# XLINKS' MOROCCO-UK POWER PROJECT

## Environmental Statement

### 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 Xlinks' Morocco-UK Power Project within the UK. The Proposed Development covers all works required to construct and operate the offshore cables (from the UK Exclusive Economic Zone to Landfall), Landfall, onshore Direct Current and Alternating Current cables, converter stations, and highways improvements. |
| Offshore Cable Corridor | The proposed corridor within which the offshore cables are proposed to be located, which is situated within the UK 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 |

| Acronym | Meaning |
|---|---|
| DTAG | Digital Acoustic Recording Tag |
| EDR | Effective Deterrence Range |
| EEA | European Economic Area |
| EEZ | Exclusive Economic Zone |
| EIA | Environmental Impact Assessment |
| EMF | Electromagnetic Fields |
| 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 |
| NSVMP | Navigational Safety and Vessel Management Plan |
| 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 |
| ZoI | Zone of Influence |

# Units

| Units | Meaning |
|---|---|
| < | Less than |
| % | Percentage |
| dB | Decibel (sound pressure) |

| Units | Meaning |
|---|---|
| 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 Environmental Statement (ES) presents the findings of the Environmental Impact Assessment (EIA) undertaken for the United Kingdom (UK) elements of Xlinks' Morocco-UK Power Project (the 'Project'). For ease of reference, the UK elements of the Project are referred to in this chapter as the 'Proposed Development'. The ES accompanies the application to the Planning Inspectorate for development consent for the Proposed Development.

4.1.2 This chapter considers the likely impacts and effects of the Proposed Development on marine mammals and sea turtles during the construction, operation and maintenance 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 ES chapter:

- identifies the key legislation, policy and guidance relevant to marine mammals and sea turtles;
- details the EIA scoping and consultation process undertaken to date for marine mammals and sea turtles;
- confirms the study area for the assessment, the methodology used to identify baseline environmental conditions, the impact assessment methodology, and identifies any assumptions and limitations encountered in compiling the environmental information;
- sets out the existing and future environmental baseline conditions, established from desk studies, surveys and consultation;
- details the mitigation and/or monitoring measures that are proposed to prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process;
- defines the project design parameters used to inform for the impact assessment;
- presents an assessment of the likely impacts and effects in relation to the construction, operation and maintenance and decommissioning phases of the Proposed Development on marine mammals and sea turtles; and
- identifies any cumulative, transboundary and/or inter-related effects in relation to the construction, operation and maintenance and decommissioning phases of the Proposed Development on marine mammals and sea turtles.

4.1.4 The assessment presented is informed by the following technical chapters and should be read in conjunction with the following ES chapters:

- Volume 1, Chapter 2: Policy and Legislation;
- Volume 1, Chapter 3: Project Description;
- Volume 1, Chapter 5: EIA Methodology;
- 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 additional information to support the assessment contained within Volume 3, Appendix 4.1: Underwater Noise Technical Assessment, of the ES.

# 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 would be located within the UK Exclusive Economic Zone (EEZ) offshore waters (beyond 12 nautical miles (nm) from the English coast) and inshore waters, with the onshore infrastructure proposed to be located wholly within Devon, England. As set out in Volume 1, Chapter 1: Introduction, of the ES, the Secretary of State for the Department for Energy Security and Net Zero (DESNZ) has directed that elements of the Proposed Development are to be treated as 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** 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 ES |
|---|---|
| **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 4.7, Table 4.16** with an assessment of effects on these receptors in **sections 4.10, 4.11** and **4.12**. |
| 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 ES chapter. The baseline for these species in the study area is detailed in **section 4.7**. The assessment of impacts to these species is provided in **sections 4.10 4.11** and **4.12**. |
| **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 4.7**. The assessment of impacts to these species is provided in **sections 4.10, 4.11** and **4.12.** |
| 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 and maintenance noise impacts and their effects on marine mammal behaviour and ecology have been assessed in **sections 4.10**, **4.11** and **4.12.** Cumulative impacts have been assessed in **section 4.13.** |
| 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, | Potential impacts of noise and their effects on marine mammal behaviour and ecology have been assessed in **sections 4.10, 4.11** and **4.12.** Cumulative impacts have been assessed in **section** |

| Summary of NPS requirement | How and where considered in the ES |
|---|---|
| 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). | **4.13**. Where relevant, reference to/consideration of the JNCC and SNCB underwater guidance has been made in these sections. |
| 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)<br>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 4.10, 4.11** and **4.12.** Cumulative impacts have been assessed in **section 4.13**. Where relevant, reference to/consideration of the JNCC and SNCB underwater guidance has been made in these sections.<br>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. Any UXO clearance will be undertaken as a standalone activity, prior to cable lay activities. |

## The National Planning Policy Framework

4.2.16 The National Planning Policy Framework (NPPF) was published in 2012 and updated in 2018, 2019 and 2021 and 2023 (Department for Levelling Up, Housing and Communities, 2023). The NPPF sets out the Government's planning policies for England.

4.2.17 The NPPF has been updated and the draft version was published for consultation on 30 July 2024 with the consultation period ending on 24 September 2024 (Ministry of Housing, Communities and Local Government, 2024). This draft version has been reviewed and considered where necessary.

4.2.18 **Table 4.2** sets out a summary of the NPPF policies relevant to this chapter.

**Table 4.2: Summary of NPPF requirements relevant to this chapter**

| Policy | Key provisions | How and where considered in the ES |
|---|---|---|
| 15 Conserving and enhancing the natural environment | Planning policies and decisions should contribute to and enhance the natural and local environment by [inter alia] … protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan); … [and] recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services; … [and] minimising impacts on and providing net gains for biodiversity; …[and] preventing new and existing development from contributing to, being | Statutory protected sites and their associated features of interest which will be impacted by the Proposed Development activities are considered in **sections 4.10, 4.11** and **4.12**.<br>In addition, a Report to Inform Appropriate Assessment (RIAA) is submitted alongside the ES (document reference 7.16). Furthermore, a Marine Conservation Zone (MCZ) Assessment has been undertaken which is also submitted alongside the ES (document reference 7.15). |

| Policy | Key provisions | How and where considered in the ES |
|---|---|---|
| | put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. | |
| 15 Conserving and enhancing the natural environment | Plans should: distinguish between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value, where consistent with other policies in this Framework; take a strategic approach to maintaining and enhancing networks of habitats and green infrastructure; and plan for the enhancement of natural capital at a catchment or landscape scale across local authority boundaries | Locally, nationally, and internationally designated sites have all been considered where designations include relevant populations of marine mammals. Details of relevant designated sites are provided in **section 4.7, Table 4.16**.<br>In addition, a RIAA is submitted alongside the ES (document reference 7.16). Furthermore, a MCZ Assessment has been undertaken which is also submitted alongside the ES (document reference 7.15). |
| Habitats and biodiversity | To protect and enhance biodiversity and geodiversity, plans should: a) Identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity; wildlife corridors and stepping stones that connect them; and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation66; and b) promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity | Impacts to biodiversity are considered in **sections 4.10, 4.11** and **4.12.**<br>In addition, a RIAA is submitted alongside the ES (document reference 7.16). Furthermore, a MCZ Assessment has been undertaken which is also submitted alongside the ES (document reference 7.15). |
| | When determining planning applications, local planning authorities should apply the following principles: a) if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused; b) development on land within or outside a Site of Special Scientific Interest (SSSIs), and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific | Consideration has been given to relevant designated sites in the project design. Lundy SSSI is the only SSSI relevant to the protection of marine mammals (grey seals) in the vicinity of the Proposed Development, which is located 2 km north of the study area. |

| Policy | Key provisions | How and where considered in the ES |
|---|---|---|
| | interest, and any broader impacts on the national network of Sites of Special Scientific Interest; c) development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists; and d) development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to improve biodiversity in and around developments should be integrated as part of their design, especially where this can secure measurable net gains for biodiversity or enhance public access to nature where this is appropriate | |
| | The following should be given the same protection as habitats sites: a) potential Special Protection Areas and possible Special Areas of Conservation; b) listed or proposed Ramsar sites; and c) sites identified, or required, as compensatory measures for adverse effects on habitats sites, potential Special Protection Areas, possible Special Areas of Conservation, and listed or proposed Ramsar sites. | Routing of the Offshore Cable Corridor has been designed to avoid protected habitats where possible. The OCC avoids all designated sites with the exception of the Bristol Channel Approaches SAC, which is assessed within this chapter with respect to potential marine mammal impacts. A desk-based exercise has not identified any relevant potential or possible designated sites and none have been identified through consultations undertaken with e.g. Natural England and the JNCC. A full list of sites designated for the protection of marine mammals is provided in **section 4.7** and **Table 4.16.** |

# Marine Policy

## UK Marine Policy Statement

4.2.19 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).

4.2.20 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

4.2.21 **Table 4.3** presents 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 4.3: Summary of inshore and offshore marine plan policies relevant to this chapter**

| Policy | Key provisions | How and where considered in the ES |
|---|---|---|
| SW-MPA-1 | SW-MPA-1 encourages and supports proposals for activities that further the conservation objectives of marine protected areas.<br><br>SW-MPA-1 also ensures proposals take account of adverse impacts on individual sites and the overall network, protecting important habitats, species and geological features, and enabling the successful and continued management of these sites. | Marine Protected Areas (MPAs) and their associated features of interest that may be affected by Proposed Development activities are considered in **sections 4.10, 4.11 and 4.12**. |
| SW-BIO-1 | SW-BIO-1 encourages and supports proposals that enhance the distribution of priority habitats and priority species.<br><br>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 4.10, 4.11 and 4.12**.<br><br>Where significant adverse effects are identified, mitigation measures are detailed in **section 4.8.** |
| 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.<br><br>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 4.10, 4.11 and 4.12**.<br><br>Where significant adverse effects are identified, mitigation measures are detailed in **section 4.8.** |
| 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 4.10, 4.11 and 4.12**. Where significant adverse effects are identified, mitigation measures are detailed in **section 4.8.** |
| 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 4.10, 4.11 and 4.12**. Where significant adverse effects are identified, mitigation measures are detailed in **section 4.8.** |

| Policy | Key provisions | How and where considered in the ES |
|---|---|---|
| | | This assessment has been informed by information in Volume 3, Appendix 4.1: Underwater Noise Technical Assessment of this ES. |
| 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 4.13.** |

## Local Planning Policy

4.2.22 The onshore elements of the Proposed Development are located within the administrative area of Torridge District Council (and Devon County Council at the County level). 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 4.4**.

**Table 4.4: Summary of local planning policy relevant to this chapter**

| Policy | Key provisions | How and where considered in the ES |
|---|---|---|
| **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 4.10, 4.11 and 4.12.** |
| **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, | Impacts on relevant high importance marine mammal species, as defined by the Plan, have been considered in **sections 4.10, 4.11 and 4.12**. |

| Policy | Key provisions | How and where considered in the ES |
|---|---|---|
| | 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. | |

## North Devon Biosphere Reserve

4.2.23 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.

4.2.24 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.

4.2.25 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.

4.2.26 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

4.2.27 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 has taken place with the North Devon Biosphere Reserve Partnership during preparation of the ES. **Table 4.5** 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 4.5: 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 ES |
|---|---|---|
| Marine Natural Capital Plan PL08: *Set management priorities that will rapidly enable 'recovery' of estuarine and coastal intertidal* | *In the North Devon Marine Natural Capital Plan area these habitats, particularly saltmarsh as well as shallow* | Impacts (direct and indirect) on marine mammal and marine turtle species (marine biodiversity) across the whole North Devon Biosphere Reserve have |

| Policy | Description | How and where considered in the ES |
|---|---|---|
| *habitats within MPAs, where this conservation objective exists.* | *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.* | been considered in **sections 4.10, 4.11 and 4.12**. |
| 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 of conservation interest within an MPA.* | *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 the whole site instead of considering only the designated features, along with the identification of thresholds for sustainable use.* | 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 4.10, 4.11 and 4.12.** |
| 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 4.10, 4.11 and 4.12**. |
| 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* | Impacts on marine mammal and marine turtle species, which are part of marine conservation zones, have been considered in **sections 4.10, 4.11 and 4.12**. |

| Policy | Description | How and where considered in the ES |
|---|---|---|
| | *fisheries and conservation of marine ecosystem services.* | |
| 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 4.16**), have been considered in **sections 4.10, 4.11 and 4.12**. |

# 4.3 Consultation and Engagement

## Scoping

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, operation and maintenance and decommissioning 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 7 March 2024. Key issues raised during the scoping process specific to marine mammals and sea turtles are listed in **Table 4.6**, together with details of how these issues have been addressed within the ES.

**Table 4.6: Summary of Scoping Responses**

| Comment | How and where considered in the ES |
|---|---|
| **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 survey and clearance would be undertaken as standalone activities 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 (not intended to be included within the draft deemed Marine Licence submitted as part of the application for DCO).<br><br>This Scoping Opinion response was specifically discussed with the MMO in preparation of the 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 |

| Comment | How and where considered in the ES |
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| | survey and separate marine licence for site specific clearance (where identified as necessary).<br>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 assessments in the ES with relevant consultation bodies. | 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. It has also been reviewed for the ES (**section 4.7**) to ensure that the most up to date information is taken into account at the time of ES submission, with baseline data sources agreed with relevant consultation bodies prior to the ES. |
| 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 4.14** |
| 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 4.6**, 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 are considered in **section 4.12**. |
| The Scoping Report states that impacts on fish and shellfish receptors would affect prey availability for | The impacts on fish and shellfish receptors have been assessed in Volume 3, Chapter 2: Fish and |

| Comment | How and where considered in the ES |
|---|---|
| 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. | Shellfish Ecology of the ES, as not significant. This is in agreement with the assessment at scoping and PEIR phase to scope out indirect impacts resulting from impacts on prey species of marine mammals and sea turtles, hence no consideration was given in the PEIR.<br><br>The Applicant consulted further with the relevant consultation bodies on the above and has included impact assessment of indirect effects on prey species to marine mammals and sea turtles in **sections 4.10, 4.11 and 4.12**. |
| 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 NSVMP to demonstrate how effects on marine mammals would be minimised. | An assessment of vessel interaction and risk of collision to marine mammals is considered in **sections 4.10, 4.11 and 4.12**. An outline NSVMP is provided with the ES (Volume 3, Appendix 5.2: Navigational Safety & Vessel Management Plan of the ES). |
| 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.<br>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.<br><br>Underwater noise modelling has been undertaken as part of the ES to assess the potential impacts on marine mammals from different activities as part of the Proposed Development. Results of the modelling are shown in **Table 4.22**. An assessment of the PTS results (including TTS) is presented in **section 4.10**. Detailed information on the underwater noise modelling is provided in Volume 3, Appendix 4.1: Underwater Noise Technical Assessment, of the ES. This assessment has concluded that it is unlikely that cumulative PTS onset level will be reached across all functional hearing groups (FHGs) during the proposed noise emitting activities. For marine mammal receptors, it has been detailed in **paragraph 4.10.9** that there is currently no threshold |

| Comment | How and where considered in the ES |
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| | for TTS-onset that would indicate a biologically significant amount of TTS in marine mammals. Therefore, it was not possible to carry out a quantitative assessment of the sensitivity, magnitude, or significance of the impact of TTS on marine mammals. Disturbance from sources of underwater noise is included as part of the qualitative assessment, which will occur over greater distances as compared to TTS.<br><br>An assessment of vessel interaction and risk of collision to marine mammals and sea turtles, and assessment of TTS impacts on sea turtle are conducted in **sections 4.10, 4.11 and 4.12.** |
| 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 a likely 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 was sought on this topic with relevant stakeholders and an assessment has been included in **section 4.11**. |
| 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, including consideration of the implications for the marine mammal populations of the Bristol Channel Approaches SAC, where likely significant effects could occur. | The impacts on fish and shellfish receptors have been assessed in Volume 3, Chapter 2: Fish and Shellfish Ecology of the ES, as not significant. This is in agreement with the assessment at scoping and PEIR phase to scope out indirect impacts resulting from impacts on prey species of marine mammals and sea turtles, hence no consideration was given in the PEIR.<br><br>The Applicant consulted further with the relevant consultation bodies on the above and has included impact assessment of indirect effects on prey species to marine mammals and sea turtles in **sections 4.10, 4.11 and 4.12**.<br><br>Consideration of the implications for the marine mammal populations of the Bristol Channel Approaches SAC has been undertaken in the RIAA (document reference 7.16) which is submitted alongside the ES. The RIAA is relevant to the harbour porpoise only, as it is the only species of marine mammal that is a qualifying feature of the site. The RIAA also includes consideration of Conservation Objective 3 (i.e. 'The condition of |

| Comment | How and where considered in the ES |
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| | 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 4.12** has been 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 has been revised to include likely reversibility and permanence (**Table 4.13)**. |
| 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 - detailed in **paragraphs 4.7.9** to **4.7.17** of this 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 has been included in the ES when 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 are defined in the Impact Assessment methodology, from **paragraph 4.6.8** to **4.6.12.** |
| The Inspectorate agrees that likely significant effects arising from residues and emissions (eg dust, pollutants, light, noise, vibration) are to be assessed in the relevant aspect chapters of the ES and a standalone aspect chapter for residues and emissions is not required. | The likely significant effects arising from residues and emissions have been scoped out for marine mammals and sea turtles in this ES as it is not identified as an LSE**.**<br><br>There is limited evidence on the impact of residues and emissions (e.g. dust, pollutants, light) on marine mammals and sea turtles. A number of embedded measures will be put in place to reduce the likelihood of pollution incidents occurring and the severity of effect if they were to occur. These include an Offshore CEMP, and related Emergency Spill Response Plan, Waste Management Plan, Marine Pollution Contingency Plan, and Shipboard Oil Emergency Plan. Furthermore, vessels will have control measures and will be compliant with |

| Comment | How and where considered in the ES |
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| | international agreements to reduce pollution. Protocols will be in place in the unlikely event of an oil spillage, which will further reduce the risk of adverse effect on marine mammals and sea turtles. In addition, there is little evidence to suggest that other emissions or residues, such as light and dust, will have an impact on marine mammals and leatherback turtles. |
| 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:<br>• East of Haig Fras Marine Conservation Zone (MCZ);<br>• South-West Approaches to Bristol Channel MCZ;<br>• Lundy Sand Special Area of Conservation (SAC);<br>• Lundy MCZ;<br>• Bristol Channel Approaches SAC;<br>• North West of Lundy MCZ; and<br>• Bidefor to Foreland Point MCZ.<br>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 has been consulted regarding the Bristol Channel Approaches SAC. Further engagement has been undertaken with the JNCC post scoping, e.g. as part of the Section 42 consultation process (including direct consultation meetings). After consultation, no further information was required for the ES.<br><br>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 RIAA (document reference 7.16) which is submitted alongside the ES. |
| 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 ES. |
| 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 (Volume 3, Figure 4.1 in the ES) 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 to undertake their HRA for the Bristol Channel Approaches SAC. | The impacts on fish and shellfish receptors have been assessed in Volume 3, Chapter 2: Fish and Shellfish Ecology of the ES, as not significant. This is in agreement with the assessment at scoping and PEIR phase to scope out indirect impacts resulting from impacts on prey species of marine mammals |

| Comment | How and where considered in the ES |
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| | and sea turtles, hence no consideration was given in the PEIR.<br><br>The Applicant consulted further with the relevant consultation bodies on the above and has included impact assessment of indirect effects on prey species to marine mammals and sea turtles in **sections 4.10, 4.11 and 4.12**.<br><br>Consideration of the implications for the marine mammal populations of the Bristol Channel Approaches SAC has been undertaken in the RIAA (document reference 7.16) which is submitted alongside the ES. The RIAA is relevant to the harbour porpoise only, as it is the only species of marine mammal that is a qualifying feature of the site. The RIAA also includes consideration of Conservation Objective 3 (i.e. 'The condition of supporting habitats and processes, and the availability of prey is maintained'). |
| 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.<br><br>Professional judgement has been applied in the assessment undertaken in the PEIR and ES. |
| 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 4.12** in the ES). |
| 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 4.13** in the ES)) was revised to include likely reversibility and permanence/recovery. |
| **Marine Mammal Organisation (MMO)** | |
| 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 has been taken into account in the ES, with further details provided in **Table 4.3.**<br><br>The Proposed Development is compliant with the marine plan. |
| **Natural England** | |
| The development site is within or may impact on the following Habitats/internationally designated nature conservation sites:<br><br>Marine sites: | All SACs with marine mammals as qualifying features (**Table 4.16**) have been considered in the ES.<br><br>Consideration of conservation objective 3 of the Bristol Channel Approaches SAC (i.e. 'The condition |

| Comment | How and where considered in the ES |
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| • Bristol Channel Approaches Special Area of Conservation (SAC)<br>• Lundy SAC<br>• Isles of Scilly Complex SAC<br>• Severn Estuary SAC/Ramsar<br><br>Terrestrial sites:<br>• Braunton Burrows SAC<br><br>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. | of supporting habitats and processes, and the availability of prey is maintained') is made in the RIAA (document reference 7.16) which is submitted alongside the ES. |
| 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 have been assessed in **sections 4.10, 4.11 and 4.12.** |
| 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. | An assessment of indirect impacts to marine mammals resulting from changes to the seabed is considered in **sections 4.11 and 4.12**. |
| 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. | Hearing damage and auditory injury on marine mammals have been assessed in **sections 4.10, 4.11 and 4.12.** |
| 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: Fish and Shellfish Ecology of the ES, as not significant. This is in agreement with the assessment at scoping and PEIR phase to scope out indirect impacts resulting from impacts on prey species of marine mammals and sea turtles, hence no consideration was given in the PEIR.<br><br>The Applicant consulted further with the relevant consultation bodies on the above and has included impact assessment of indirect effects on prey species to marine mammals and sea turtles in **sections 4.10, 4.11 and 4.12**.<br><br>Consideration of the implications for the marine mammal populations of the Bristol Channel Approaches SAC has been undertaken in the RIAA (document reference 7.16) which is submitted alongside the ES.. The RIAA is relevant to the harbour porpoise only, as it is the only species of marine mammal that is a qualifying feature of the site. The RIAA also includes consideration of Conservation Objective 3 (i.e. 'The condition of |

| Comment | How and where considered in the ES |
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| | supporting habitats and processes, and the availability of prey is maintained'). |

## Preliminary Environmental Information Report

4.3.3 The preliminary findings of the EIA process were published in the Preliminary Environmental Information Report (PEIR) on 16 May 2024. The PEIR was prepared to provide the basis for statutory public consultation under the Planning Act 2008. This included consultation with statutory bodies under section 42 of the Planning Act 2008.

