lam, F. P. A., Visser, F., Kleivanec, L., Tyack, P. L., Harris, C. M. and Miller, P. J. (2015), 'Severity of expert-identified behavioural responses of Humpback Whale, Minke Whale, and Northern Bottlenose Whale to naval sonar', Aquatic Mammals, 41/4: 469-502.

Smout, S., Rindorf, A., Hammond, P. S., Harwood, J. and Matthiopoulos, J. (2014), 'Modelling prey consumption and switching by UK grey seals', ICES Journal of Marine Science, 71/1: 81-89.

Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. J. Greene, D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. (2007). Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals 33:411-414.

Southall, B., Calambokidis, J., Tyack, P., Moretti, D., Hildebrand, J., Kyburg, C., Carlson, R., Friedlaender, A., Falcone, E., Schorr, G. and Douglas, A. (2011), 'Biological and Behavioral Response Studies of Marine Mammals in Southern California, 2010 (" SOCAL-10")', Project Report. https://apps.dtic.mil/sti/pdfs/ADA538910.pdf [Accessed: December 2023].

Southall, Brandon L., James J. Finneran, Colleen Reichmuth, Paul E. Nachtigall, Darlene R. Ketten, Ann E. Bowles, William T. Ellison, Douglas P. Nowacek, and Peter L. Tyack (2019) "Marine mammal noise exposure criteria: Updated scientific recommendations for residual hearing effects." Aquatic Mammals 45, no. 2 (2019): 125-232.

Southall, B.L., Nowacek, D.P., Bowles, A.E., Senigaglia, V., Bejder, L. and Tyack, P.L. (2021). Marine mammal noise exposure criteria: assessing the severity of marine mammal behavioral responses to human noise. *Aquatic Mammals*, *47*(5), pp.421-464.

Southall, B. L., Schusterman, R. J., Kastak, D. (2000), 'Masking in three pinnipeds: Underwater, low-frequency critical ratios'. J. Acoust. Soc. Am. 1 September 2000; 108 (3): 1322–1326.

Stansbury, A.L., Götz, T., Deecke, V.B. and Janik, V.M. (2015). Grey seals use anthropogenic signals from acoustic tags to locate fish: evidence from a simulated foraging task. *Proceedings of the Royal Society B: Biological Sciences*, *282*(1798), p.20141595.

Stockin, K. A., Lusseau, D., Binedell, V., Wiseman, N., and Orams, M. B. (2008), 'Tourism affects the behavioural budget of the common dolphin Delphinus sp. in the Hauraki Gulf, New Zealand'. MEPS 355:287-295.

Stone, C., Hall, K., Mendes, S. and Tasker, M. (2017), 'The effects of seismic operations in UK waters: analysis of Marine Mammal Observer data', The Journal of Cetacean Research and Management, 16/1: 71-85.

Taormina, B., Bald, J., Want, A., Thouzeau, G., Lejart, M., Desroy, N. and Carlier, A. (2018). A review of potential impacts of submarine power cables on the marine environment: Knowledge gaps, recommendations and future directions. *Renewable and Sustainable Energy Reviews*, *96*, pp.380-391.

The Planning Inspectorate (2017) Advice Note Ten, Habitat Regulations Assessment relevant to Nationally Significant Infrastructure Projects. Version 8. Available: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-ten/. Accessed April 2022.

Thomsen, F., Lüdemann, K., Kafemann, R. and Piper, W. (2006), 'Effects of offshore wind farm noise on marine mammals and fish', Biola, Hamburg, Germany on behalf of COWRIE Ltd, 62.

Todd, V. L., I. B. Todd, J. C. Gardiner, E. C. Morrin, N. A. MacPherson, N. A. DiMarzio, and F. Thomsen. (2015). A review of impacts of marine dredging activities on marine mammals. ICES Journal of Marine Science: Journal du Conseil 72:328-340.

Torridge District Council. (2018). North Devon and Torridge Local Plan 2011—2031

Tougaard, J., Wright, A.J. and Madsen, P.T. (2015). Cetacean noise criteria revisited in the light of proposed exposure limits for harbour porpoises. *Marine pollution bulletin*, *90*(1-2), pp.196-208.

Tougaard, J. (2021). Thresholds for noise induced hearing loss in marine mammals. *J. Acoust. Soc. Am*, *118*, pp.3154-3163.

Trigg, L. (2019). Assessing the exposure and behavioural response of grey seals (*Halichoerus grypus*) to shipping noise. A Ph.D. thesis submitted to the University of Plymouth.