4.3.4 A summary of the key items raised specific to marine mammals and sea turtles is presented in **Table 4.7** together with how these issues have been considered in the production of this ES chapter.

**Table 4.7: Summary of PEIR Responses**

| Comment | How and where considered in the ES |
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| **Marine Mammal Organisation** | |
| The MMO notes in paragraph 4.7.3 of the PEIR that a Marine Mammal Mitigation Protocol ("MMMP") was proposed as part of the Scoping Report. However, the chapter concludes that a MMMP is no longer needed due to the lack of activities that produce impulsive noise association with the proposed development. The MMO defers to the relevant SNCBs regarding the need for an MMMP. | Noted (no action needed). |
| One of the embedded measures in table 4.17 of the PEIR is the inclusion of a 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. 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. The MMO supports the inclusion of a VMP. | Noted. An outline Navigational Safety and Vessel Management Plan is presented as Volume 3, Appendix 5.2 to the ES. |
| The modelling methodology presented in the underwater noise assessment at volume 3 appendix 4.1 of the PEIR is based on the National Marine Fisheries Service ("NMFS") multi-species calculator for predicting the underwater noise levels and the subsequent marine mammal and fish species impact ranges. The MMO considers this to be a reasonable approach for assessing the proposed noise generating activities, which are deemed to be "low-risk". However, the inherent simplifications of this methodology come with several challenges related to the interpretation of the modelling outputs and the risk of impacts on the animal receptors. For example, the calculation of impact ranges for cumulative exposure effects (such as Permanent Threshold Shift ("PTS") and Temporary Threshold Shift ("TTS") for marine mammals), assumes | Noted. The underwater noise assessment has been updated assuming fleeing marine mammal receptors travelling at an average swimming speed of 1.5 m/s away from the noise source. As such the calculation of PTS, TTS and noise disturbance impact ranges consider SEL values of lower magnitude over time as a receptor flees from the noise source, which is regarded a more realistic scenario in the ES. The assumptions and limitations of the underwater noise assessment have been detailed in **section 4.6.13**. |

| Comment | How and where considered in the ES |
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| stationary receptors (and noise sources) for the entire duration of the activities (typically 24 hours). While in general this can be considered a very precautionary approach, it can serve as proof that impacts are unlikely if the relevant injury thresholds are not reached, or if the predicted impact ranges are very small. Conversely, if the impact ranges derived from a precautionary assessment are rather large (e.g., extending over several km or even more than 10 km, as observed in table 7.3 on page 21 for TTS effects) then it becomes much more challenging to interpret the results and to determine what the likely outcomes would have been if a more realistic approach (i.e., one with less unnecessary conservatism, but at the expense of simplicity) had been used instead. | |
| In particular, the report at volume 3 appendix 4.1 of the PEIR includes several comments and interpretations on the cumulative exposure effect ranges as calculated for stationary marine mammal receptors, with contextual calculations of the "exposure times" for swimming receptors (e.g., in paragraphs 7.2.3 – 7.2.10, then repeated in the Summary and Conclusions, paragraphs 8.3.2 – 8.3.5, and Table 8.3). The MMO considers that the logic of these calculations and their interpretation is flawed, for the reasons presented below. | Noted, please find below our responses to each comment. |
| It is stated in several places throughout volume 3 appendix 4.1 of the PEIR that "in order for this threshold to be exceeded, the receptor would have to be stationary within this range from the source for a 24-hour period" (paragraphs 7.2.3 for PTS and 7.2.8 for TTS); or that for the predicted "PTS and TTS impacts to take place, receptors would need to be exposed to the noise levels of the relevant noise emitting activity for a 24-hour period" (paragraph 8.3.2). The MMO consider these statements to be incorrect – in reality, the PTS or TTS thresholds can be exceeded with a shorter exposure period (potentially much shorter in the case of TTS). A full 24-hour period would likely be necessary only if the receptor is stationary at the maximum predicted range. Inside this range (i.e., closer to the noise source), the noise levels are likely to be higher (or indeed, much higher in the case of some of the large ranges, such as some of the TTS ranges). Thus, a much shorter exposure period/duration could produce the same outcome as a longer exposure period further away from the source. For example, if a 24-hour exposure period is needed to exceed the TTS cumulative sound exposure level threshold at 10 km from the source, then at, say, 100 m from the source, where the noise levels could be comparatively 30 decibels ("dB") higher (assuming, conservatively, a 15 log R transmission loss), then the same threshold would be reached in less than 2 minutes (30 dB | Noted, we agree with MMO and the text has been updated to describe the modelled ranges within which PTS/TTS/disturbance onset could occur assuming the animal is swimming away from the noise source at 1.5 m/s across a 24-hour period. The assumptions and limitations of the underwater noise assessment have been detailed in **section 4.6.13**. |

| Comment | How and where considered in the ES |
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| translates in three orders of magnitude increase in energy and this reduces the required exposure time by three orders of magnitude, namely from 86,400 seconds to only 86 seconds). | |
| Considering the above points, "swim times" cannot simply be calculated across the stationary effect ranges and used as criteria to establish if the effect will occur or not (as attempted in paragraphs 7.2.4, 7.2.9, and in table 8.3). The meaning of these impact zones for stationary receptors is indeed one of indicating the areas where the animals will suffer an impact if they remain for 24 hours, but with the latter being a sufficient, not a necessary, condition (as the example above illustrates). Therefore, if a receptor swims away from the noise source and exits the stationary effect zone after less than 24 hours, there is no guarantee that its accumulated exposure has not exceeded the relevant injury threshold. The noise exposure continues even outside this zone (albeit at lower levels), which could, in principle, still drive the accumulated total exposure above the threshold. More importantly, as the previous example illustrated, the threshold level of exposure can be reached very quickly when closer to the source, and thus a fleeing animal that starts from near the source could exceed the threshold well before crossing the boundary of the "stationary effect zone". | Noted, impact assessment of PTS, TTS and disturbance during construction, operation and maintenance and decommissioning has been conducted in sections **4.10, 4.11** and **4.12.** Assessments have considered that where there is potential PTS/TTS/disturbance, impact would take place within the modelled range of impact onset specific to different functional hearing groups (FHGs) of marine mammals. |
| The logic of the "swim times" calculations across the stationary effect zones would work if the noise levels were uniform (constant) inside these zones. In that case, the 24-hours exposure duration inside the zone would be both a sufficient and a necessary condition for exceeding the effect threshold. In reality the noise levels are unlikely to present this picture (especially for the larger zones, where the noise level variation with range can be considerable). A correct assessment of the potential effect zones for fleeing animals would require a more complex modelling methodology that uses fleeing receptors and account for the spatial (and temporal) variability of noise (and accumulated exposure) levels. | Noted, impact magnitude of PTS, TTS and disturbance has been assessed based on the respective modelled impact ranges assuming fleeing receptor with swimming speed of 1.5 m/s to account for the spatial and temporal variability of noise levels. The assumptions and limitations of the underwater noise assessment has been detailed in section **4.6.13**. The assessment for construction, operational and maintenance and decommissioning phases are presented in sections **4.10, 4.11** and **4.12** respectively.<br>Note that for TTS, it has been detailed in **section 4.10.9** that there is currently no threshold for TTS-onset that would indicate a biologically significant amount of TTS in marine mammals. Therefore, it was not possible to score receptor sensitivity, impact magnitude and significance resulting from TTS impact on marine mammals. |
| It should be noted that the MMO are not particularly concerned about the potential of injury effects from the noise generating activities assessed in this report, but rather with the interpretation of some of the results, as detailed in the points above. Using a more complex modelling methodology that incorporates fleeing receptors would likely result in no exceedance of the cumulative PTS thresholds for | Noted, the Under Water Noise Technical Assessment has been updated accordingly (Volume 3, Appendix 4.1 of this ES), with the modelling of PTS, TTS and noise disturbance impact ranges considering a fleeing receptor with swimming speed of 1.5 m/s. The assumptions and limitations of the underwater noise assessment have been detailed in **section 4.6.13**. |

| Comment | How and where considered in the ES |
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| marine mammals, and much smaller TTS ranges than the corresponding stationary ones (but not necessarily their complete absence). This would provide a more robust assessment and therefore higher level of confidence in the conclusions made. | |
| Chapter 4 of the PEIR considers the sensitivity of marine mammals and sea turtles. For each specific marine mammal receptor, the chapter concludes that they are considered to be of "high adaptability, reasonable tolerance, have high recoverability, and are of very high value". The sensitivity of the receptor ranges from medium (for harbour porpoise) to low (for bottlenose dolphin, common dolphin, Risso's dolphin, minke whale, and grey seal). The sensitivity of the leatherback turtle has been assessed as negligible. The MMO would question why harbour porpoise has only been assigned 'medium' sensitivity when the assessment acknowledges that harbour porpoises are particularly vulnerable to disturbance. Furthermore, all other species (apart from leatherback turtles) have been assigned low sensitivity, even though the assessment acknowledges that there is limited information on the responses of these species to underwater noise. The ES should include more detailed justification as to why these conclusions have been made. | The assessment of receptor sensitivity follows the criteria listed in **Table 4.11**. For harbour porpoise, section **4.10.68** details 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). While for Risso's dolphin, a medium sensitivity has been predicted based on the species responses to impulsive noise, which is predicted to result in larger impact ranges compared to by non-impulsive noise from the Proposed Development. For bottlenose dolphin, common dolphin, minke whale and grey seal, it has been detailed in **section 4.10**, evidence has shown that they have some capability to adapt and tolerate certain levels of temporary disturbance.<br>In addition, 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. |
| **Natural England** | |
| While Natural England agrees with the scoping out of water quality changes and accidental pollution (as this will be covered in MARPOL); Natural England does not agree with the scoping out of collision with vessels, hearing damage and auditory injury, the presence of electromagnetic fields (EMF) and prey availability.<br><br><u>Recommendation:</u><br>Natural England cannot agree with scoping out collision with vessels and hearing damage and auditory injury until we have seen a Vessel Management Plan (VMP).<br>Natural England advise that collision with vessels, hearing damage and auditory injury, presence of EMF and prey availability are scoped in and assessed in the EIA.<br>In the absence of information relating to quantities and locations of external cable protection, it is not possible to fully understand the full impact on the Bristol Channel Approaches SAC and therefore NE are unable to agree that prey availability should be scoped out at this stage. | Vessel collision, hearing damage and auditory injury have been assessed in **sections 4.10, 4.11 and 4.12.**<br><br>The presence of EMF has been assessed for turtles and presented in **section 4.11**. Other marine mammals have not been assessed as per NE comment in Scoping Opinion and due to the lack of evidence of EMF having any impact (either positive or negative) on marine mammals (Copping, 2018).<br><br>Indirect effects on prey species on marine mammal and sea turtle receptors have also been assessed in **sections 4.10, 4.11 and 4.12.** Consideration of the implications for the marine mammal populations of the Bristol Channel Approaches SAC has been undertaken in the RIAA (document reference 7.16) which is submitted alongside the ES. The RIAA is relevant to the harbour porpoise only, as it is the only species of marine mammal that is a qualifying feature of the site. The RIAA also includes consideration of Conservation Objective 3 (i.e. 'The condition of supporting habitats and processes, and the availability of prey is maintained').<br><br>An outline Navigational Safety and Vessel Management Plan (NSVMP) is presented as Volume 3, Appendix 5.2. |

| Comment | How and where considered in the ES |
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| | |
| Natural England agrees with not including a Marine Mammal Mitigation Plan (MMMP) as long as a MMMP is included in the licence application for the geophysical survey and UXO clearance activities.<br><br>Recommendation:<br>MMMP to be included in geophysical survey and UXO clearance marine licence applications. | Noted (no action needed). |
| It is unclear if the Coastal West Channel Management Unit (CWC MU) population of bottlenose dolphins has been included in these assessments.<br><br>Recommendation:<br>Although unlikely to make a material different to the assessment, Natural England advise that the updated IAMMWG 2023 MU for the Coastal West Channel MU population is included in this assessment. | Noted, the CWC MU has been considered in the assessment as detailed in **section 4.4.7** and **Table 4.17.** |
| Natural England agrees with the scoping out of Sea Turtles in underwater noise modelling due to lack of data.<br><br>Recommendation:<br>However, Natural England would like to see more robust justification for doing so and demonstrate that data on sea turtles currently does not exist, i.e. even OSPAR does not have population data and note that the Celtic Sea is not considered an area of high use compared to Bay of Biscay and Iberian Peninsula Leatherback turtle (ospar.org).<br>We would also advise that any of sightings of turtles in UK waters be reported to increase the dataset and improve our understanding of turtle distribution. | Turtle sightings has been considered in **Table 4.17** and detailed in the NSVMP (Volume 3, Appendix 5.2 of the ES). Qualitative assessment of underwater noise impacts on sea turtles are also detailed in **sections 4.10, 4.11 and 4.12.** |
| **JNCC** | |
| UXO clearance: JNCC acknowledge and agree with the decision to not include UXO clearance within licence application and subsequent HRA. We welcome the approach that a stand-alone application to determine UXO removal will be applied for if it is needed during the pre-lay works. | Noted (no action needed). |
| Bristol Channel Approaches SAC: This is the only harbour porpoise SAC that is crossed by the proposed cable corridor. Conservation Objective 3 for this site states that "The condition of supporting habitats and processes, and the availability of prey is maintained'. However, Table 6.3 (HRA screening for Likely Significant Effects on European and Ramsar Sites), has screened out 'Physical change to another seabed/sediment type' of the assessment for this | Consideration of the implications for the marine mammal populations of the Bristol Channel Approaches SAC has been undertaken in the RIAA (document reference 7.16) which is submitted alongside the ES.. The RIAA is relevant to the harbour porpoise only, as it is the only species of marine mammal that is a qualifying feature of the site. |

| Comment | How and where considered in the ES |
|---|---|
| site. The justification provided for this decision is that "although prey species may be displaced initially during the installation, this change in habitat type may result in an artificial reef effect, potentially influencing the fish assemblage present". We recommend that this rationale is supported with relevant evidence, as a permanent physical change to the seabed may impede the maintain conservation objective of the site, in reference to CO3. The potential effects of the projects works on the habitat of porpoise and their prey should be considered. | Indirect impacts through changes to the seabed for marine mammals and sea turtles have been assessed in **section 4.11:** Assessment of Operation and Maintenance Effects of the ES. As detailed in Volume 3, Chapter 2: Fish and Shellfish Ecology of the ES, habitat alteration and long-term habitat loss as a result of the placement of rock protection along cables is not estimated to result in significant impact on any fish or shellfish receptors assessed. Therefore, any indirect effects of such changes on harbour porpoise would be anticipated to be negligible. |
| Other harbour porpoise sites: We agree with the conclusions of the LSE test of the project alone for all other harbour porpoise SACs due to their distance being >40km from the proposed works. We defer to the relevant agencies for matters relating to inshore sites. | Noted (no action needed). |
| In-combination assessment: We agree with the conclusions regarding plans and projects to be screened in to the in-combination assessment. The Zone of Influence of 30km applied is appropriate and reflects a precautionary approach given maximum EDR proposed in the noise management approach for harbour porpoise SACs (JNCC, 2020a). | Noted (no action needed). |
| **Public** | |
| The current assessment and mitigation strategies appear to underestimate the potential impact on marine life, particularly for species with limited acoustic data like the leatherback turtle. Given the limited data on the species' acoustic sensitivity, it is important to implement more conservative measures and continuous monitoring to avoid unexpected disturbances. (E48) | All impacts to marine mammals have been considered for the Proposed Development. Impacts deemed to have a potential effect on marine mammals have been scoped in and an assessment has been undertaken, using current scientific knowledge. Noise levels have been modelled to be low (**Table 4.24**) due to the nature of the activities (no impulsive sound). Turtles are expected to be present in small numbers in the area, so the probability of impact is reduced. |
| Concern about 'Lundy marine safe zone. Harbour dolphins. These were protected in Atlantic Array Survey' during offshore construction. (O8) | Impacts on harbour porpoises and other marine mammal species have been considered in **sections 4.10, 4.11 and 4.12.**<br>The Atlantic Array survey used impulsive sound sources, which is a much higher sound source than the one that will be produced during the installation of the proposed development (no impulsive sound). Harbour porpoises may avoid the development area during construction but are expected to return in a couple of hours to days. The closest point to Lundy SAC being 3.6 km. |
| In the documents provided, it is stated that the effects of the construction, operational, and decommissioning phases on marine mammals and sea turtles are non-significant, thus no mitigation or further monitoring is required. However, no field-based studies have been undertaken, and there are no plans to do so. As stated in the document "A desk-based review is deemed sufficient to enable characterization of the baseline and to allow a robust | The assessment was undertaken using data from the most recent SCANS survey conducted in summer 2022, in combination with densities reported in the MU. In addition, this was supplement with wider data sets including local survey information for offshore developments to ensure that all species potentially impacted were considered and assessed. The above datasets take into account the mobility of |

| Comment | How and where considered in the ES |
|---|---|
| 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." Despite this, some of the evidence used in the review is more than 10 years old, and these are highly mobile species whose distribution varies. We recommend that if no field study is undertaken to validate statements, then the precautionary approach should be adopted, and a monitoring plan developed to ensure that the impacts of the development on marine mammals and sea turtles are as insignificant as anticipated.(E48) | the animals and changing distributions, allowing for a robust assessment to be undertaken. |
| 'There is a potential threat to the wildlife, especially on Lundy. Lundy and our local areas are within a Marine Nature Reserve, an SSSI, an AONB, a Heritage Coast and a Special Area of Conservation. All of these categories have been put in place for a reason, because the area is so unique.<br>The Area shown in the map is a Special Area of Conservation (SAC) This area has been identified as a winter area of importance for the Celtic and<br>Irish Seas Management Unit of Harbour porpoises. Lundy has the harbour porpoise which is protected by Article 4 of the EU Habitats Directive (1992)<br>It is now transposed into UK Law by the Conservation of Habitats and Species Regulations (2019).'<br>(E54) | Impacts on Lundy wildlife have been considered fully within the assessment. The main marine mammal species protected by the Lundy SAC is the grey seal, with impacts considered in **sections 4.10, 4.11 and 4.12.** |

## Further Engagement

4.3.5 Throughout the EIA process, consultation and engagement (in addition to scoping and section 42 consultation) with interested parties specific to marine mammals and sea turtles has been undertaken.

4.3.6 A summary of the key items raised specific to marine mammals and sea turtles is presented in **Table 4.8,** together with how these issues have been considered in the production of this ES chapter.

**Table 4.8: Summary of additional direct consultations relevant to this chapter**

| Date | Consultee and type of response | Issues raised | How and where considered in the ES |
|---|---|---|---|
| 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 were arranged with JNCC marine mammal leads. Additional disturbance effects were subsequently assessed in the Scoping Report. Additional noise impacts were discussed in subsequent meetings, which have informed the ES. |
| March 2024 | Natural England meeting | Discussion of:<br>• Inclusion of EMF impacts on marine turtles in ES.<br>• Assessment of indirect impacts on marine mammals resulting from indirect impacts on marine mammal prey species for the Bristol Channel Approaches SAC<br>• 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 (**Section 4.11**).<br>• NE agreed with the Applicant's approach of assessing indirect impacts on marine mammal prey species in the RIAA (document 7.16) which is submitted alongside the ES, hence not considered in the ES.<br>• 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 Technical Assessment, of the ES. An overview of results is presented in **section 4.10** and **Table 4.24**. |
| April 2024 | JNCC | Discussion of:<br>• Impacts scoped into PEIR<br>• Type of work being undertaken (non-impulsive)<br>• Consideration of Conservation Objective 3 | • Assessment text has been edited to clarify that only non-impulsive noise operations are taking part as part of the Proposed Development<br>• Indirect impacts through changes to seabed and the availability of prey is have been assessed in **sections 4.10, 4.11** and **4.12** of the ES. |
| August 2024 | Natural England | Discussion of: | • Injury and temporary changes in hearing from anthropogenic noise, vessel collision risk and |

| Date | Consultee and type of response | Issues raised | How and where considered in the ES |
|---|---|---|---|
| | | • New impacts scoped into ES<br>• Updated UWN modelling<br>• Need to assess EMF impacts for marine mammals | indirect effects to prey species have been assessed in **sections 4.10, 4.11** and **4.12**.<br>• Updated underwater noise modelling is provided in Volume 3, Appendix 4.1: Underwater Noise Technical Assessment, of the ES.<br>• Reiterated that the Scoping Opinion stated no need to assess EMF for marine mammals hence there were no plans to consider such effects in the ES; note potential EMF effects on leatherback turtles have been assessed in **Section 4.11** of the ES. |
| September 2024 | Natural England | Email confirmation that EMF should be assessed for all marine mammals | Potential EMF effects on marine mammals have been assessed in **section 4.11** of the ES. |
| October 2024 | MMO | Discussion of MMO Section 42 consultation responses (**Table 4.7**)– including presentation of the updated underwater noise modelling calculations undertaken for the ES and the TTS and PTS results. | Impact magnitude of PTS, TTS and disturbance has been assessed based on the respective modelled impact ranges assuming fleeing receptor with swimming speed of 1.5 m/s to account for the spatial and temporal variability of noise levels. The assumptions and limitations of the underwater noise assessment has been detailed in **section 4.6.13**. The assessment for construction, operational and maintenance and decommissioning phases are presented in **sections 4.10**, **4.11** and **4.12** respectively. |

## 4.4 Study Area

4.4.1 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.

4.4.2 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.

4.4.3 The site-specific study area was based on a precautionary zone of influence (ZoI) of the works, using the Joint Nature Conservation Committee (JNCC, 2020a) 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 maintenance and decommissioning activities considered in the ES, 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.

4.4.4 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.

4.4.5 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).

4.4.6 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.

4.4.7 In addition, for bottlenose dolphin the Coastal West Channel MU has also been taken into account in the assessment, where an impact pathway has been determined.

4.4.8 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 ES.

4.4.9 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 ES.

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

# 4.5 Scope of the Assessment

4.5.1 The scope of this ES has been developed in consultation with relevant statutory and non-statutory consultees as detailed in **Table 4.6, Table 4.7** and **Table 4.8**.

4.5.2 During construction, there is potential for underwater noise impacts on sensitive ecological receptors due to cable installation activities and increased vessel disturbance. During operation and maintenance, 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.

4.5.3 Taking into account the scoping and consultation process, **Table 4.9** summarises the impacts considered as part of this assessment.

**Table 4.9: Impacts considered within this assessment**

| Activity | Impacts scoped into the assessment |
|---|---|
| **Construction Phase** | |
| Ground condition surveys, seabed preparation, route clearance, cable lay and burial activities. | Auditory injury (Permanent Threshold Shift; PTS) and temporary (Temporary Threshold Shift; TTS) changes in hearing due to anthropogenic noise |
| | Disturbance due to anthropogenic noise |
| | Increased vessel disturbance |
| | Vessel collision risk |
| | Indirect effects on prey species |
| **Operation and Maintenance – repair activities only** | |
| Repair works (cable cut, recover, and burial activities) | Auditory injury (Permanent Threshold Shift; PTS) and temporary (Temporary Threshold Shift; TTS) changes in hearing due to anthropogenic noise |
| | Disturbance due to anthropogenic noise |
| | Increased vessel disturbance |
| | Vessel collision risk |
| | Indirect effects on prey species |

| Activity | Impacts scoped into the assessment |
|---|---|
| | EMF Impacts on marine mammals and leatherback turtles |
| | Indirect Impacts through changes to the seabed |
| **Decommissioning Phase - removal** | |
| Repair works (cable cut, recover, and burial activities) | Auditory injury (Permanent Threshold Shift; PTS) and temporary (Temporary Threshold Shift; TTS) changes in hearing due to anthropogenic noise |
| | Disturbance due to anthropogenic noise |
| | Increased vessel disturbance |
| | Vessel collision risk |
| | Indirect effects on prey species |
| | Removal of hard substrate |

4.5.4 Impacts that are not likely to result in significant effects have been scoped out of the assessment. A summary of the impacts scoped out, together with justification for scoping them out and whether the approach has been agreed with key stakeholders through either scoping or consultation, is presented in **Table 4.10**.

**Table 4.10: Issues scoped out of the assessment**

| Impact | Justification |
|---|---|
| **Construction Phase** | |
| 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. |
| Disturbance at seal haul-out sites | 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 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. |
| Effects arising from residues and emission | A number of embedded measures will be put in place to reduce the likelihood of pollution incidents occurring and the severity of effect if they were to occur. Furthermore, vessels will have control measures in place and will be compliant with international agreements to reduce pollution. In addition, there is little evidence to suggest that other emissions or residues, such as light and dust, will have an impact on marine mammals and leatherback turtles. |
| **Operation and Maintenance - normal** | |
| n/a | n/a |
| **Operation and Maintenance – repair activities only** | |
| 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. |
| 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. |
| Effects arising from residues and emission | A number of embedded measures will be put in place to reduce the likelihood of pollution incidents occurring and the severity of effect if |

| Impact | Justification |
|---|---|
| | they were to occur. Furthermore, vessels will have control measures in place and will be compliant with international agreements to reduce pollution. In addition, there is little evidence to suggest that other emissions or residues, such as light and dust, will have an impact on marine mammals and leatherback turtles. |
| **Decommissioning Phase - removal** | |
| 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. |
| 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. |
| Effects arising from residues and emission | A number of embedded measures will be put in place to reduce the likelihood of pollution incidents occurring and the severity of effect if they were to occur. Furthermore, vessels will have control measures in place and will be compliant with international agreements to reduce pollution. In addition, there is little evidence to suggest that other emissions or residues, such as light and dust, will have an impact on marine mammals and leatherback turtles. |

# 4.6 Methodology

## Relevant Guidance

4.6.1 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, 2020a);
- 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.

# Methodology for Baseline Studies

## Desk Studies

4.6.2 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 4.15.**

## Site-Specific Surveys

4.6.3 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 identified during the desk-based review. Information on the presence of marine mammals and sea turtles in the Celtic Sea is generally well known, with several sources of information from surveys for other offshore developments, research and citizen projects and SCANS surveys.

# Impact Assessment Methodology

## Overview

4.6.4 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 impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on relevant guidance, including the Design Manual for Roads and Bridges (DMRB) methodology (Highways England et al., 2020) where appropriate as described in further detail in Volume 1, Chapter 5: EIA methodology of the ES.

## Receptor Sensitivity/Value

4.6.5 The criteria for defining sensitivity in this chapter are outlined in **Table 4.11**. The definitions of value for marine mammal and sea turtle receptors are provided in **Table 4.12**

4.6.6 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 4.12**). 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 4.11: Sensitivity criteria for marine mammal and sea turtle receptors**

| Sensitivity | Definition |
|---|---|
| Very High | The species has very limited tolerance to impacts such as auditory injury, temporary changes in hearing, disturbance from noise, prey disturbance and vessel movements |
| High | The species has limited tolerance to impacts such as auditory injury, temporary changes in hearing, disturbance from noise, prey disturbance and vessel movements |
| Medium | The species has some tolerance to impacts such as auditory injury, temporary changes in hearing, disturbance from noise, prey disturbance and vessel movements |
| Low | The species is generally tolerant to impacts such as auditory injury, temporary changes in hearing, disturbance from noise, prey disturbance and vessel movements |
| Negligible | Negligible or no sensitivity to impacts such as auditory injury, temporary changes in hearing, disturbance from noise, prey disturbance and vessel movements |

**Table 4.12: 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.<br>• 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.<br>• Globally threatened species (i.e., Critically endangered or endangered on IUCN Red list) or species listed on Annex 1 of the Bern Convention.<br>• European Protected Species under Annex IV of the European Commission Habitats Directive<br>• Regularly occurring populations of internationally important species that are rare or threatened in the UK or of uncertain conservation status.<br>• A regularly occurring, nationally significant population/number of any internationally important species.<br>• 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.<br>• Regularly occurring, globally threatened species (i.e., Vulnerable or lower on IUCN Red list) or species listed on Annex 1 of the Bern Convention.<br>• Previously UKBAP habitats and species; S41 species of NERC Act.<br>• Habitat/species which have important biodiversity, social/community value and/or economic value. |
| Medium | • Significant populations of a regionally/county important species.<br>• Habitat/species possess moderate biodiversity, social / community value and/or economic value. |
| Low | • Species are abundant, common or widely distributed.<br>• Habitat/species have low biodiversity, social/community value and/or economic value. |
| Negligible | • Negligible or no value and/or economic value. |

## Magnitude of Impact

4.6.7 The criteria for defining magnitude in this chapter are outlined in **Table 4.13**.

**Table 4.13: Impact magnitude criteria for marine mammal and sea turtle receptors**

| Magnitude of impact | Definition | |
|---|---|---|
| High | Adverse | The impact would have a permanent change in the behaviour and distribution of sufficient numbers of individuals, with sufficient severity, to affect the long-term viability and/or favourable conservation status of the population. |
| | Beneficial | The impact would result in long term increase in population size. |
| Medium | Adverse | The impact would have a temporary change in behaviour and/or distribution of most individuals, and permanent changes on a small portion of the population although not at a level that would affect the long-term viability of the population. |
| | Beneficial | The impact would result in increased population health and/or size resulting from benefits to the supporting habitat. |
| Low | Adverse | The impact would have short-term and/or intermittent change to a small proportion of the population, which is unlikely to impact the population trajectory. |
| | Beneficial | The impact would result in short-term (over a limited number of breeding cycles) benefit to the supporting habitat influencing reproductive potential, yet unlikely to increase population health and/or size. |
| Negligible | Adverse | The impact would result in very short- term and recoverable effect on the behaviour and/or distribution in a very small proportion of the population. No change to the population size or trajectory is expected. |
| | Beneficial | The impact would bring very minor benefit to the supporting habitat, influencing foraging efficiency of a limited number of individuals but not increasing population health and/or size. |
| No change | The impact would not result in any adverse or beneficial effect to the population or supporting habitat. | |

## Significance of Effect

4.6.8 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. The method employed for this assessment is presented in **Table 4.14**. Where a range of significance levels is presented, the final assessment for each effect is based upon expert judgement.

4.6.9 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.

4.6.10 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 4.14: 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 |

4.6.11 Where the magnitude of impact is 'no change', no effect would arise.

4.6.12 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

4.6.13 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 Technical Assessment, of the ES). The model typically 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. Due to this, marine mammal receptors in transit have been considered within the calculations,

with an average swim speed of 1.5 $ms^{-1}$. The model assumes that the source is active continuously over a 24-hour period and that the animal will continue to swim away at a constant relative speed.

4.6.14 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 Technical Assessment, of the ES.

4.6.15 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.

4.6.16 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, as discussed by Southall *et al.* (2016, 2019) and Ellison *et al.* (2012). Individual variation in behavioural responses to underwater noise, has been shown in harbour porpoise (Graham *et al.*, 2017) and harbour seals (Whyte, *et al*., 2020) for other activities. Factors resulting in behavioural variation include individual's experience of previous exposure to noise, 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.

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

# 4.7 Baseline Environment

## Desk Study

4.7.1 Information on marine mammals and sea turtles within the study area was collected through a detailed review of existing studies and datasets. These are summarised in **Table 4.15**.

**Table 4.15: Summary of desk study sources used**

| Title | Source | Year | 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.* |
| 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 |

| Title | Source | Year | Author |
|---|---|---|---|
| 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 |

4.7.2 Desk study results are summarised succinctly within the key receptors table (**Table 4.17**).

4.7.3 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.

## Designated sites

4.7.4 All designated sites within the study area and qualifying interest features that could be affected by the construction, operation and maintenance, and decommissioning phases of the Proposed Development are set out in **Table 4.16**.

**Table 4.16: Designated sites and relevant qualifying interests**

| Designated Site | Distance to the Proposed Development (nearest point) | Relevant Qualifying Interest |
|---|---|---|
| Bristol Channel Approaches SAC | 0 km | Harbour porpoise<br>*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

4.7.5 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

4.7.6 Schedule 4, paragraph 3 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 require that 'an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge' is included within the ES. This section provides an outline of the likely future baseline conditions in the absence of the Proposed Development.

4.7.7 Cable laying in UK waters will be undertaken in several campaigns. Subject to DCO consent, pre-lay works may commence in 2027 with cable lay campaigns beginning in Q3 2027. Existing data are considered appropriate to characterise the project baseline for the construction period.

4.7.8 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 and maintenance phase impacts against.

4.7.9 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.

4.7.10 The specific impacts of anthropogenic-induced climate change on marine mammal populations however are poorly understood, largely due to difficulties in obtaining sufficient evidence (Evans and Bjørge, 2013). There is little information available to provide an assessment of the effects of extreme weather events on marine mammals and turtles, with most of the existing literature relating to impacts from global warming. The main impacts of climate change for marine mammals would likely be changes in prey availability, reductions in suitable habitat, increase in mass mortality, increased susceptibility to disease and changes in exposure to pollution (Boyd and Hanson, 2021; Martay *et al.,* 2023).

4.7.11 Around the UK, evidence of range shift is increasing, with a shift north by some warmer water species (Martin *et al*., 2023), trying 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).

4.7.12 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). 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).

4.7.13 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.

4.7.14 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.

4.7.15 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. The future population trajectories of marine mammal and sea turtle species are difficult to predict because monitoring at the appropriate temporal and spatial scales does not exist at present. It is also difficult to predict at what timescale any of these additional climate change influences will take place.

4.7.16 However, with the current proposed programme where pre-lay works begin in 2027, the current baseline characterisation is still deemed fully relevant to the entire construction phase.

4.7.17 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 maintenance and decommissioning effects (as assessed against the current baseline), there is unlikely to be any significant change in the associated future impact significance (from minor or negligible) of climate change effects, arising from the Proposed Development.

## Key Receptors

4.7.18 **Table 4.17** identifies the marine mammal and sea turtle receptors taken forward into the assessment, together with their value (considering conservation objectives).

**Table 4.17: Key receptors taken forward to assessment**

| Receptor | Description | 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. A total of four sightings were made around the Taw/Torridge WFD Transitional and Coastal waterbody between 2002 and 2017 (NBN Atlas, 2024).<br><br>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).<br>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 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.<br>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).<br>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 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. There is an estimated population of 40 individuals (CV=0.18; 95% CI=30-59) within the Coastal West Channel 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).<br>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 value of the receptor is very high. |

| Receptor | Description | Value |
|---|---|---|
| Risso's dolphin<br>*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.<br>There is an estimated population of 8,686 (CV=0.63; 95% CI=2,810-26,852) individuals within 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).<br>The current conservation status and short-term trends for Risso's dolphin within UK waters are unknown due to insufficient data (JNCC, 2019d). | The value of the receptor is very high. |
| Minke whale<br>*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.<br>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).<br>The current conservation status and short-term trends for minke whales within UK waters is unknown due to insufficient data (JNCC, 2019e). | The value of the receptor is very high. |
| Grey seal<br>*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. A total of 18 sightings of grey seals were made in the Taw/Torridge WFD Transitional and Coastal waterbody between 1970 and 2022 (NBN Atlas, 2024).<br><br>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).<br>Grey seals in the UK have been assessed as having a favourable conservation status with an improving conservation status trend (JNCC, 2019f). | The value of the receptor is very high. |
| Leatherback turtle<br>*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 | The value of the receptor is very high. |

| Receptor | Description | Value |
|---|---|---|
| | Ireland, and in the English Channel (Botterell *et al*., 2020). They have regularly been observed in waters off the south west of England.<br>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.<br>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). | |

# 4.8 Mitigation Measures Adopted as Part of the Proposed Development

4.8.1 For the purposes of the EIA process, the term *'measures adopted as part of the Proposed Development'* is used to include the following types of mitigation measures (adapted from IEMA, 2016). These measures are set out in Volume 1, Appendix 3.1: Mitigation Schedule of the ES.

- Embedded mitigation. This includes the following.
  - Primary (inherent) mitigation - measures included as part of the Proposed Development design. 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 project 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 project and the parameters secured in the DCO and/or marine licences. For example, a reduction in footprint or height.
  - 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 a Construction Environmental Management Plan or similar.
- 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 environmental management plan.

4.8.2 In addition, where relevant, measures have been identified that may result in enhancement of environmental conditions. Such measures are clearly identified within Volume 1, Appendix 3.1: Mitigation Schedule of the ES. The measures relevant to this chapter are summarised in **Table 4.18**.

4.8.3 Embedded measures that will form part of the final design (and/or are established legislative requirements/good practice) have been taken into account as part of the initial assessment presented in **section 4.10** to **4.12** below (i.e., the initial determination of impact magnitude and significance of effects assumes

implementation of these measures). This ensures that the measures to which the Applicant is committed are taken into account in the assessment of effects.

4.8.4 Where an assessment identifies likely significant adverse effects, further or secondary mitigation measures may be applied. These are measures that could further prevent, reduce and, where possible, offset these effects. They are defined by IEMA as actions that will require further activity in order to achieve the anticipated outcome and may be imposed as part of the planning consent, or through inclusion in the ES (referred to as secondary mitigation measures in IEMA, 2016). For further or secondary measures both pre-mitigation and residual effects are presented.

**Table 4.18: Mitigation measures adopted as part of the Proposed Development**

| Commitment Number | Measure Adopted | How the Measure Will be Secured |
|---|---|---|
| **Embedded Measures** | | |
| OFF05 | An Offshore CEMP will set out the detailed approach to offshore construction 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 (via the Offshore Biosecurity Plan); and dropped object procedures. An Outline Offshore CEMP (document reference 7.9) forms part of the application for DCO (with a final Offshore CEMP finalised by the offshore contractor).) | The Offshore CEMP is a requirement of the Deemed Marine Licence. |
| OFF07 | A MPCP will form part of the final Offshore CEMP and will include measures to minimise the impact of any pollution events arising from the Proposed Development, and will comply with the International Convention for the Prevention of Pollution from Ships (MARPOL). | Requirement of the Outline Offshore CEMP (document ref. 7.9). |
| OFF11 | The NSVMP 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. The NSVMP will include protocols for vessel communications, lighting and maintenance of "safe" distances (which will be monitored by guard vessels during the construction period). An outline NSVMP is provided as Volume 3, Appendix 5.2 Navigational Safety and Vessel Management Plan of the ES; the NSVMP will be updated to final by the offshore construction contractor. | Requirement of the Outline Offshore CEMP (document ref. 7.9). |
| **Secondary (Further) Measures** | | |
| N/A | | |
| **Enhancement Measures** | | |
| N/A | | |

# 4.9 Key Parameters for Assessment

## Maximum Design Scenario

4.9.1 The maximum design scenarios identified in **Table 4.19** 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 information provided in Volume 1, Chapter 3: Project Description of the ES. 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. Therefore, this comprises a conservative assessment of a worst case scenario.