Tripovich, J. S., Hall-Aspland, S., Charrier, I., and Arnould, J. P. Y. (2012) The behavioural response of australian fur seals to motor boat noise. PLoS One, 7 (5), 3–9.

Verboom, W. 2014. Preliminary information on dredging and harbour porpoises. JunoBioacoustics.

Vincent, C., Huon, M., Caurant, F., Dabin, W., Deniau, A., Dixneuf, S., Dupuis, L., Elder, JF., Fremau, M-H., Hassani, S., Hemon, A., Karpouzopoulos, J., Lefeuvre, C., McConnell, B.J., Moss, S.E.W., Provost, P., Spitz, J., Turpin, Y. and Ridoux, V. (2017), 'Grey and harbour seals in France: Distribution at sea, connectivity and trends in abundance at haulout sites'. Deep Sea Research Part II: Topical Studies in Oceanography 141: 294-305

Van Bressem, M. F., Raga, J. A., Di Guardo, G., Jepson, P. D., Duignan, P. J., Siebert, U., Barrett, T., de Oliveira Santos, M. C., Moreno, I. B., Siciliano, S. and Aguilar, A. (2009), 'Emerging infectious diseases in cetaceans worldwide and the possible role of environmental stressors', Diseases of aquatic organisms, 86/2: 143-157.

Visser, F., Hartman, K.L., Rood, E.J., Hendriks, A.J., Zult, D.B., Wolff, W.J., Huisman, J. and Pierce, G.J., 2011. Risso's dolphins alter daily resting pattern in response to whale watching at the Azores. *Marine Mammal Science*, *27*(2), pp.366-381.

Waggitt, J. J., P. G. H. Evans, J. Andrade, A. N. Banks, O. Boisseau, M. Bolton, G. Bradbury, T. Brereton, C. J. Camphuysen, J. Durinck, T. Felce, R. C. Fijn, I. Garcia-Baron, S. Garthe, S. C. V. Geelhoed, A. Gilles, M. Goodall, J. Haelters, S. Hamilton, L. Hartny-Mills, N. Hodgins, K. James, M. Jessopp, A. S. Kavanagh, M. Leopold, K. Lohrengel, M. Louzao, N. Markones, J. Martinez-Cediera, O. O'Cadhla, S. L. Perry, G. J. Pierce, V. Ridoux, K. P. Robinson, M. B. Santos, C. Saavedra, H. Skov, E. W. M. Stienen, S. Sveegaard, P. Thompson, N. Vanermen, D. Wall, A. Webb, J. Wilson, S. Wanless, and J. G. Hiddink. (2020), 'Distribution maps of cetacean and seabird populations in the North-East Atlantic'. Journal of Applied Ecology 57:253-269.

Weir, C.R. (2007) Observations of marine turtles in relation to seismic airgun sound off Angola. Mar Turtle Newsl 116: 17−20.

Wild Seas Wales. (2024). Respect. Version and Available: https://wildseas.wales/respect/?location=anglesey

Wilson, B., Batty, R., Daunt, F., Carter, C. (2007), ‘Collision Risks Between Marine Renewable Energy Devices and Mammals, Fish and Diving Birds’, Report by Centre for Ecology & Hydrology for Scottish Government.

Wisniewska, D. M., Johnson, M., Teilmann, J., Siebert, U., Galatius, A., Dietz, R. and Madsen, P. T. (2018), ‘High rates of vessel noise disrupt foraging in wild harbour porpoises (Phocoena phocoena)’, Proceedings of the Royal Society B: Biological Sciences, 285/1872: 20172314.

Wisniewska, D. M., Johnson, M., Teilmann, J., Rojano-Donate, L., Shearer, J., Sveegaard, S., Miller, L. A., Siebert, U. and Madsen, P. T. (2016), ‘Ultra-high foraging rates of harbor porpoises make them vulnerable to anthropogenic disturbance’, Current Biology, 26/11: 1441-1446.

Whooley, P. (2016), ‘Minke whale (Balaenoptera acutorostrata)’, in Liam Lysaght and Ferdia Marnell (eds.), Atlas of Mammals in Ireland 2010-2015 (Waterford: National Biodiversity Data Centre).

Wyatt, R. (2008). Joint Industry Programme on Sound and Marine Life - Review of Existing Data on Underwater Sounds Produced by the Oil and Gas Industry.