**Table 4.19: Maximum design scenario considered for the assessment of impacts**

| Impact | Phase[1] | | | Maximum Design Scenario | Justification |
|---|---|---|---|---|---|
| | C | O | D | | |
| Auditory injury (Permanent Threshold Shift; PTS) and temporary (Temporary Threshold Shift; TTS) changes in hearing due to anthropogenic noise | ✓ | ✓ | ✓ | **Construction phase**<br>• Cable installation activities will be undertaken on a 24 hour/7-day basis<br>• Pre-lay, burial and protection activities will progress broadly in parallel with cable lay and burial a few days apart<br>• The precise number of vessels to be used is to be determined, however, it is expected that up to five trenching vessels, two pre-installation vessels, two rock placement vessels, one CLV (two for brief periods during changeovers), and up to 20 guard vessels stationed every 10 nautical miles (post cable lay, prior to cable protection). | This is based on the maximum number of vessels stated within Volume 1, Chapter 3: Project Description of the ES.<br><br>The maximum number of vessels and associated vessel operations represents the maximum potential for auditory injury and temporary changes in hearing due to anthropogenic noise. |
| | | | | **Operation and Maintenance phase**<br>• One survey vessel to undertake routine post installation inspection surveys under the following survey schedule:<br>- Routine surveys of the offshore submarine cables shall commence two years from the commissioning of the first Bipole.<br>- If no issues are found, the next follow up survey would be in three years, with the interval increasing by one year each time, until the period between surveys reaches five years.<br>- If no issues are found, routine surveying through the remainder of the operational phase, is likely to be conducted on a five-year basis.<br>- If an issue is found, it will be flagged for further investigation, and mobilisation of repair as appropriate.<br>• Repair works (cable cut, recovery, and burial activities) assumed similar to construction phase (noting on a localised scale). | |
| | | | | **Decommissioning phase** | |

| Impact | Phase[1] | | | Maximum Design Scenario | Justification |
|---|---|---|---|---|---|
| | C | O | D | | |
| | | | | • Cable deburial and removal works assumed similar to construction phase in terms of activities and vessel types. | |
| Increased disturbance by anthropogenic noise - from ground condition surveys, seabed preparation, route clearance, cable lay, and burial activities.<br><br>Includes similar construction type activities where required during operational and decommissioning phases | ✓ | ✓ | ✓ | **Construction phase**<br>• Cable installation activities will be undertaken on a 24 hour/7-day basis<br>• Pre-lay, burial and protection activities will progress broadly in parallel with cable lay and burial a few days apart<br>• The precise number of vessels to be used is to be determined, however, it is expected that up to five trenching vessels, two pre-installation vessels, two rock placement vessels, one CLV (two for brief periods during changeovers), and up to 20 guard vessels stationed every 10 nautical miles (post cable lay, prior to cable protection).<br><br>**Operation and Maintenance phase**<br>• One survey vessel to undertake routine post installation inspection surveys under the following survey schedule:<br>- Routine surveys of the offshore submarine cables shall commence two years from the commissioning of the first Bipole.<br>- If no issues are found, the next follow up survey would be in three years, with the interval increasing by one year each time, until the period between surveys reaches five years.<br>- If no issues are found, routine surveying through the remainder of the operational phase, is likely to be conducted on a five-year basis.<br>- If an issue is found, it will be flagged for further investigation, and mobilisation of repair as appropriate.<br>• Repair works (cable cut, recovery, and burial activities) assumed similar to construction phase (noting on a localised scale).<br><br>**Decommissioning phase**<br>• 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 Volume 1, Chapter 3: Project Description of the ES.<br><br>The maximum number of vessels and associated vessel operations represents the maximum potential for noise disturbance. |

| Impact | Phase[1] | | | Maximum Design Scenario | Justification |
|---|---|---|---|---|---|
| | C | O | D | | |
| Increased vessel disturbance | ✓ | ✓ | ✓ | **Construction phase**<br>• Cable installation activities will be undertaken on a 24 hour/7-day basis<br>• Pre-lay, burial and protection activities will progress broadly in parallel with cable lay and burial a few days apart<br>• The precise number of vessels to be used is to be determined, however, it is expected that up to five trenching vessels, two pre-installation vessels, two rock placement vessels, one CLV (two for brief periods during changeovers), and up to 20 guard vessels stationed every 10 nautical miles (post cable lay, prior to cable protection) | This is based on the maximum number of vessels stated within Volume 1, Chapter 3: Project Description of the ES.<br><br>The maximum number of vessels and associated vessel movement represents the maximum potential for vessel disturbance. |
| | | | | **Operational and Maintenance activities**<br>• One survey vessel to undertake routine post installation inspection surveys under the following survey schedule:<br>- Routine surveys of the offshore submarine cables shall commence two years from the commissioning of the first Bipole.<br>- If no issues are found, the next follow up survey would be in three years, with the interval increasing by one year each time, until the period between surveys reaches five years.<br>- If no issues are found, routine surveying through the remainder of the operational phase, is likely to be conducted on a five-year basis.<br>- If an issue is found, it will be flagged for further investigation, and mobilisation of repair as appropriate.<br>• Repair works (cable cut, recovery, and burial activities) assumed similar to construction phase (noting on a localised scale). | |
| | | | | **Decommissioning phase**<br>• Cable deburial and removal works assumed similar to construction phase in terms of activities and vessel types. | |
| | ✓ | ✓ | ✓ | **Construction phase** | |

| Impact | Phase[1] | | | Maximum Design Scenario | Justification |
|---|---|---|---|---|---|
| | C | O | D | | |
| Vessel collision risk | | | | • Cable installation activities will be undertaken on a 24 hour/7-day basis<br>• Pre-lay, burial and protection activities will progress broadly in parallel with cable lay and burial a few days apart<br>• The precise number of vessels to be used is to be determined, however, it is expected that up to five trenching vessels, two pre-installation vessels, two rock placement vessels, one CLV (two for brief periods during changeovers), and up to 20 guard vessels stationed every 10 nautical miles (post cable lay, prior to cable protection). | This is based on the maximum number of vessels stated within Volume 1, Chapter 3: Project Description of the ES.<br><br>The maximum number of vessels and associated vessel movement represents the maximum potential for vessel collision. |
| | | | | **Operational and Maintenance activities**<br>• One survey vessel to undertake routine post installation inspection surveys under the following survey schedule:<br>- Routine surveys of the offshore submarine cables shall commence two years from the commissioning of the first Bipole.<br>- If no issues are found, the next follow up survey would be in three years, with the interval increasing by one year each time, until the period between surveys reaches five years.<br>- If no issues are found, routine surveying through the remainder of the operational phase, is likely to be conducted on a five-year basis.<br>- If an issue is found, it will be flagged for further investigation, and mobilisation of repair as appropriate.<br>• Repair works (cable cut, recovery, and burial activities) assumed similar to construction phase (noting on a localised scale). | |
| | | | | **Decommissioning phase**<br>• Cable deburial and removal works assumed similar to construction phase in terms of activities and vessel types. | |
| Indirect impacts resulting from impacts on marine | ✓ | ✓ | ✓ | **Construction phase**<br>• The worst case scenario for impacts which are specific to fish and shellfish at construction, and which may therefore have | |

| Impact | Phase[1] | | | Maximum Design Scenario | Justification |
|---|---|---|---|---|---|
| | C | O | D | | |
| mammal prey species | | | | an indirect effect on marine mammals, is presented within Volume 3, Chapter 2: Fish and Shellfish Ecology of this ES.<br>**Operational and Maintenance activities**<br>• The worst case scenario for impacts which are specific to fish and shellfish at operation and maintenance phase, and which may therefore have an indirect effect on marine mammals, is presented within Volume 3, Chapter 2: Fish and Shellfish Ecology of this ES.<br>**Decommissioning phase**<br>• The worst case scenario for impacts which are specific to fish and shellfish at decommissioning phase, and which may therefore have an indirect effect on marine mammals, is presented within Volume 3, Chapter 2: Fish and Shellfish Ecology of this ES. | |
| EMF Impacts | × | ✓ | × | **Operational and Maintenance activities**<br>• Maximum offshore cable length is 370 km in UK waters. | This is based on the maximum cable length stated within Volume 1, Chapter 3: Project Description of the ES.<br><br>The maximum cable length represents the maximum potential for EMF impacts. |
| Indirect Impacts through changes to the seabed | × | ✓ | × | **Operational and Maintenance activities**<br>• The worst case scenario for impacts which may therefore have an indirect effect on marine mammals during operation and maintenance phase, is presented within Volume 3, Chapter 1: Benthic Ecology of the ES. | |
| Removal of hard substrate | × | × | ✓ | **Decommissioning phase**<br>• The worst case scenario for impacts which may therefore have an indirect effect on marine mammals during decommissioning phase, is presented within Volume 3, Chapter 1: Benthic Ecology of the ES. | |

[1] C=construction, O=operation and maintenance, D=decommissioning

# 4.10 Assessment of Construction Effects

## Introduction

4.10.1 The impacts of the construction of the Proposed Development have been assessed. The impacts arising from the construction phase of the Proposed Development are listed in **Table 4.19**, along with the maximum design scenario against which each impact has been assessed.

4.10.2 A description of the likely effect on receptors caused by each identified impact is given below.

## Injury and temporary changes in hearing from anthropogenic noise

4.10.3 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.

4.10.4 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.

4.10.5 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.

4.10.6 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, 2020a). 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 4.20** presents the generalised hearing ranges, as highlighted in Southall *et al.* (2019), for the relevant marine mammal species.

**Table 4.20: 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 |

4.10.7 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).

4.10.8 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.

4.10.9 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).

4.10.10 The current set of TTS-onset thresholds presented by Southall *et al.* (2019) define a TTS-onset as the exposure required to produce a 6 dB shift in the hearing threshold. However, data upon which these thresholds are based for TTS-onset in marine mammals from impulsive or non-impulsive noise is extremely limited. It is therefore necessary to determine exposure functions for TTS in order to estimate the levels at which the onset of PTS could occur, as experiments inducing PTS in animals are considered unethical. Southall *et al.* (2007) predict an exposure of 40 dB of TTS would result in PTS onset in marine mammals. Southall *et al.* (2007) define TTS in marine mammals as 'the minimum threshold shift clearly larger than any day-to-day or session-to-session variation in a subject's normal hearing ability' for the purposes of developing these thresholds, and that it was 'typically the minimum amount of threshold shift that can be differentiated in most

experimental conditions'. Thus, the adoption of this TTS-onset threshold would typically result in overestimates of potential impact ranges at which ecologically significant effects could occur in marine mammals. In addition, as TTS-onset is defined primarily as a means of predicting PTS-onset, there is currently no threshold for TTS-onset that would indicate a biologically significant amount of TTS in marine mammals. Therefore, it was not possible to carry out a quantitative assessment of the sensitivity, magnitude, or significance of the impact of TTS on marine mammals.

4.10.11 Underwater noise also has the potential to impact sea turtles if the frequency is within their hearing range (**Table 4.21**). The current standing in the scientific community is that fish hearing (rather than mammalian hearing) is the preferred model for marine turtles until more data becomes available (Popper *et al.*, 2014). For this, Popper *et al.* (2014) proposed the adoption of underwater noise thresholds for Group two fish, which include fishes sensitive to particle motion only; the authors considered this a precautionary approach for marine turtles. 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 sea turtle hearing capabilities and responses to sound (Dow Piniak *et al*., 2012).

**Table 4.21: Sea turtle hearing range (Popper *et al*, 2014)**

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

4.10.12 This impact assessment will focus on physiological injury to and temporary hearing changes in marine mammals and turtles as a result of underwater noise from construction activities (non-impulsive sources). For marine mammal impact assessment, it was based on the $SPL_{peak}$ and $SEL_{cum}$ onset thresholds presented by Southall et al. (2019) and listed in **Table 4.22**.For turtles impact assessment, the approach is described above (**paragraph 4.10.11**) with further details in **paragraph 4.10.39**.

**Table 4.22: PTS and TTS -onset thresholds for non-impulsive noise (Southall *et al.*, 2019).**

| Functional Hearing Group | Relevant Species | Cumulative PTS ($SEL_{cum}$ dB re 1 $\mu Pa^2s$ weighted) | Cumulative TTS ($SEL_{cum}$ dB re 1 $\mu Pa^2s$ weighted) |
|---|---|---|---|
| Very High Frequency (VHF) cetacean | Harbour porpoise | 173 | 153 |
| High Frequency (HF) cetacean | Bottlenose dolphin, Risso's dolphin, common dolphin | 198 | 178 |
| Low Frequency (LF) cetacean | Minke whale | 199 | 179 |
| Phocid (in water) (PCW) | Grey seal | 201 | 181 |

## Sensitivity of the Receptor

4.10.13 For marine mammals, hearing is a key sensory mechanism via which they negotiate the underwater environment. It is essential for navigation, communication and locating prey (Southall *et al*., 2007). Permanent and irreversible hearing impairment (PTS), therefore has the potential to negatively affect vital life functions, including foraging, mating and predator detection, with possible consequences to an animal's health or vital rates (Erbe *et al*., 2018). This could result in disruption in key life functions and deterioration of health, possibly leading to mortality of individuals and reduced birth rates. A non-recoverable elevation of the hearing threshold by 6dB is considered to constitute the onset of PTS (Southall *et al.*, 2007).

4.10.14 At a Department of Business, Energy, and Industrial Strategy (BEIS)-funded expert elicitation workshop in 2018, experts discussed the nature, extent, and potential consequences of PTS to marine mammal species in the UK (Booth *et al.*, 2019). Using the best and most recent data available on the effects of PTS on marine mammals, the experts concluded that PTS did not mean animals were deaf, but more that they permanently lose sensitivity in hearing across the impacted frequencies. The magnitude and frequency band in which PTS occurs is critical to assessing the effect on vital rates.

4.10.15 As detailed in paragraph 4.10.9, no TTS assessment of species sensitivity is given for marine mammal receptors because there are no thresholds to determine a biologically significant effect from TTS-onset. In addition, modelled disturbance ranges are higher than modelled TTS ranges, so any impacts are captured in the disturbance assessment.

### Harbour Porpoise

4.10.16 Harbour porpoise are considered to be a cetacean with a very high frequency (VHF) hearing range (**Table 4.20**, Southall *et al*., 2019). The species has a vocal repertoire (and hearing range) ranging between 275 Hz to 160 kHz (NMFS, 2018; Southall *et al*., 2019) which includes their VHF, short-range and narrow-band high-frequency (NBHF) echolocation clicks. The hearing sensitivity of harbour porpoises is greatest in the higher part of this range (e.g. 100 to 125 kHz; Morell *et al*., 2021).

4.10.17 According to **Table 4.23** below, the operating frequency of the proposed activities range from 10Hz to 10 kHz, which is within the hearing range yet outside of the peak hearing sensitivity in harbour porpoises.

4.10.18 During an expert elicitation workshop, experts discussed the nature, extent, and potentially consequences of PTS from low-frequency impulsive noise (such as from piling and airgun pulses) to harbour porpoises; concluding that the probability of PTS significantly affecting the survival and reproduction of harbour porpoises was very low (Booth and Heinis, 2018). Continuous noise from the Proposed Development is generally considered to be very unlikely to result in PTS in marine mammals due to its non-impulsive nature, as such it is not likely to alter population trajectories in harbour porpoises.

4.10.19 PTS is a permanent effect which cannot be recovered from. While also considering harbour porpoise's sensitivity to low frequency noise, the species is considered to be of reasonable adaptability, high tolerance, have no recoverability, and is of very high value. The sensitivity of the receptor is **low**.

## Bottlenose Dolphin

4.10.20 Bottlenose dolphin are classed as a cetacean with a high frequency hearing range (**Table 4.20**, Southall *et al*., 2019). The species has a vocal repertoire ranging between 200 Hz to 135 kHz (including barks (0.2 – 16 kHz), whistles (0.8 – 24 kHz; peak 3.5 – 14.5 kHz) and echolocation (peak 15 – 135 kHz); David, 2006; Nachtigall *et al*., 2016). However, their hearing range also extends to 150 kHz (Nachtigall *et al.,* 2016). The hearing sensitivity of bottlenose dolphins is greatest in the higher part of this range (e.g. 15 to 110 kHz; Johnson, 1967).

4.10.21 According to **Table 4.23** below, the operating frequency of the proposed activities range from 10Hz to 10 kHz, which is within the hearing range yet outside of the peak hearing sensitivity in bottlenose dolphins.

4.10.22 As described for harbour porpoise, continuous noise from the Proposed Development is generally considered to be very unlikely to result in PTS in marine mammals due to its non-impulsive nature, as such it is not likely to alter population trajectories in bottlenose dolphin.

4.10.23 PTS is a permanent effect which cannot be recovered from. While also considering bottlenose dolphin's sensitivity to low frequency noise, the species is considered to be of reasonable adaptability, high tolerance, have no recoverability, and is of very high value. The sensitivity of the receptor is **low**.

## Risso's Dolphin

4.10.24 Like bottlenose dolphin, Risso's dolphin are considered to be a cetacean with a high frequency hearing range (**Table 4.20**, Southall *et al*., 2019). The species has a vocal repertoire (and hearing range) ranging between 4 kHz to 128 kHz, with a peak in hearing sensitivity at 11.2 kHz and between 40 and 80 kHz (Mooney *et al*., 2015).

4.10.25 According to **Table 4.23** below, the operating frequency of the proposed activities range from 10Hz to 10 kHz, which is within the hearing range yet outside of the peak hearing sensitivity in Risso's dolphin.

4.10.26 As described for bottlenose dolphin, continuous noise from the Proposed Development is generally considered to be very unlikely to result in PTS in marine mammals due to its non-impulsive nature, as such it is not likely to alter population trajectories in Risso's dolphin.

4.10.27 PTS is a permanent effect which cannot be recovered from. While also considering Risso's dolphin's sensitivity to low frequency noise, the species is considered to be of reasonable adaptability, high tolerance, have no recoverability, and is of very high value. The sensitivity of the receptor is **low**.

## Common Dolphin

4.10.28 Common dolphin also falls into the cetacean with a high frequency hearing range classification (**Table 4.20**, Southall *et al*., 2019). The species has a vocal repertoire within and hearing range between 600 Hz and 160 kHz, with a peak in hearing sensitivity between 400 and 600 Hz and between 1.2 and 1.3 kHz (Houser *et al*., 2022).

4.10.29 According to **Table 4.23** below, the operating frequency of the proposed activities range from 10Hz to 10 kHz, which is within the hearing range and peak hearing sensitivity in common dolphin.

4.10.30 As described above, continuous noise from the Proposed Development is generally considered to be very unlikely to result in PTS in marine mammals due to its non-impulsive nature, as such it is not likely to alter population trajectories in common dolphin.

4.10.31 PTS is a permanent effect which cannot be recovered from. While also considering common dolphin's sensitivity to low frequency noise, the species is considered to be of reasonable adaptability, reasonable tolerance, have no recoverability, and is of very high value. The sensitivity of the receptor is **medium**.

### Minke Whale

4.10.32 Minke whale are classed as a cetacean with a low frequency hearing range (Southall *et* al., 2019). Estimations of an audiogram for minke whale are rare (Ketten and Mountain, 2011; Boisseau *et al.,* 2021). No direct measures of auditory threshold have been made for baleen whales, in part due to the challenges associated with studying large animals in controlled environments; therefore, current understanding of their hearing range is assumed to overlap the bandwidth of vocalisations. Minke whales produce low-frequency vocalisations between 50 Hz and 9.4 kHz (Edds-Walton, 2000; Gedamke et al., 2001; Mellinger et al., 2000; Risch et al., 2013; 2014). It is estimated that their hearing range falls between 40 Hz and 15 kHz due to behavioural responses to vessels and ADDs outwith their recorded vocalising range (Ketten and Mountain, 2011; Risch et al. 2013; Cranford and Krysl, 2015; Boisseau et al., 2021). Tubeli *et al.* (2012) estimated the most sensitive hearing range for minke whales extends from 30 to 100 Hz and 7.5 to 25 kHz.

4.10.33 According to **Table 4.23** below, the operating frequency of the proposed activities range from 10Hz to 10 kHz, which is within the hearing range and peak hearing sensitivity in minke whale.

4.10.34 As described for dolphin species, continuous noise from the Proposed Development is generally considered to be very unlikely to result in PTS in marine mammals due to its non-impulsive nature, as such it is not likely to alter population trajectories in minke whale.

4.10.35 PTS is a permanent effect which cannot be recovered from. While also considering minke whale's sensitivity to low frequency noise, the species is considered to be of reasonable adaptability, reasonable tolerance, have no recoverability, and is of very high value. The sensitivity of the receptor is **medium**.

### Grey Seal

4.10.36 For the purposes of PTS and TTS assessment, grey seal is considered to be a Phocid in Water (Southall *et al*., 2019). Grey seal use sound both in air and water for communication, predator avoidance, and reproductive interactions, and are less dependent on hearing for foraging than cetaceans (Deecke *et al*., 2002). The species has very well developed tactile sensory systems that are used for foraging, but in certain conditions they may also listen to sounds produced by vocalising fish whilst hunting for prey (Dehnhardt *et al*., 2001; Schulte-Pelkum *et al.*, 2007). Seals may rely on sound for communication with conspecifics and predator avoidance (Deeke *et al*., 2002).

4.10.37 As described for dolphin species, continuous noise from the Proposed Development is generally considered to be very unlikely to result in PTS in marine

mammals due to its non-impulsive nature, as such it is not likely to alter population trajectories in grey seal.

4.10.38 PTS is a permanent effect which cannot be recovered from, whereas grey seal appear to be less dependent on sound for vital activities. The species is considered to be of high adaptability, high tolerance, have no recoverability, and is of very high value. The sensitivity of the receptor is **low**.

### Leatherback Turtle

4.10.39 Leatherback turtle are seasonal migrants to UK waters with a preference for more oceanic areas during summer and autumn months. There are limited data on the hearing abilities of leatherback turtle, their uses of sound or their vulnerability to sound exposure. Examinations of green and loggerhead sea turtles (Lenhardt *et al.*, 1985; Wever 1978; Ridgway *et al.,* 1969) revealed that these marine turtles, from the family Cheloniidae, possess a reptilian ear with underwater adaptations, with the retention of air in the middle ear suggesting the ability to detect sound pressure. It is assumed that leatherback turtle, from the family Dermochelyidae, have the same or similar adaptations. The current standing in the scientific community is that fish hearing (rather than mammalian hearing) is the preferred model for marine turtles until more data becomes available (Popper *et al.,* 2014). For this, Popper *et al.* (2014) proposed the adoption of underwater noise thresholds for Group two fish, which include fishes sensitive to particle motion only; the authors considered this a precautionary approach for marine turtles. Using these thresholds, non-impulsive noise is unlikely to result in mortality, potential mortal injury or minor auditory issue injury (recoverable injury) in marine turtles (Popper *et al.*, 2014).

4.10.40 Considering sea turtle's general sensitivity to underwater noise, leatherback turtle are considered to be of high adaptability, high tolerance, have no recoverability, and are of very high value. The sensitivity of the receptor is **negligible**.

## Magnitude of Impact

4.10.41 Project activities that are expected to operate at frequencies within the hearing ranges of the marine mammal and sea turtle receptors are provided in **Table 4.23**.

**Table 4.23: Operating frequencies of different activities. Source: Volume 3, Appendix 4.1: Underwater Noise Technical Assessment of the ES**

| 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 |

Table notes: *Dredging included as slightly greater frequency range than seabed clearance (ensuring a precautionary assessment).

4.10.42 Underwater noise modelling (Volume 3, Appendix 4.1: Underwater Noise Technical Assessment, of the ES) 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 4.22**). Sea turtles were not assessed in the underwater modelling, as they aren't considered a separate hearing group.

## Marine Mammals

4.10.43 For marine mammals, underwater noise from all activities listed in **Table 4.23** is not predicted to exceed the cumulative PTS thresholds ($SEL_{cum}$) for any of the FHGs (Volume 3, Appendix 4.1: Underwater Noise Technical Assessment, of the ES). While for TTS, the largest onset impact ranges considering $SEL_{cum}$ thresholds are predicted for cable burial by water jetting, which are estimated to be less than 940 m for minke whale (low frequency cetaceans) and less than 160 m for grey seal (phocids in water) (**Table 4.24**). Underwater noise from the proposed activities is not estimated to exceed the cumulative TTS thresholds for harbour porpoise (very high frequency cetaceans) and dolphin species (high frequency cetaceans) (**Table 4.24**).

**Table 4.24: Summary of the modelled TTS-onset impact ranges for marine mammals. Source: Volume 3, Appendix 4.1: Underwater Noise Technical Assessment of the ES**

| Activity | Impact ranges (m) | | | |
|---|---|---|---|---|
| | LF Cetaceans | HF Cetaceans | VHF Cetaceans | PCW |
| **Thresholds: $SEL_{cum}$, dB re 1 $\mu Pa^2s$** | 179 | 178 | 153 | 181 |
| **Seabed obstacle clearance** | <20 | Not Reached | Not Reached | Not Reached |
| **Mass flow excavation** | Not Reached | Not Reached | Not Reached | Not Reached |
| **Dredging** | <110 | Not Reached | Not Reached | <20 |
| **Cable burial – water jetting** | <940 | Not Reached | Not Reached | <160 |
| **Cable burial – mechanical cutter** | <110 | Not Reached | Not Reached | <20 |

| Activity | Impact ranges (m) | | | |
|---|---|---|---|---|
| | LF Cetaceans | HF Cetaceans | VHF Cetaceans | PCW |
| **HDD** | Not Reached | Not Reached | Not Reached | Not Reached |
| **Installation of Rock protection** | <110 | Not Reached | Not Reached | <20 |
| **Associated vessel movements – tug** | Not Reached | Not Reached | Not Reached | Not Reached |
| **Associated vessel movements – cable lay vessel** | <110 | Not Reached | Not Reached | <20 |

4.10.44 The modelled results of PTS and TTS impact ranges are considered precautionary as a lower worst-case swimming speed of 1.5 m/s was assumed for all FHGs including both adults and juveniles, and that marine mammal receptor was modelled fleeing from the immediate vicinity of the noise source. It also did not consider the fact that the sound source was also moving, and that as distance between source and receiver (i.e. animal) increased, 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.

4.10.45 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 or TTS onsets will occur for any of the FHGs as a result of the Proposed Development.

4.10.46 The $SEL_{cum}$ thresholds of PTS-onset are not reached for all FHGs of marine mammal receptors. The magnitude of PTS at construction phase is therefore **negligible (adverse)**. As detailed in **paragraph 4.10.9**, no assessment of TTS impact magnitude is given because there are no thresholds to determine a biologically significant effect from TTS-onset.

## Leatherback Turtle

4.10.47 According to **Table 4.23,** all proposed activities are not estimated to exceed the weighted $SEL_{cum}$ or unweighted $SPL_{peak}$ thresholds (210 dB re 1 µPa² s and 207 dB re 1µPa respectively, Popper *et al*., 2014) of hearing injury or mortality in sea turtles. Popper *et al.* (2014) also highlight that the relative risk of mortality and potential mortal injury, recoverable injury[1] or TTS in sea turtles is low even when

[1] According to Popper *et al.* (2014), mortality and mortal injury are defined as the immediate or delayed death in receptors, while recoverable injury refers to injuries that are not likely to cause direct mortality, such as hair cell damage, minor internal and external bleeding.

individual is close to (tens of metres) the sources of shipping and other continuous sounds.

4.10.48 Based on the above, the impacts of PTS and TTS are predicted to be of very localised spatial extent and very short term duration. The magnitude of PTS and TTS at construction phase is therefore **negligible (adverse)**.

## Significance of the Effect

### Harbour Porpoise

4.10.49 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on harbour porpoise based on the modelling results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in very high frequency cetaceans.

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

### Bottlenose Dolphin

4.10.51 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on bottlenose dolphin based on the modelling results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in high frequency cetaceans.

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

### Risso's Dolphin

4.10.53 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on Risso's dolphin based on the modelling results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in high frequency cetaceans.

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

### Common Dolphin

4.10.55 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on common dolphin based on the modelling results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in high frequency cetaceans.

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

### Minke Whale

4.10.57 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on minke whale based on the modelling results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in low frequency cetaceans.

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

### Grey Seal

4.10.59 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on grey seals based on the modelling results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in phocids in water.

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

### Leatherback Turtle

4.10.61 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS or TTS would occur on leatherback turtles based on the evidence provided above.

4.10.62 Overall, the magnitude of the impact is **negligible (adverse),** 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

4.10.63 The significance of PTS impact on marine mammals and sea turtles, and TTS impact on sea turtles as a result of construction activities is assessed as not significant in EIA terms. Therefore, no further mitigation is proposed and not deemed necessary.

## Future Monitoring

4.10.64 The significance of PTS impact on marine mammals and sea turtles, and TTS impact on sea turtles as a result of construction activities is assessed as not significant in EIA terms. Therefore, no future monitoring is considered necessary.

# Disturbance from anthropogenic noise

4.10.65 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.

4.10.66 Underwater noise from construction activities can cause displacement and disturbance to marine mammals (Brandt *et al*., 2011; Culloch *et al.,* 2016; Graham

*et al*., 2019; Pirotta *et al.,* 2014; Stone *et al.,* 2017) and sea turtles (Díaz *et al.,* 2024; Tyson *et al.,* 2017) which can have various impacts depending on the sensitivity of the receptor to the noise, importance of the area to the receptor and duration that the sound source is active for.

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

## Sensitivity of the Receptor

### Harbour Porpoise

4.10.68 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).

4.10.69 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).

4.10.70 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).

4.10.71 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).

4.10.72 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.

4.10.73 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).

4.10.74 A review of potential effects of various cable types and installation methods including burial ploughs, tracked burial 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 reasonable adaptability, reasonable tolerance, have high recoverability, and are of very high value. The sensitivity of the receptor is **medium**.

### Bottlenose Dolphin

4.10.75 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.

4.10.76 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).

4.10.77 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

4.10.78 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.

4.10.79 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).

4.10.80 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

4.10.81 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.

4.10.82 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).

4.10.83 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

4.10.84 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).

4.10.85 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).

4.10.86 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.

4.10.87 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

4.10.88 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.

4.10.89 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).

4.10.90 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).

4.10.91 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

4.10.92 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 4.23** (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).

4.10.93 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).

4.10.94 Díaz *et al.,* (2024) note that sea turtles increase time travelling and scanning for food or predators with an increased 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.

4.10.95 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.

4.10.96 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.

4.10.97 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

4.10.98 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 4.23**Table 4.23.

4.10.99 Underwater noise modelling (Volume 3, Appendix 4.1: Underwater Noise Technical Assessment, of the ES) has been undertaken to estimate the impact ranges of behavioural disturbance in marine mammals as a result of underwater noise from the Proposed Development, and the ranges are listed in **Table 4.25**. These impact ranges were calculated using the National Marine Fisheries Service disturbance (onset of behavioural response) threshold for all marine mammal species for non-impulsive criteria (NMFS, 2023). Sea turtles were not assessed in the underwater modelling.

4.10.100 The largest unweighted $SPL_{rms}$ impact range is predicted for cable burial by water jetting and is estimated to be 73.6 km, based on a behavioural disturbance threshold of 120 dB $SPL_{rms}$ for all marine mammal species (Volume 3, Appendix 4.1: Underwater Noise Technical Assessment, of the ES). The modelled impact ranges are considered precautionary assuming a lower worst-case swimming speed of 1.5 m/s for all marine mammal species (including both adults and juveniles). 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.

**Table 4.25: Summary of the modelled underwater noise disturbance impact ranges for marine mammals. Source: Volume 3, Appendix 4.1: Underwater Noise Technical Assessment of the ES**

| Activity | Impact ranges (m) |
|---|---|
| **Seabed obstacle clearance** | <16,900 |
| **Mass flow excavation** | <1,400 |
| **Dredging** | <34,200 |
| **Cable burial – water jetting** | <73,600 |
| **Cable burial – mechanical cutter** | <34,200 |
| **HDD** | <470 |
| **Installation of Rock protection** | <36,400 |
| **Associated vessel movements – tug** | <3,000 |
| **Associated vessel movements – cable lay vessel** | <34,200 |

## Harbour Porpoise

4.10.101 Construction activities are expected to operate at frequencies within the hearing range of harbour porpoise (**Table 4.20**).

4.10.102 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 Technical Assessment, of the ES).

4.10.103 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 UK waters 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.

4.10.104 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).

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

4.10.106 Fixed EDRs are advised within JNCC (2020a) guidance to account for a radius 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.

4.10.107 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.

4.10.108 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.

4.10.109 The cable burial progress speed is estimated at 150 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. As outlined in Volume 3, Chapter 5: Shipping and Navigation of the ES, 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.

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

### Bottlenose Dolphin

4.10.111 Construction activities are expected to operate at frequencies within the hearing range of bottlenose dolphin (**Table 4.20**).

4.10.112 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 Technical Assessment, of the ES).

4.10.113 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 UK waters 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.

4.10.114 A review of potential effects of various cable types and installation methods including burial ploughs, tracked burial 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).

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

4.10.116 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.

4.10.117 The cable burial progress will be around 150 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. As outlined in Volume 3, Chapter 5: Shipping and Navigation of the ES, 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.

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

## Risso's Dolphin

4.10.119 Construction activities are expected to operate at frequencies within the hearing range of Risso's dolphin (**Table 4.20**).

4.10.120 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 Technical Assessment, of the ES).

4.10.121 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 UK waters 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.

4.10.122 A review of potential effects of various cable types and installation methods including burial ploughs, tracked burial 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).

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

4.10.124 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.

4.10.125 The cable burial progress is around 150 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. As outlined in Volume 3, Chapter 5: Shipping and Navigation of the ES, 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.

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

### Common Dolphin

4.10.127 Construction activities are expected to operate at frequencies within the hearing range of common dolphin (**Table 4.20**).

4.10.128 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 Technical Assessment, of the ES).

4.10.129 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 UK waters 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.

4.10.130 A review of potential effects of various cable types and installation methods including burial ploughs, tracked burial 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).

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

4.10.132 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.

4.10.133 The cable burial progress is around 150 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. As outlined in

Volume 3, Chapter 5: Shipping and Navigation of the ES, 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.

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

### Minke Whale

4.10.135 Construction activities are expected to operate at frequencies within the hearing range of minke whale (**Table 4.20**).

4.10.136 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 Technical Assessment, of the ES).

4.10.137 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 UK waters 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.

4.10.138 A review of potential effects of various cable types and installation methods including burial ploughs, tracked burial 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).

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

4.10.140 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.

4.10.141 The cable burial progress is around 150 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. As outlined in Volume 3, Chapter 5: Shipping and Navigation of the ES, 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.

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

### Grey Seal

4.10.143 Construction activities are expected to operate at frequencies within the hearing range of grey seal (**Table 4.20**).

4.10.144 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 Technical Assessment, of the ES).

4.10.145 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 UK waters 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.

4.10.146 A review of potential effects of various cable types and installation methods including burial ploughs, tracked burial 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).

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

4.10.148 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.

4.10.149 The cable burial progress will be around 150 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. As outlined in Volume 3, Chapter 5: Shipping and Navigation of the ES, 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.

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

### Leatherback Turtle

4.10.151 Construction activities are expected to operate at frequencies within the hearing range of leatherback turtles (**Table 4.21**).

4.10.152 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).

4.10.153 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 $\mu Pa^2$ 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 and 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).

4.10.154 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.

4.10.155 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).

4.10.156 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.

4.10.157 The cable burial progress will be around 150 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. As outlined in Volume 3, Chapter 5: Shipping and Navigation of the ES, 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.

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

## Significance of the Effect

### Harbour Porpoise

4.10.159 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.

4.10.160 Overall, the magnitude of the impact is **low (adverse),** 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

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

4.10.162 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.

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

### Risso's Dolphin

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

4.10.165 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.

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

### Common Dolphin

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

4.10.168 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.

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

### Minke Whale

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

4.10.171 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.

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

### Grey Seal

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

4.10.174 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.

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

### Leatherback Turtle

4.10.176 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.

4.10.177 Overall, the magnitude of the impact is **low (adverse),** 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

4.10.178 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 further mitigation is proposed, or considered necessary.

## Future Monitoring

4.10.179 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

4.10.180 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.

4.10.181 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 90 vessels recorded per day, with approximately 74 vessels per day recorded crossing the Offshore Cable Corridor. The busiest day recorded 122 vessels. The most common vessel type was cargo vessels, accounting for 50% of vessels within the study area with an average of 44 vessels per day. Tankers (20%), fishing vessels (15%) and recreational vessels (7%) also accounted for a large proportion of vessel traffic (See Volume 3, Chapter 5: Shipping and Navigation of the ES for further information).

4.10.182 This impact assessment will focus on increased vessel disturbance from construction activities.

## Sensitivity of receptor

### Harbour Porpoise

4.10.183 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).

4.10.184 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).

4.10.185 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).

4.10.186 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).

4.10.187 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).

4.10.188 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).

4.10.189 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

4.10.190 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.

4.10.191 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.

4.10.192 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).

4.10.193 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.

4.10.194 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

4.10.195 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).

4.10.196 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).

4.10.197 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.

4.10.198 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

4.10.199 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).

4.10.200 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).

4.10.201 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.

4.10.202 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.

4.10.203 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

4.10.204 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).

4.10.205 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).

4.10.206 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.

4.10.207 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.

4.10.208 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

4.10.209 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).

4.10.210 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.

4.10.211 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).

4.10.212 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.

4.10.213 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).

4.10.214 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

4.10.215 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.

4.10.216 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.

4.10.217 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.

4.10.218 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

4.10.219 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 up to five trenching vessels, two pre-installation vessels, two rock placement vessels, one CLV (two for brief periods during changeovers), and up to 20 guard vessels stationed every 10 nautical miles (during short periods post cable lay, prior to full burial and protection), 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.

4.10.220 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.

4.10.221 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.

4.10.222 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.

4.10.223 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).

4.10.224 The area surrounding the Offshore Cable Corridor already experiences 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

4.10.225 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).

4.10.226 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.

4.10.227 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 90 vessels per day (see Volume 3, Chapter 5: Shipping and Navigation of the ES).

4.10.228 Throughout the construction of the Proposed Development, the NSVMP 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.

4.10.229 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.

4.10.230 The proposed implementation of a NSVMP 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).

4.10.231 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.

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

### Bottlenose Dolphin

4.10.233 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).

4.10.234 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).

4.10.235 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.

4.10.236 Throughout the construction of the Proposed Development, the NSVMP 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.

4.10.237 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.

4.10.238 The proposed implementation of a NSVMP 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).

4.10.239 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.

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

### Risso's Dolphin

4.10.241 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.

4.10.242 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.

4.10.243 Throughout the construction of the Proposed Development, the NSVMP 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.

4.10.244 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.

4.10.245 The proposed implementation of a NSVMP 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).

4.10.246 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.

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

### Common Dolphin

4.10.248 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.

4.10.249 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.

4.10.250 Throughout the construction of the Proposed Development, the NSVMP 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.

4.10.251 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.

4.10.252 The proposed implementation of a NSVMP 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).

4.10.253 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.

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

### Minke Whale

4.10.255 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.

4.10.256 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.

4.10.257 Throughout the construction of the Proposed Development, the NSVMP 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.

4.10.258 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.

4.10.259 The proposed implementation of a NSVMP 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).

4.10.260 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.

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

### Grey Seal

4.10.262 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.

4.10.263 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.

4.10.264 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).

4.10.265 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.

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

4.10.267 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.

4.10.268 The proposed implementation of a NSVMP 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).

4.10.269 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.

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

### Leatherback Turtle

4.10.271 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.

4.10.272 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.

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

4.10.274 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.

4.10.275 The proposed implementation of a NSVMP 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.

4.10.276 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.

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

## Significance of effect

### Harbour Porpoise

4.10.278 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.

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

### Bottlenose Dolphin

4.10.280 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.

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

### Risso's Dolphin

4.10.282 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.

4.10.283 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.

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

### Common Dolphin

4.10.285 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.

4.10.286 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.

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

### Minke Whale

4.10.288 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.

4.10.289 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.

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

### Grey Seal

4.10.291 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.

4.10.292 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.

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

### Leatherback Turtle

4.10.294 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.

4.10.295 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.

4.10.296 Overall, the magnitude of the impact is **negligible (adverse),** 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

4.10.297 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 further mitigation is proposed, or considered necessary.

### Future Monitoring

4.10.298 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.

## Vessel collision risk

4.10.299 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 injury or death due to collision with vessels due to increased vessel presence.

4.10.300 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 90 vessels recorded per day, with approximately 74 vessels per day recorded crossing the Offshore Cable Corridor. The busiest day recorded 122 vessels. The most common vessel type was cargo vessels, accounting for 50% of vessels within the study area with an average of 44 vessels per day. Tankers (20%), fishing vessels (15%) and recreational vessels (7%) also accounted for a large proportion of vessel traffic (See Volume 3, Chapter 5: Shipping and Navigation of the ES for further information).

4.10.301 This impact assessment will focus on vessel collision risk from construction activities.

### Sensitivity of receptor

4.10.302 During construction of the Proposed Development, a potential source of impact from increased vessel activity is physical trauma from collision with a boat or ship. In general, three consequences of vessel collision are defined: direct (injuries to the animals that are the immediate result of collision), long-term (a decrease in the fitness of the animal over time), and population consequences (Schoeman et al., 2020). With regards to injuries, both fatal and non-fatal injuries between marine mammals and vessels have been documented (Laist et al., 2001; Vanderlaan et al., 2008; Cates et al., 2017). Fatal collisions have been evidenced via carcasses washing up on beaches (Laist et al., 2001; Peltier et al., 2019); carcasses caught on vessel bows (Laist et al., 2001; Peltier et al., 2019); and floating carcasses which have strong evidence of ship strike, such as propeller cuts, significant bruising, oedema, internal bleeding radiating from a specific impact site, fractures and ship paint marks (Jensen and Silber, 2003; Douglas et al., 2008). Fatalities from ship strikes, however, often go unreported (Authier et al., 2014). For non-fatal injuries, evidence of animals which have survived ship strikes with non-fatal injuries from propellers has been widely documented (Wells et al., 2008; Luksenburg, 2014).

4.10.303 Although many species of marine mammals are able to detect and avoid vessels, it is unclear why some individuals do not always move out of the path of an approaching vessel (Schoeman et al., 2020), although it has been suggested that behaviours such as resting, foraging, nursing, and socialising could distract animals from detecting the risk posed by vessels (Dukas, 2002). It is also possible that animals do not hear vessels when they are near the surface. Collisions

between cetaceans and vessels, however, are not necessarily lethal on all occasions (Wells et al., 2008; Luksenburg, 2014).

4.10.304 The risk of collision between marine mammals vessels is directly influenced by the type of vessel and the speed with which it is travelling (Laist et al, 2001), and indirectly by ambient noise levels underwater and the behaviour the marine mammal is engaged in. Vessels travelling at higher speeds (14 knots) pose a higher risk. Smaller vessels (such as guard vessels) are also able to avoid marine mammals (when detected) due to better manoeuvrability compared to larger vessels (Schoeman et al,2020). Similar vessels during construction and decommissioning will have low to moderate working speeds, hence a reduced risk of collision.

4.10.305 There is currently a lack of information on the frequency of occurrence of vessel collisions as a source of marine mammal mortality. There is little evidence from marine mammals stranded in the UK that injury from vessel collisions is an important source of mortality. The UK Cetacean Strandings Investigation Programme (CSIP) documents the annual number of reported strandings and the cause of death for those individuals examined at post-mortem. According to the most recent CSIP report, post-mortems were conducted on 37 out of the 497 reported harbour porpoise strandings in 2020. A cause of death was established in 33 examined individuals and, of these, four individuals had died from physical trauma of an unknown cause, which could have been due to vessel strike (CSIP, 2020). For bottlenose dolphin, post-mortems were conducted on eight out of the 27 reported strandings in 2020. A cause of death was established for seven individuals, with the cause of death for one individual classed as physical trauma resulting from a vessel collision (CSIP, 2020). For Risso's dolphin, post-mortems were not conducted on any of the eight reported strandings in 2020. (CSIP, 2020). For common dolphin, post-mortems were conducted on 51 out of the 320 reported strandings in 2020 and a cause of death was established for 46 individuals. Of these, two individuals had died from physical trauma of an unknown cause, which could have been due to vessel strike (CSIP, 2020). For minke whale, post-mortems were conducted on two out of the 36 reported strandings in 2020. Of these, neither individual had died due to vessel strike (CSIP, 2020). The CSIP data shows that very few strandings have been attributed to vessel collisions (CSIP 2016; 2017; 2018; 2019; 2020), therefore, while there is evidence that mortality from vessel collisions can and does occur, it is not considered to be a key source of mortality highlighted from post-mortem examinations. However, it is important to note that the strandings data are biased to those carcasses that wash ashore for collection and therefore may not be representative.

4.10.306 Collision risk for seals is less understood than for cetaceans, however trauma ascribed to collisions with vessels has been identified in a small proportion of both live stranded (Goldstein et al., 1999) and dead stranded seals in the US (Swails, 2005). In these cases, however, less than 2% of all dead necropsied seals had vessel collision attributed to cause of death. A study in the Moray Firth showed that seals use the same areas as vessels during trips between haul-outs and foraging sites but that seals tended to remain beyond 20 m from vessels (only three instances over 2,241 days of seal activity resulted in passes at less than 20 m) (Onoufriou et al., 2016), suggesting that the possibility of a risk of collision is very low.

4.10.307 Harbour porpoises, dolphins, seals 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. Predictability of vessel movement by marine mammals is known to be a key aspect in minimising the

potential risks imposed by vessel traffic (Nowacek et al, 2001, Lusseau 2003, Lusseau 2006).

4.10.308 Overall, marine mammal and sea turtle will avoid vessels and vessel collision is not considered to be a key source of mortality highlighted from post-mortem examinations of stranded animals. However, should a collision event occur, this is likely to kill or injure the animal.

4.10.309 Based on the above, all marine mammal and sea turtle receptors are considered to be of reasonable adaptability, limited to no tolerance, have medium-term to no recoverability, and are of very high value. The sensitivity of the receptor is **high.**

## Magnitude of impact

4.10.310 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 up to five trenching vessels, two pre-installation vessels, two rock placement vessels, one CLV (two for brief periods during changeovers), and up to 20 guard vessels stationed every 10 nautical miles (during short periods post cable lay, prior to full burial and protection), 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.

4.10.311 Vessel traffic associated with the Proposed Development has the potential to lead to an increase in vessel movements within the coastal areas and immediate surrounding waters. This increase in vessel movement could lead to an increase in interactions between marine mammals and sea turtles and vessels during offshore construction. Whilst a broad range of vessel types have been involved in collisions with marine mammals (Laist et al., 2001), vessels travelling at higher speeds pose a higher risk because of the potential for a stronger strike impact (Schoeman et al., 2020). For example, a study by Laist et al. (2001) found that in 89% of collisions in which the whale was killed or seriously injured vessels were travelling at speeds of 14 kn (7 m/s) or more, and the vessel exceeded a length of 80 m. Therefore, larger vessels travelling at 7 m/s or faster are those most likely to cause death or serious injury to marine mammals (Laist et al., 2001). The majority of vessels used during the construction phase are likely to be large vessels that will either be travelling considerably slower than 7 m/s or will be stationary for significant periods of time. Therefore, the actual increase in vessel traffic moving within the Proposed Development and to/from port will occur over short periods of the offshore construction activity. Smaller vessels involved in construction activities (i.e. guard vessels) are able to move to avoid marine mammals (when detected), even when an animal is close and the vessel is going at high speed, due to better manoeuvrability compared to larger vessels (Schoeman et al., 2020). In contrast, large vessels, such as jack-up vessels, have low manoeuvrability and may require larger distances to avoid an animal, but travel at slower speeds.

4.10.312 Throughout the construction of the Proposed Development, the implementation of a NSVMP 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. This is known to be a key aspect in minimising the potential risks imposed by vessel traffic (Nowacek et al., 2001; Lusseau 2003; 2006).

4.10.313 The proposed implementation of a NSVMP will reduce the risk of vessel collision by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause a risk.

4.10.314 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.

4.10.315 It is not expected that the level of vessel activity during construction would cause an increase in the risk of mortality from collisions. The use of predetermined vessel routes as a result of the adoption of a NSVMP during construction will minimise the potential for any impact.

4.10.316 The impact of injury to all marine mammal and sea turtle receptors from vessel activities is considered to result in a very small proportion of the population affected, to occur relatively frequently throughout the construction phase, the effect is unlikely to occur given implementation of a NSVMP, intermittent (during vessel movements only), and is very unlikely to affect the population trajectory.

4.10.317 The impact is therefore predicted to be of local spatial extent, short term duration and intermittent. The magnitude is therefore **negligible (adverse)**.

## Significance of effect

### Harbour Porpoise

4.10.318 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Bottlenose Dolphin

4.10.320 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Risso's Dolphin

4.10.322 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Common Dolphin

4.10.324 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Minke Whale

4.10.326 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Grey Seal

4.10.328 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Leatherback Turtle

4.10.330 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

## Further mitigation

4.10.332 The significance of effect from vessel collision risks to marine mammals and sea turtles during construction activities is not significant in EIA terms. Therefore, no future mitigation is proposed, or considered necessary.

## Future monitoring

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

## Indirect effects on prey species

4.10.334 This impact assessment focusses on indirect impacts on marine mammals and sea turtles as a result of impacts on their prey. These impacts could arise 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 prey.

4.10.335 Given that marine mammals and sea turtles are dependent on prey, there is the potential for indirect effects via any impacts on prey species or the habitats that support them. **Table 4.26** lists the key prey species of each receptor.

**Table 4.26: Common prey species for each of the marine mammal receptors.**

| Receptor | Prey species | Reference |
|---|---|---|
| Harbour porpoise | Whiting, sandeel, herring, haddock, saith, pollock, bobtail squid | Pierce *et al*. (2007) |
| Bottlenose dolphin | Cod, saith, whiting, salmon, haddock, cephalopods | Santos *et al*. (2001) |
| Risso's dolphin | Cephalopods | Clarke and Pascoe (1985) |
| Common dolphin | Mackerel, lanternfish, lancet fish, *Gadidae* spp., *Gobiidae* spp., cephalopod | Brophy *et al*. (2009) |
| Minke whale | Sandeel, herring, sprat, mackerel, goby, Norway pout/poor cod | Pierce *et al*. (2004) |
| Grey seal | Sandeel, cod, whiting, haddock, ling, plaice, sole, flounder, dab | SCOS (2017) |
| Leatherback turtle | Gelatinous zooplankton | Dodge *et al*. (2011) |

4.10.336 This impact assessment will focus on indirect effects on prey species from construction activities.

## Sensitivity of receptor

4.10.337 Impacts to prey resources will be largely restricted to the boundaries of the Proposed Development and, therefore, marine mammals and sea turtles occurring within this area also have the potential to be affected. The fish and shellfish species identified in Volume 3, Chapter 2: Fish and Shellfish Ecology of

the ES are typical of those present within the Celtic Sea and provide a thorough dataset to consider this potential marine mammal impact against.

4.10.338 Changes to prey availability could increase the energy expenditure required for feeding through increased effort. However, as the majority of marine mammal receptors are generalists, they can switch prey species, thereby removing the requirement for additional energy expenditure. Exceptions to this are Risso's dolphins and leatherback turtles, which feed on cephalopods and gelatinous zooplankton respectively. All marine mammal and sea turtle receptors are highly mobile and search large areas for prey, and no impact on survival or reproduction of any receptor is predicted.

4.10.339 Based on the above, marine mammals and sea turtles are considered to be of high adaptability, reasonable tolerance, have high recoverability, and are of very high value. The sensitivity of the receptors is **low**.

## Magnitude of Impact

4.10.340 Potential impacts on fish and shellfish during the construction phase of the Proposed Development are described in Volume 3, Chapter 2: Fish and Shellfish Ecology of the ES and include:

- Temporary habitat loss/disturbance;
- Temporary increase in suspended sediments and sediment deposition;
- Injury and disturbance from noise and vibration;
- Changes in water quality from resuspension of sediments and as a result of accidental pollution.

4.10.341 Potential impacts on fish and shellfish are assessed in Volume 3, Chapter 2: Fish and Shellfish Ecology of the ES, which concluded there will be no significant effects arising from the Proposed Development on the species listed in **Table 4.26** during the construction phase. Gelatinous zooplankton are not covered in the chapter; however it is reasonable to assume that no significant effects will arise for gelatinous zooplankton given that they are found in similar habitat to many of the fish species assessed.

4.10.342 The impact to all marine mammal and sea turtle receptors from indirect effects on prey species is considered to be highly localised, to occur relatively frequently throughout the construction phase, and is unlikely to occur as there is expected to be no significant impacts on fish and shellfish species

4.10.343 The impact is therefore predicted to be of local spatial extent, short term duration and intermittent. The magnitude is therefore **negligible (adverse)**.

## Significance of effect

### Harbour Porpoise

4.10.344 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Bottlenose Dolphin

4.10.346 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Risso's Dolphin

4.10.348 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Common Dolphin

4.10.350 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Minke Whale

4.10.352 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Grey Seal

4.10.354 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Leatherback Turtle

4.10.356 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

4.10.358 Note, for cross reference purposes, the RIAA (document reference 7.16, which is submitted alongside the ES) also includes consideration of the Bristol Channel Approaches SAC Conservation Objective 3 i.e. 'The condition of supporting habitats and processes, and the availability of prey is maintained'.

### Further mitigation

4.10.359 The significance of effect from indirect effects on prey species as a result of construction of the Proposed Development is not significant in EIA terms. No further mitigation is proposed, or considered necessary.

### Future monitoring

4.10.360 The significance of effect from indirect effects on prey species as a result of construction of the Proposed Development is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

## 4.11 Assessment of Operation and Maintenance Effects

4.11.1 The impacts of the operation and maintenance phase of the Proposed Development have been assessed. The impacts arising from the operation and maintenance phase of the Proposed Development are listed in **Table 4.19**, along with the maximum design scenario against which each impact has been assessed.

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

### Injury and temporary changes in hearing from anthropogenic noise

4.11.3 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.

4.11.4 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 under the proposed survey schedule outlined in **Table 4.19**. On each occasion, the applicant 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.

4.11.5 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.

4.11.6 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.

4.11.7 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, 2020a). 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 4.27** presents the generalised hearing ranges, as highlighted in Southall *et al.* (2019), for the relevant marine mammal species.

**Table 4.27: 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 |

4.11.8 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).

4.11.9 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.

4.11.10 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).

4.11.11 The current set of TTS-onset thresholds presented by Southall *et al.* (2019) define a TTS-onset as the exposure required to produce a 6 dB shift in the hearing threshold. However, data upon which these thresholds are based for TTS-onset in marine mammals from impulsive or non-impulsive noise is extremely limited. It is therefore necessary to determine exposure functions for TTS in order to estimate the levels at which the onset of PTS could occur, as experiments inducing PTS in animals are considered unethical. Southall *et al.* (2007) predict an exposure of 40 dB of TTS would result in PTS onset in marine mammals. Southall *et al.* (2007) define TTS in marine mammals as 'the minimum threshold shift clearly larger than any day-to-day or session-to-session variation in a subject's normal hearing ability' for the purposes of developing these thresholds, and that it was 'typically the minimum amount of threshold shift that can be differentiated in most experimental conditions'. Thus, the adoption of this TTS-onset threshold would typically result in overestimates of potential impact ranges at which ecologically significant effects could occur in marine mammals. In addition, as TTS-onset is defined primarily as a means of predicting PTS-onset, there is currently no threshold for TTS-onset that would indicate a biologically significant amount of TTS in marine mammals. Therefore, it was not possible to carry out a quantitative

assessment of the sensitivity, magnitude, or significance of the impact of TTS on marine mammals.

4.11.12 Underwater noise also has the potential to impact sea turtles if the frequency is within their hearing range (**Table 4.28**). The current standing in the scientific community is that fish hearing (rather than mammalian hearing) is the preferred model for marine turtles until more data becomes available (Popper *et al.*, 2014). For this, Popper *et al.* (2014) proposed the adoption of underwater noise thresholds for Group two fish, which include fishes sensitive to particle motion only; the authors considered this a precautionary approach for marine turtles. 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 $\mu Pa^2$ 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 sea turtle hearing capabilities and responses to sound (Dow Piniak *et al*., 2012).

**Table 4.28: Sea turtle hearing range (Popper *et al*, 2014)**

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

4.11.13 This impact assessment will focus on physiological injury to and hearing shift in marine mammals and sea turtles as a result of underwater noise from repair works (cable cut, recovery and burial activities), as these activities have the greatest potential for impact on marine mammals and sea turtles. For marine mammal impact assessment, it was based on the $SPL_{peak}$ and $SEL_{cum}$ onset thresholds presented by Southall *et al*. (2019) and listed in **Table 4.29**.

**Table 4.29: PTS and TTS -onset thresholds for non-impulsive noise (Southall et al., 2019).**

| Functional Hearing Group | Relevant Species | Cumulative PTS ($SEL_{cum}$ dB re 1 $\mu Pa^2$s weighted) | Cumulative TTS ($SEL_{cum}$ dB re 1 $\mu Pa^2$s weighted) |
|---|---|---|---|
| Very High Frequency (VHF) cetacean | Harbour porpoise | 173 | 153 |
| High Frequency (HF) cetacean | Bottlenose dolphin, Risso's dolphin, common dolphin | 198 | 178 |
| Low Frequency (LF) cetacean | Minke whale | 199 | 179 |
| Phocid (in water) (PCW) | Grey seal | 201 | 181 |

## Sensitivity of the Receptor

4.11.14 As detailed in **paragraph 4.10.9**, no TTS assessment of species sensitivity is given for marine mammal receptors because there are no thresholds to determine a biologically significant effect from TTS-onset.

### Harbour Porpoise

4.11.15 Harbour porpoise sensitivity to PTS impact from anthropogenic noise is described in **section 4.10**.The sensitivity of the receptor is **low**.

### Bottlenose Dolphin

4.11.16 Bottlenose dolphin sensitivity to PTS impact from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Risso's Dolphin

4.11.17 Risso's dolphin sensitivity to PTS impact from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Common Dolphin

4.11.18 Common dolphin sensitivity to PTS impact from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **medium**.

### Minke Whale

4.11.19 Minke whale sensitivity to PTS impact from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **medium**.

### Grey Seal

4.11.20 Grey seal sensitivity to PTS impact from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Leatherback Turtle

4.11.21 Leatherback turtle sensitivity to PTS impact from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **negligible.**

## Magnitude of impact

4.11.22 Underwater noise impact resulting from activities during the operational and maintenance phase is estimated to be of similar level and magnitude (worst case) as that for the construction phase. 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 **Table 4.30**.

**Table 4.30: Operating frequencies of different activities. Source: Volume 3, Appendix 4.1: Underwater Noise Technical Assessment of the ES**

| 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 |

4.11.23 Underwater noise modelling (Volume 3, Appendix 4.1: Underwater Noise Technical Assessment, of the ES) 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 4.29**). Sea turtles were not assessed in the underwater modelling.

## Marine Mammals

4.11.24 For marine mammals, underwater noise from all operational and maintenance phase activities is not predicted to exceed the cumulative PTS thresholds ($SEL_{cum}$) for any of the FHGs, according to **Table 4.30** and Volume 3, Appendix 4.1: Underwater Noise Technical Assessment, of the ES. While for TTS, the largest onset impact ranges considering $SEL_{cum}$ thresholds are predicted to be less than 940 m for minke whale (low frequency cetaceans) and less than 160 m for grey seal (phocids in water) (**Table 4.31**). Underwater noise from operational and maintenance activities is not estimated to exceed the cumulative TTS thresholds for harbour porpoise (very high frequency cetaceans) and dolphin species (high frequency cetaceans) (**Table 4.31**).

**Table 4.31: Summary of the modelled TTS-onset impact ranges for marine mammals. Source: Volume 3, Appendix 4.1: Underwater Noise Technical Assessment of the ES**

| Activity | Impact ranges (m) | | | |
|---|---|---|---|---|
| | LF Cetaceans | HF Cetaceans | VHF Cetaceans | PCW |
| **Thresholds: $SEL_{cum}$, dB re 1 $\mu Pa^2s$** | 179 | 178 | 153 | 181 |
| **Seabed obstacle clearance** | <20 | Not Reached | Not Reached | Not Reached |

| Activity | Impact ranges (m) | | | |
|---|---|---|---|---|
| | LF Cetaceans | HF Cetaceans | VHF Cetaceans | PCW |
| **Mass flow excavation** | Not Reached | Not Reached | Not Reached | Not Reached |
| **Dredging** | <110 | Not Reached | Not Reached | <20 |
| **Cable burial – water jetting** | <940 | Not Reached | Not Reached | <160 |
| **Cable burial – mechanical cutter** | <110 | Not Reached | Not Reached | <20 |
| **HDD** | Not Reached | Not Reached | Not Reached | Not Reached |
| **Installation of Rock protection** | <110 | Not Reached | Not Reached | <20 |
| **Associated vessel movements – tug** | Not Reached | Not Reached | Not Reached | Not Reached |
| **Associated vessel movements – cable lay vessel** | <110 | Not Reached | Not Reached | <20 |

4.11.25 The modelled results of PTS and TTS impact ranges are considered precautionary as a lower worst-case swimming speed of 1.5 m/s was assumed for all FHGs including both adults and juveniles, and that marine mammal receptor was modelled fleeing from the immediate vicinity of the noise source. It also did not consider the fact that the sound source was also moving, and that as distance between source and receiver (i.e. animal) increased, 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.

4.11.26 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 or TTS onsets will occur for any of the FHGs as a result of the Proposed Development.

4.11.27 The $SEL_{cum}$ thresholds of PTS-onset are not reached for all FHGs of marine mammal receptors. The magnitude of PTS at construction phase is therefore **negligible (adverse)**. As detailed in above, no assessment of TTS impact magnitude is given because there are no thresholds to determine a biologically significant effect from TTS-onset.

### Leatherback Turtle

4.11.28 According to **Table 4.23,** all proposed activities are not estimated to exceed the weighted $SEL_{cum}$ or unweighted $SPL_{peak}$ thresholds (210 dB re 1 µPa² s and 207 dB re 1µPa respectively, Popper *et al*., 2014) of hearing injury or mortality in sea turtles. Popper *et al.* (2014) also highlight that the relative risk of mortality and potential mortal injury, recoverable injury[2] or TTS in sea turtles is low even when individual is close to (tens of metres) the sources of shipping and other continuous sounds.

4.11.29 Based on the above, the impacts of PTS and TTS are predicted to be of very localised spatial extent and very short term duration. The magnitude of PTS and TTS at construction phase is therefore **negligible (adverse)**.

## Significance of effect

### Harbour Porpoise

4.11.30 Notwithstanding the short-term and transient nature of operational and maintenance phase activities, it is highly unlikely that PTS would occur on harbour porpoise based on the modelling results, as underwater noise from all activities listed in **Table 4.30** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in very high frequency cetaceans.

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

### Bottlenose Dolphin

4.11.32 Notwithstanding the short-term and transient nature of operational and maintenance phase activities, it is highly unlikely that PTS would occur on bottlenose dolphin based on the modelling results, as underwater noise from all activities listed in **Table 4.30** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in high frequency cetaceans.

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

### Risso's Dolphin

4.11.34 Notwithstanding the short-term and transient nature of operational and maintenance phase activities, it is highly unlikely that PTS would occur on Risso's dolphin based on the modelling results, as underwater noise from all activities listed in **Table 4.30** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in high frequency cetaceans.

[2] According to Popper *et al.* (2014), mortality and mortal injury are defined as the immediate or delayed death in receptors, while recoverable injury refers to injuries that are not likely to cause direct mortality, such as hair cell damage, minor internal and external bleeding.

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

### Common Dolphin

4.11.36 Notwithstanding the short-term and transient nature of operational and maintenance phase activities, it is highly unlikely that PTS would occur on common dolphin based on the modelling results, as underwater noise from all activities listed in **Table 4.30** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in high frequency cetaceans.

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

### Minke Whale

4.11.38 Notwithstanding the short-term and transient nature of operational and maintenance phase activities, it is highly unlikely that PTS would occur on minke whale based on the modelling results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in low frequency cetaceans.

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

### Grey Seal

4.11.40 Notwithstanding the short-term and transient nature of operational and maintenance phase activities, it is highly unlikely that PTS would occur on grey seals based on the modelling results, as underwater noise from all activities listed in **Table 4.30** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in phocids in water.

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

### Leatherback Turtle

4.11.42 Notwithstanding the short-term and transient nature of operational and maintenance phase activities, it is highly unlikely that PTS or TTS would occur on leatherback turtles based on the evidence provided above.

4.11.43 Overall, the magnitude of the impact is **negligible (adverse),** 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

4.11.44 The significance of PTS impact on marine mammals and sea turtles, and TTS impact on sea turtles as a result of operational and maintenance phase activities

is assessed as not significant in EIA terms. Therefore, no further mitigation is proposed, or considered necessary.

### Future Monitoring

4.11.45 The significance of PTS impact on marine mammals and sea turtles, and TTS impact on sea turtles as a result of operational and maintenance phase activities is assessed as not significant in EIA terms. Therefore, no future monitoring is considered necessary.

## Disturbance from anthropogenic noise

4.11.46 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.

4.11.47 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 under the proposed survey schedule outlined in **Table 4.19**. On each occasion, the applicant 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.

4.11.48 Underwater noise from construction activities can cause displacement and disturbance to marine mammals (Brandt *et al*., 2011; Culloch *et al.,* 2016; Graham *et al*., 2019; Pirotta *et al.,* 2014; Stone *et al.,* 2017) and sea turtles (Díaz *et al.,* 2024; Tyson *et al.,* 2017) which can have various impacts depending on the sensitivity of the receptor to the noise, importance of the area to the receptor and duration that the sound source is active for.

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

### Sensitivity of receptor

#### Harbour Porpoise

4.11.50 Harbour porpoise sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **medium**.

#### Bottlenose Dolphin

4.11.51 Bottlenose dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Risso's Dolphin

4.11.52 Risso's dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Common Dolphin

4.11.53 Common dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Minke Whale

4.11.54 Minke whale sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Grey Seal

4.11.55 Grey seal sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Leatherback Turtle

4.11.56 Leatherback turtle sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **negligible.**

## Magnitude of impact

4.11.57 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 **Table 4.32**.

**Table 4.32: Operating frequencies of different activities. Source: Volume 3, Appendix 4.1: Underwater Noise Technical Assessment of the ES**

| 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 |

4.11.58 Underwater noise modelling (Volume 3, Appendix 4.1: Underwater Noise Technical Assessment, of the ES) has been undertaken to estimate the impact ranges of behavioural disturbance in marine mammals as a result of underwater noise from the Proposed Development, and the ranges are listed in **Table 4.25**.

These impact ranges were calculated using the National Marine Fisheries Service disturbance (onset of behavioural response) threshold for all marine mammal species for non-impulsive criteria (NMFS, 2023). Sea turtles were not assessed in the underwater modelling, as they aren't considered a separate hearing group.

4.11.59 The largest unweighted $SPL_{rms}$ impact range is predicted for cable burial by water jetting and is estimated to be 73.6 km, based on a behavioural disturbance threshold of 120 dB $SPL_{rms}$ for all marine mammal species (Volume 3, Appendix 4.1: Underwater Noise Technical Assessment, of the ES). The modelled impact ranges are considered precautionary assuming a lower worst-case swimming speed of 1.5m/s for all marine mammal species (including both adults and juveniles). 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.

## Harbour Porpoise

4.11.60 During the operational and maintenance phase, maintenance activities are expected to operate at frequencies within the hearing range of harbour porpoise (**Table 4.32**).

4.11.61 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 Technical Assessment, of the ES).

4.11.62 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 UK waters 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.

4.11.63 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).

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

4.11.65 Fixed EDRs are advised within JNCC (2020a) 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.

4.11.66 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 and maintenance phase of the Proposed Development.

4.11.67 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 harbour porpoise receptor is highly mobile and has a large distribution range within the Celtic and Irish Seas MU.

4.11.68 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.

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

## Bottlenose Dolphin

4.11.70 During the operational and maintenance phase, maintenance activities are expected to operate at frequencies within the hearing range of bottlenose dolphin (**Table 4.32**).

4.11.71 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 Technical Assessment, of the ES).

4.11.72 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 UK waters 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.

4.11.73 A review of potential effects of various cable types and installation methods including burial ploughs, tracked burial 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).

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

4.11.75 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.

4.11.76 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.

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

## Risso's Dolphin

4.11.78 During the operational and maintenance phase, maintenance activities are expected to operate at frequencies within the hearing range of Risso's dolphin (**Table 4.32**).

4.11.79 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 Technical Assessment, of the ES).

4.11.80 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 UK waters 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.

4.11.81 A review of potential effects of various cable types and installation methods including burial ploughs, tracked burial 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).

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

4.11.83 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, the Risso's dolphin receptor is highly mobile and has a large distribution range within the Celtic and Greater North Seas MU.

4.11.84 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.

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

### Common Dolphin

4.11.86 During the operational and maintenance phase, maintenance activities are expected to operate at frequencies within the hearing range of common dolphin (**Table 4.32**).

4.11.87 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 Technical Assessment, of the ES).

4.11.88 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 UK waters 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.

4.11.89 A review of potential effects of various cable types and installation methods including burial ploughs, tracked burial 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).

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

4.11.91 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.

4.11.92 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.

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

### Minke Whale

4.11.94 During the operational and maintenance phase, maintenance activities are expected to operate at frequencies within the hearing range of minke whale (**Table 4.32**).

4.11.95 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 Technical Assessment, of the ES).

4.11.96 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 UK waters 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.

4.11.97 A review of potential effects of various cable types and installation methods including burial ploughs, tracked burial 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).

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

4.11.99 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.

4.11.100 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.

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

### Grey Seal

4.11.102 During the operational and maintenance phase, maintenance activities are expected to operate at frequencies within the hearing range of grey seal (**Table 4.32**).

4.11.103 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 Technical Assessment, of the ES).

4.11.104 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 UK waters 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.

4.11.105 A review of potential effects of various cable types and installation methods including burial ploughs, tracked burial 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).

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

4.11.107 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.

4.11.108 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.

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

## Leatherback Turtle

4.11.110 During the operational and maintenance phase, maintenance activities are expected to operate at frequencies within the hearing range of leatherback turtles (**Table 4.32**).

4.11.111 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).

4.11.112 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 $\mu Pa^2$ 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).

4.11.113 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.

4.11.114 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)

4.11.115 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.

4.11.116 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.

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

## Significance of effect

### Harbour Porpoise

4.11.118 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.

4.11.119 Overall, the magnitude of the impact is **low (adverse),** 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

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

4.11.121 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.

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

### Risso's Dolphin

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

4.11.124 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.

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

### Common Dolphin

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

4.11.127 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.

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

### Minke Whale

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

4.11.130 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.

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

### Grey Seal

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

4.11.133 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.

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

### Leatherback Turtle

4.11.135 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.

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

### Further Mitigation

4.11.137 The significance of effect from disturbance to marine mammals and sea turtles from underwater noise as a result of activities during the operational and maintenance phase is not significant in EIA terms. Therefore, no further mitigation is proposed, or considered necessary.

### Future Monitoring

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

## Increased vessel disturbance

4.11.139 Increased vessel movement during the operational and maintenance 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.

4.11.140 A single survey vessel will conduct routine post installation inspection surveys under the proposed survey schedule outlined in **Table 4.19**.

4.11.141 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.

4.11.142 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 90 vessels recorded per day, with approximately 74 vessels per day recorded crossing the Offshore Cable Corridor. The busiest day recorded 122 vessels. The most common vessel type was cargo vessels, accounting for 50% of vessels within the study area with an average of 44 vessels per day. Tankers (20%), fishing vessels (15%) and recreational vessels (7%) also accounted for a large proportion of vessel traffic (See Volume 3, Chapter 5: Shipping and Navigation of the ES for further information).

4.11.143 This impact assessment will focus on increased vessel disturbance from operation and maintenance activities.

## Sensitivity of receptor

### Harbour Porpoise

4.11.144 Harbour porpoise sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Bottlenose Dolphin

4.11.145 Bottlenose dolphin sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Risso's Dolphin

4.11.146 Risso's dolphin sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Common Dolphin

4.11.147 Common dolphin sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Minke Whale

4.11.148 Minke whale sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Grey Seal

4.11.149 Grey seal sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Leatherback Turtle

4.11.150 Leatherback turtle sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **negligible**.

## Magnitude of impact

4.11.151 Vessels used in the operational and maintenance 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 and maintenance 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.)

4.11.152 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.

4.11.153 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.

4.11.154 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.

4.11.155 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).

4.11.156 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 and maintenance phase is not considered a novel impact for marine mammals or sea turtles present in the area.

## Harbour Porpoise

4.11.157 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).

4.11.158 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.

4.11.159 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 90 vessels per day (see Volume 3, Chapter 5: Shipping and Navigation of the ES).

4.11.160 Throughout the operational and maintenance phase of the Proposed Development, the NSVMP 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.

4.11.161 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.

4.11.162 The proposed implementation of a NSVMP 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).

4.11.163 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 and maintenance phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

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

## Bottlenose Dolphin

4.11.165 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).

4.11.166 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).

4.11.167 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.

4.11.168 Throughout the operational and maintenance phase of the Proposed Development, the NSVMP 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.

4.11.169 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.

4.11.170 The proposed implementation of a NSVMP 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).

4.11.171 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 and maintenance phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

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

### Risso's Dolphin

4.11.173 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.

4.11.174 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.

4.11.175 Throughout the operational and maintenance phase of the Proposed Development, the NSVMP 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.

4.11.176 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.

4.11.177 The proposed implementation of a NSVMP 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).

4.11.178 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 and maintenance phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

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

### Common Dolphin

4.11.180 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.

4.11.181 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.

4.11.182 Throughout the operational and maintenance phase of the Proposed Development, the NSVMP 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.

4.11.183 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.

4.11.184 The proposed implementation of a NSVMP 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).

4.11.185 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 and maintenance phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

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

### Minke Whale

4.11.187 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.

4.11.188 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.

4.11.189 Throughout the operational and maintenance phase of the Proposed Development, the NSVMP 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.

4.11.190 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.

4.11.191 The proposed implementation of a NSVMP 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).

4.11.192 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 and maintenance phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

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

### Grey Seal

4.11.194 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.

4.11.195 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.

4.11.196 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).

4.11.197 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.

4.11.198 Throughout the operational and maintenance phase of the Proposed Development, the NSVMP 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.

4.11.199 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.

4.11.200 The proposed implementation of a NSVMP 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).

4.11.201 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 and maintenance phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

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

### Leatherback Turtle

4.11.203 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.

4.11.204 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.

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

4.11.206 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.

4.11.207 The proposed implementation of a NSVMP 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).

4.11.208 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 and maintenance phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory given implementation of embedded measures.

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

## Significance of effect

### Harbour Porpoise

4.11.210 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.

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

### Bottlenose Dolphin

4.11.212 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.

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

### Risso's Dolphin

4.11.214 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.

4.11.215 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.

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

### Common Dolphin

4.11.217 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.

4.11.218 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.

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

### Minke Whale

4.11.220 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.

4.11.221 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.

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

### Grey Seal

4.11.223 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.

4.11.224 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.

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

### Leatherback Turtle

4.11.226 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 against maintenance related traffic.

4.11.227 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.

4.11.228 Overall, the magnitude of the impact is **negligible (adverse),** 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

4.11.229 The significance of effect from disturbance to marine mammals and sea turtles from increased vessel disturbance during the operational and maintenance phase is not significant in EIA terms. Therefore, no further mitigation is proposed, or considered necessary.

## Future Monitoring

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

## Vessel collision risk

4.11.231 Increased vessel movement during the operation and maintenance phase of the Proposed Development has the potential to result in a range of impacts on marine mammals and sea turtles. These include injury or death due to collision with vessels due to increased vessel presence.

4.11.232 A single survey vessel will conduct routine post installation inspection surveys under the proposed survey schedule outlined in **Table 4.19**.

4.11.233 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.

4.11.234 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 90 vessels recorded per day, with approximately 74 vessels per day recorded crossing the Offshore Cable Corridor. The busiest day recorded 122 vessels. The most common vessel type was cargo vessels, accounting for 50% of vessels within the study area with an average of 44 vessels per day. Tankers (20%), fishing vessels (15%) and recreational vessels (7%) also accounted for a large proportion of vessel traffic (See Volume 3, Chapter 5: Shipping and Navigation of the ES for further information).

4.11.235 This impact assessment will focus on vessel collision risk from operation and maintenance activities.

## Sensitivity of receptor

4.11.236 Marine mammal and sea turtle receptors sensitivity to vessel collision risk is described in **section 4.10.** The sensitivity of the receptors is **high.**

## Magnitude of impact

4.11.237 Vessels used in the operational and maintenance phase of the Proposed Development, for maintenance activities have the potential to lead to an increase in vessel movements within the study area. This increase in vessel movement could lead to an increase in interactions between marine mammals and sea turtles and vessels. The small number (approx. one vessel) and infrequent nature of operational and maintenance 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.)

4.11.238 Whilst a broad range of vessel types have been involved in collisions with marine mammals (Laist et al., 2001), vessels travelling at higher speeds pose a higher risk because of the potential for a stronger strike impact (Schoeman et al., 2020). For example, a study by Laist et al. (2001) found that in 89% of collisions in which the whale was killed or seriously injured vessels were travelling at speeds of 14 kn (7 m/s) or more, and the vessel exceeded a length of 80 m. Therefore, larger vessels travelling at 7 m/s or faster are those most likely to cause death or serious injury to marine mammals (Laist et al., 2001). The majority of vessels used during the operation and maintenance phase are likely to be large vessels that will either be travelling considerably slower than 7 m/s or will be stationary for significant periods of time. Therefore, the actual increase in vessel traffic moving within the Study Area and to/from port will occur over short periods of the offshore operation and maintenance phase. Smaller vessels involved in operation and

maintenance activities (i.e. guard vessels) are able to move to avoid marine mammals (when detected), even when an animal is close and the vessel is going at high speed, due to better manoeuvrability compared to larger vessels (Schoeman et al., 2020). In contrast, large vessels, such as jack-up vessels, have low manoeuvrability and may require larger distances to avoid an animal, but travel at slower speeds.

4.11.239 Throughout the operation and maintenance of the Proposed Development, the implementation of a NSVMP 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. This is known to be a key aspect in minimising the potential risks imposed by vessel traffic (Nowacek et al., 2001; Lusseau 2003; 2006).

4.11.240 The proposed implementation of a NSVMP will reduce the risk of vessel collision by controlling the speed and movement of vessels, limiting vessel speed and ensuring predictable routes which are less likely to cause a risk.

4.11.241 The coastal areas and immediate waters surrounding the Offshore Cable Corridor already experience a relatively high amount of vessel traffic. Therefore, the increase in vessel activity as a result of operation and maintenance is not considered a novel impact for marine mammals or sea turtles present in the area.

4.11.242 It is not expected that the level of vessel activity during operation and maintenance would cause an increase in the risk of mortality from collisions. The use of predetermined vessel routes as a result of the adoption of a NSVMP during operation and maintenance will minimise the potential for any impact.

4.11.243 The impact of injury to all marine mammal and sea turtle receptors from vessel activities is considered to result in a very small proportion of the population affected, to occur relatively frequently throughout the construction phase, the effect is unlikely to occur given implementation of a NSVMP, intermittent (during vessel movements only), and is very unlikely to affect the population trajectory.

4.11.244 The impact is therefore predicted to be of local spatial extent, short term duration and intermittent. The magnitude is therefore **negligible (adverse)**.

## Significance of effect

### Harbour Porpoise

4.11.245 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Bottlenose Dolphin

4.11.247 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Risso's Dolphin

4.11.249 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Common Dolphin

4.11.251 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Minke Whale

4.11.253 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Grey Seal

4.11.255 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Leatherback Turtle

4.11.257 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Further Mitigation

4.11.259 The significance of effect from vessel collisions during the operational and maintenance phase is not significant in EIA terms. Therefore, no further mitigation is proposed, or considered necessary.

### Future monitoring

4.11.260 The significance of effect from vessel collisions during the operational and maintenance phase is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

## Indirect effects on prey species

4.11.261 This impact assessment focusses on indirect impacts on marine mammals and sea turtles as a result of impacts on their prey. These impacts could arise as a result of noise from survey and maintenance vessels, as these activities have the greatest potential for generating underwater noise and having an impact on marine mammals and sea turtles prey.

4.11.262 Given that marine mammals and sea turtles are dependent on prey, there is the potential for indirect effects on these receptors as a result of impacts upon prey species or the habitats that support them. The key prey species for each receptor are listed in **Table 4.33**.

**Table 4.33: Common prey species for each of the marine mammal receptors.**

| Receptor | Prey species | Reference |
|---|---|---|
| Harbour porpoise | Whiting, sandeel, herring, haddock, saith, pollock, bobtail squid | Pierce *et al*. (2007) |
| Bottlenose dolphin | Cod, saith, whiting, salmon, haddock, cephalopods | Santos *et al*. (2001) |
| Risso's dolphin | Cephalopods | Clarke and Pascoe (1985) |
| Common dolphin | Mackerel, lanternfish, lancet fish, *Gadidae* spp., *Gobiidae* spp., cephalopod | Brophy *et al*. (2009) |

| Receptor | Prey species | Reference |
|---|---|---|
| Minke whale | Sandeel, herring, sprat, mackerel, goby, Norway pout/poor cod | Pierce *et al*. (2004) |
| Grey seal | Sandeel, cod, whiting, haddock, ling, plaice, sole, flounder, dab | SCOS (2017) |
| Leatherback turtle | Gelatinous zooplankton | Dodge *et al*. (2011) |

## Sensitivity of receptor

4.11.263 Marine mammal and sea turtle receptors sensitivity to impacts resulting from indirect effects on prey species is described in **section 4.10**. The sensitivity of all receptors is **low**.

## Magnitude of impact

4.11.264 Potential impacts on fish and shellfish during the operation and maintenance phase of the Proposed Development are described in Volume 3, Chapter 2: Fish and Shellfish Ecology of the ES and include:

- Temporary habitat loss/disturbance;
- Temporary increase in suspended sediments and sediment deposition;
- Injury and disturbance from noise and vibration;
- Electromagnetic field (EMF) effects;
- Habitat alteration and long-term habitat loss;
- Changes in water quality from resuspension of sediments and as a result of accidental pollution.

4.11.265 Potential impacts on fish and shellfish are assessed in Volume 3, Chapter 2: Fish and Shellfish Ecology of the ES, which concluded there will be no significant effects arising from the Proposed Development on the species listed in **Table 4.33** during the operation and maintenance phase. Gelatinous zooplankton are not covered in the chapter; however it is reasonable to assume that no significant effects will arise for gelatinous zooplankton given that they are found in similar habitat to many of the fish species assessed.

4.11.266 The impact to all marine mammal and sea turtle receptors from indirect effects on prey species is considered to be highly localised, to occur continuously throughout the operation and maintenance phase, and is unlikely to occur as there is expected to be no significant impacts on fish and shellfish species

4.11.267 The impact is therefore predicted to be of local spatial extent and short term duration. The magnitude is therefore **negligible (adverse)**.

## Significance of effect

### Harbour Porpoise

4.11.268 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects, from impacts on prey species are unlikely.

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

### Bottlenose Dolphin

4.11.270 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects, from impacts on prey species are unlikely.

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

### Risso's Dolphin

4.11.272 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects, from impacts on prey species are unlikely.

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

### Common Dolphin

4.11.274 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects, from impacts on prey species are unlikely.

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

### Minke Whale

4.11.276 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects, from impacts on prey species are unlikely.

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

### Grey Seal

4.11.278 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects, from impacts on prey species are unlikely.

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

### Leatherback Turtle

4.11.280 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects, from impacts on prey species are unlikely.

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

## Further Mitigation

4.11.282 The significance of effect from indirect effects to marine mammals and sea turtles impacts on prey species during the operational and maintenance phase is not significant in EIA terms. Therefore, no further mitigation is proposed or considered necessary.

## Future Monitoring

4.11.283 The significance of effect from indirect effects to marine mammals and sea turtles impacts on prey species during the operational and maintenance phase is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

# Indirect impacts through changes to the seabed

4.11.284 This impact assessment focusses on indirect impacts on marine mammals and sea turtles as a result of changes to the seabed. Once constructed, the presence of rock protection, including at in-service cable crossings, may result in habitat loss.

4.11.285 Given that marine mammals and sea turtles are dependent on fish as prey, there is the potential for indirect effects on marine mammals as a result of impacts upon the habitats that support them**.**

## Sensitivity of receptor

### Harbour Porpoise

4.11.286 Harbour porpoises 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). They are generalist feeders, and are therefore considered to be resilient to changes in prey abundance and distribution.

4.11.287 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

4.11.288 Bottlenose dolphins have capability to adapt their behaviour and tolerate certain levels of temporary disturbance, including from changes in prey distribution. They are generalist feeders and are therefore considered to be resilient to changes in prey abundance and distribution.

4.11.289 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

4.11.290 Unlike the other marine mammals in this assessment, Risso's dolphins are less generalist in their diet than other species, feeding on cephalopods (Clarke and Pascoe, 1985). However, due to the highly localised impact of the Proposed Development, there is no impact predicted to prey species in, which will in turn have no impact on Risso's dolphins.

4.11.291 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

4.11.292 Changes to the seabed could potentially impact common dolphins by causing a change in prey distribution, requiring an increase in energy expenditure for feeding. However, as common dolphins are generalist feeders they are able to switch prey, removing the requirement for additional energy expenditure.

4.11.293 Based on the above, 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

4.11.294 Changes to the seabed could potentially impact minke whales by causing a change in prey distribution, requiring an increase in energy expenditure for feeding. However, as minke whales are generalist feeders they are able to switch prey, removing the requirement for additional energy expenditure.

4.11.295 Based on the above, 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

4.11.296 Changes to the seabed could potentially impact grey seals by causing a change in prey distribution, requiring an increase in energy expenditure for feeding. However, as grey seals are generalist feeders they are able to switch prey, removing the requirement for additional energy expenditure.

4.11.297 Based on the above, grey seals 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**.

### Leatherback Turtle

4.11.298 Changes to the seabed could potentially impact leatherback turtles by causing a change in prey distribution, requiring an increase in energy expenditure for feeding. However, as leatherback turtles are able to feed on a variety of gelatinous organisms (Medusozoa spp.) (Botterell *et al*., 2020), they are able to switch prey, removing the requirement for additional energy expenditure.

4.11.299 Based on the above, leatherback turtles 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**.

## Magnitude of impact

4.11.300 Potential changes to the seabed (long-term habitat loss/change) during the operation and maintenance phase of the of the Proposed Development are described in Volume 3, Chapter 1: Benthic Ecology of the ES. The benthic assessment concluded that there will be no significant effects arising from the Proposed Development on the benthic receptors, including benthic habitats.

4.11.301 In addition, potential impacts on fish and shellfish are assessed in Volume 3, Chapter 2: Fish and Shellfish Ecology of the ES, which concluded there will be no significant effects arising from the Proposed Development on the species listed in **Table 4.33** during the operation and maintenance phase. Gelatinous zooplankton are not covered in the chapter; however it is reasonable to assume that no significant effects will arise for gelatinous zooplankton given that they are found in similar habitat to many of the fish species assessed.

4.11.302 The impact to all marine mammal and sea turtle receptors from indirect impacts through changes to the seabed (and therefore effects on prey species) is considered to be highly localised, to occur continuously throughout the operation and maintenance phase, and is unlikely to occur as there is expected to be no significant impacts on benthic receptors or fish and shellfish species.

4.11.303 The impact is therefore predicted to be of local spatial extent and short term duration. The magnitude is therefore **negligible (adverse)**.

## Significance of effect

### Harbour Porpoise

4.11.304 Although impacts may occur as a result of indirect impacts through changes to the seabed, they will be localised. When considered together with the small spatial scale of the activities, effects, from changes to the seabed are unlikely.

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

### Bottlenose Dolphin

4.11.306 Although impacts may occur as a result of indirect impacts through changes to the seabed, they will be localised. When considered together with the small spatial scale of the activities, effects, from changes to the seabed are unlikely.

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

### Risso's Dolphin

4.11.308 Although impacts may occur as a result of indirect impacts through changes to the seabed, they will be localised. When considered together with the small spatial scale of the activities, effects, from changes to the seabed are unlikely.

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

### Common Dolphin

4.11.310 Although impacts may occur as a result of indirect impacts through changes to the seabed, they will be localised. When considered together with the small spatial scale of the activities, effects, from changes to the seabed are unlikely.

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

### Minke Whale

4.11.312 Although impacts may occur as a result of indirect impacts through changes to the seabed, they will be localised. When considered together with the small spatial scale of the activities, effects, from changes to the seabed are unlikely.

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

### Grey Seal

4.11.314 Although impacts may occur as a result of indirect impacts through changes to the seabed, they will be localised. When considered together with the small spatial scale of the activities, effects, from changes to the seabed are unlikely.

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

### Leatherback Turtle

4.11.316 Although impacts may occur as a result of indirect impacts through changes to the seabed, they will be localised. When considered together with the small spatial scale of the activities, effects, from changes to the seabed are unlikely.

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

## Sensitivity testing

4.11.318 Potential changes in the construction years or periods would not affect the significance assessment. The main impacts on marine mammals and sea turtles if works were shifted to begin in year five would be the result of anthropogenic climate change. 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 maintenance and decommissioning effects, there is unlikely to be any change in the associated future significance due to climate change.

## Further Mitigation

4.11.319 The significance of effect from indirect impacts to marine mammals and sea turtles from changes to the seabed during the operational and maintenance phase is not significant in EIA terms. Therefore, no further mitigation is proposed or considered necessary.

## Future Monitoring

4.11.320 The significance of effect from indirect impacts to marine mammals and sea turtles from changes to the seabed during the operational and maintenance phase is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

## EMF impacts

4.11.321 The conduction of electricity through subsea power cables has the potential to emit a localised EMF which could potentially affect the sensory mechanisms of marine mammals and sea turtles (CMACS, 2003; Copping, 2018; Normandeau *et al.*, 2011).

4.11.322 The effects of EMF on marine mammals and sea turtles are not well understood and, more broadly, there has been a lack of studies investigating the effects of EMFs on the behaviour of magneto- and electrosensitive animals.

4.11.323 There are no thresholds for assessing impacts to marine life from EMFs, therefore by necessity, this impact assessment is qualitative by nature, based on the available evidence base (a combination of laboratory experiments and field studies).

4.11.324 This impact assessment will focus on EMF impacts on marine mammals and sea turtles from the operational and maintenance phase.

## Sensitivity of receptor

4.11.325 Marine mammals are thought to use magnetic fields for navigational purposes (Kirschvink et al., 1986). The use of magnetic fields for navigation has not been demonstrated experimentally, however, and it is not known how this sense operates. The only marine mammal known to show any response to EMF is the Guiana dolphin (Sotalia guianensis). The Guiana dolphin possesses an electroreceptive system which uses the vibrissal crypts on their rostrum to detect electrical stimuli similar to those generated by small and medium sized fish (Czech-Damal et al., 2013). This system has not been shown in any other species of marine mammal so is not relevant to the marine mammal receptors in this ES.

### Harbour Porpoise

4.11.326 It is widely believed that harbour porpoise are able to detect differences in relative magnetic field strength (Klinowska, 1985), however to date there is no evidence to suggest that existing cables have influenced cetacean movements. There are several high voltage DC cables in the Skagerrak and west Baltic Sea, which appear to have no effect on harbour porpoise migration in and out of the Baltic Sea (Faber Maunsell and Metoc, 2007).

4.11.327 In addition, harbour porpoise are a highly mobile pelagic species and will therefore only interact with the EMF fields from the cables when diving to hunt for prey.

4.11.328 Based on the above, harbour porpoise are considered to be of high adaptability, high tolerance, high recoverability, and of very high value. The sensitivity of the receptor is negligible.

### Bottlenose Dolphin

4.11.329 While bottlenose dolphin are potentially capable of detecting magnetic fields, there is no evidence that EMF from cables has an effect on bottlenose dolphin (Normandeau et al., 2011). In addition, bottlenose dolphin are a highly mobile pelagic species and will therefore only interact with the EMF fields from the cables when diving to hunt for prey.

4.11.330 Based on the above, bottlenose dolphin are considered to be of high adaptability, high tolerance, high recoverability, and of very high value. The sensitivity of the receptor is negligible.

### Risso's Dolphin

4.11.331 While Risso's dolphin are potentially capable of detecting magnetic fields, there is no evidence that EMF from cables has an effect on Risso's dolphin (Normandeau et al., 2011) In addition, Risso's dolphin are a highly mobile pelagic species and will therefore only interact with the EMF fields from the cables when diving to hunt for prey.

4.11.332 Based on the above, Risso's dolphin are considered to be of high adaptability, high tolerance, high recoverability, and of very high value. The sensitivity of the receptor is negligible.

### Common Dolphin

4.11.333 While common dolphin are potentially capable of detecting magnetic fields, there is no evidence that EMF from cables has an effect on common dolphin (Normandeau et al., 2011). In addition, common dolphin are a highly mobile pelagic species and will therefore only interact with the EMF fields from the cables when diving to hunt for prey.

4.11.334 Based on the above, common dolphin are considered to be of high adaptability, high tolerance, high recoverability, and of very high value. The sensitivity of the receptor is negligible.

### Minke Whale

4.11.335 While minke whale are potentially capable of detecting magnetic fields, there is no evidence that EMF from cables has an effect on minke whale (Normandeau et al., 2011). In addition, minke whale are a highly mobile pelagic species and will therefore only interact with the EMF fields from the cables when diving to hunt for prey.

4.11.336 Based on the above, minke whale are considered to be of high adaptability, high tolerance, high recoverability, and of very high value. The sensitivity of the receptor is negligible.

### Grey Seal

4.11.337 There is currently no evidence that seals respond to EMF (Gill et al., 2005), and they are known to actively forage along anthropogenic structures at sea (Russell et al., 2014). In addition, grey seal are a mobile and primarily pelagic species and will therefore only interact with the EMF fields from the cables when diving to hunt for prey.

4.11.338 Based on the above, grey seal are considered to be of high adaptability, high tolerance, high recoverability, and of very high value. The sensitivity of the receptor is **negligible**.

### Leatherback Turtle

4.11.339 There is evidence to suggest that sea turtles are able to detect magnetic fields and use them as a cue for navigation and orientation (Lohmann, 1991). In particular, sea turtles are known to use magnetic cues during two life critical stages: the hatching stage (which occurs in tropical and sub-tropical waters) and as reproductive adults, where they use multiple cues, including EMF, for

navigation during long migrations lasting several days (Tricas and Gill, 2011; Lohmann, 1991).

4.11.340 As such the conduction of electricity through subsea power cables has the potential to emit a localised EMF which could potentially interfere with the sensory mechanisms of leatherback turtle (CMACS, 2003; Copping, 2018; Normandeau *et al.*, 2011). Potential impacts from EMF to leatherback turtles could include interference with feeding, navigation use and habitat preference (Normandeau *et al.,* 2011). However, the susceptibility of leatherback turtles to adverse effects from EMF is low given the species' mobility and pelagic nature (Normandeau *et al.,* 2011) and the localised nature of EMFs from the Proposed Development. Furthermore, it has been suggested by Lohmann and Lohmann (1996) that although sea turtle species use these magnetic fields, they are not thought to be essential and rely on multiple cues for navigation.

4.11.341 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

4.11.342 EMFs are a combination of an electrical field and a magnetic field, with the electrical field generated by static charges and the magnetic field generated by moving currents. Anthropogenic sources of EMF are primarily subsea cables used for power generation and telecommunications or submarine communications (Normandeau *et al.*, 2011; Tasker *et al.*, 2010).

4.11.343 The maximum design scenario for the Proposed Development proposes to install four 525 kV HVDC sub-sea cables along 370 km of UK offshore cable corridor, which will be buried at a target depth of 1.5 m. The calculated static magnetic field of the bundled cables is 79 µT (790 mG), with no static electric fields being emitted due to the cable shielding system (Amplitude Consultants, 2021). The presence of these cables may cause highly localised EMF effects on marine mammals and sea turtles.

4.11.344 Submarine cables can cause three different types of EMFs: electrical (E) fields, magnetic (B) fields, and induced electric (iE) fields. E-fields are measured in volts per metre (V/m) and are generated by the voltage of the cable. B-fields are measured in microtesla (µT) or milligauss (mG) where 1 µT = 10 mG and are generated by the current of the power through the cable. They attenuate both horizontally and vertically away from the cable, with field strength directly related to the power of the current passing through the cable, rather than being specifically related to the voltage. iE-fields are measured in V/m and are generated by the fluctuation of the B-fields (in AC transmission) or by the motion of the seawater (or an organism) through the B-field. Therefore, they are dependent on the strength of the B-field, thus the strength of the iE-field is directly related to the B-field, which is strongest closest to the cable, attenuating horizontally and vertically away from it.

4.11.345 EMFs also occur naturally in the marine environment from a variety of sources including background levels from the Earth's magnetic field, and very small fields generated by electrical currents moving through organisms (Tricas and Gill, 2011). The Earth's static B-field is present in both terrestrial and aquatic environments and lies in the range 25 to 65 µT (Hutchison *et al.*, 2018). The B-

field strength of the Irish Sea is approximately 49 µT (National Oceanic and Atmospheric Administration (NOAA), 2020).

4.11.346 A variety of design and installation factors affect EMF levels in the vicinity of the cables such as current flow, distance between cables, cable insulation, number of conductors, configuration of cable and burial depth. For example, the B-fields generated by High Voltage Alternating Current (HVAC) and High Voltage Direct Current (HVDC) cables are significantly different, with HVDC cables typically generating much larger EMFs than HVAC cables (Tricas and Gill, 2011).

4.11.347 Studies have shown that EMF magnetic field levels directly over AC power cables ranged between 30 to 165 mG for 138 to 400 kV export cables at the sea floor, For DV export cables, EMF magnetic field ranged between 590 to 1250[2]mG for ±75 to ±500[2]kV export cables at the seafloor (CSA, 2019). For AC export cables, there was a reduction in magnetic field levels 1 m above the seafloor, with 10 to 40 mG for export cables. Induced electric field levels for export cables were 0.2 to 2.0 mV/m at 1 m above the sea floor (CSA, 2019). Other studies have also shown that for HVDC cables there is a reduction in EMF magnetic field emissions with increasing burial depth (Hutchinson *et al.,* 2021).

4.11.348 While there may be some changes to EMF levels as a result of the Proposed Development, the above studies suggest that cable burial will result in highly localised EMF impact only. Therefore, the impact of EMF on marine mammals and sea turtles is considered to result in only a small proportion of the population affected, to occur frequently throughout the operation and maintenance phase, have intermittent and reversible consequences, and is very unlikely to affect the population trajectory.

4.11.349 The impact is predicted to be of local spatial extent (within metres of cable) and short-term duration (occur across whole operational period). The magnitude is therefore **low (adverse)**.

## Significance of effect

### Harbour Porpoise

4.11.350 Although impacts on harbour porpoise may occur as a result of EMF, they will be temporary and localised.

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

### Bottlenose Dolphin

4.11.352 Although impacts on bottlenose dolphin may occur as a result of EMF, they will be temporary and localised.

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

### Risso's Dolphin

4.11.354 Although impacts on Risso's dolphin may occur as a result of EMF, they will be temporary and localised.

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

### Common Dolphin

4.11.356 Although impacts on common dolphin may occur as a result of EMF, they will be temporary and localised.

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

### Minke Whale

4.11.358 Although impacts on minke whale may occur as a result of EMF, they will be temporary and localised.

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

### Grey Seal

4.11.360 Although impacts on grey seal may occur as a result of EMF, they will be temporary and localised.

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

### Leatherback Turtle

4.11.362 Although impacts on leatherback turtle may occur as a result of EMF, they will be temporary and localised.

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

## Further Mitigation

4.11.364 The significance of effect from EMF on marine mammals and sea turtles during the operational and maintenance phase is not significant in EIA terms. Therefore, no further mitigation is proposed or considered necessary.

## Future Monitoring

4.11.365 The significance of effect from EMF on marine mammals and sea turtles during the operational and maintenance phase is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

# 4.12 Assessment of Decommissioning Effects

4.12.1 The potential preliminary impacts arising from the decommissioning phase of the Proposed Development are listed in **Table 4.19,** along with the maximum design scenario against which each impact has been assessed.

4.12.2 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.

4.12.3 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.

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

4.12.5 A description of the likely effect on receptors caused by each identified impact is given below.

## Injury and temporary changes in hearing from anthropogenic noise

4.12.6 Cable removal activities have the greatest potential to generate underwater noise during the decommissioning phase and thus have an impact on marine mammals and sea turtles if the frequency of the noise is within their hearing range (**Table 4.20** and **Table 4.21**).

4.12.7 This impact assessment will focus on physiological injury to and hearing shift in marine mammals and turtles as a result of underwater noise from decommissioning activities (non-impulsive sources). For the marine mammal impact assessment, it was based on the $SPL_{peak}$ and $SEL_{cum}$ onset thresholds presented by Southall et al. (2019) and listed in **Table 4.22**.

## Sensitivity of receptor

4.12.8 As detailed in **paragraph 4.10.9**, no TTS assessment of species sensitivity is given for marine mammal receptors because there are no thresholds to determine a biologically significant effect from TTS-onset.

### Harbour Porpoise

4.12.9 Harbour porpoise sensitivity to PTS is described in **section 4.10**.The sensitivity of the receptor is **low**.

### Bottlenose Dolphin

4.12.10 Bottlenose dolphin sensitivity to PTS is described in **section 4.10**.The sensitivity of the receptor is **low**.

### Risso's Dolphin

4.12.11 Risso's dolphin sensitivity to PTS is described in **section 4.10**.The sensitivity of the receptor is **low**.

### Common Dolphin

4.12.12 Common dolphin sensitivity to PTS is described in **section 4.10**.The sensitivity of the receptor is **medium**.

### Minke Whale

4.12.13 Minke whale sensitivity to PTS is described in **section 4.10**.The sensitivity of the receptor is **medium**.

### Grey Seal

4.12.14 Grey seal sensitivity to PTS is described in **section 4.10**.The sensitivity of the receptor is **low**.

### Leatherback Turtle

4.12.15 Leatherback turtle sensitivity to PTS and TTS is described in **section 4.10**.The sensitivity of the receptor is **negligible**.

## Magnitude of impact

4.12.16 Project activities during decommissioning that are expected to operate at frequencies within the hearing range of marine mammal and sea turtle receptors are provided in **Table 4.23**.

4.12.17 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 to those assessed in the construction phase (this is considered to be a worst case).

### Marine Mammals

4.12.18 The magnitude of PTS impacts on marine mammals is described in **section 4.10**. The magnitude of PTS impacts from the Proposed Development on marine mammals is assessed as **negligible (adverse)**.

### Leatherback Turtle

4.12.19 The magnitude of PTS and TTS impacts on leatherback turtle is described in **section 4.10**. The magnitude of PTS and TTS impacts from the Proposed Development on leatherback turtle is assessed as **negligible (adverse)**.

## Significance of effect

### Harbour Porpoise

4.12.20 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on harbour porpoise based on the modelling

results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in very high frequency cetaceans.

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

### Bottlenose Dolphin

4.12.22 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on bottlenose dolphin based on the modelling results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in very high frequency cetaceans.

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

### Risso's Dolphin

4.12.24 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on Risso's dolphin based on the modelling results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in very high frequency cetaceans.

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

### Common Dolphin

4.12.26 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on common dolphin based on the modelling results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in very high frequency cetaceans.

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

### Minke Whale

4.12.28 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on minke whale based on the modelling results, as underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in very high frequency cetaceans.

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

### Grey Seal

4.12.30 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS would occur on grey seal based on the modelling results, as

underwater noise from all activities listed in **Table 4.23** is not estimated to reach the $SEL_{cum}$ threshold of PTS-onset in very high frequency cetaceans.

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

### Leatherback Turtle

4.12.32 Notwithstanding the short-term and transient nature of the activities, it is highly unlikely that PTS or TTS would occur on leatherback turtles based on the evidence provided above.

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

## Further Mitigation

4.12.34 The significance of PTS impact on marine mammals and sea turtles, and TTS impact on sea turtles as a result of decommissioning activities is assessed as not significant in EIA terms. No further mitigation is proposed.

## Future Monitoring

4.12.35 The significance of PTS impact on marine mammals and sea turtles, and TTS impact on sea turtles as a result of decommissioning activities is assessed as not significant in EIA terms. Therefore, no future monitoring is considered necessary.

# Disturbance from anthropogenic noise

4.12.36 Cable removal activities have the greatest potential to generate underwater noise during the decommissioning phase and thus have an impact on marine mammals and sea turtles.

4.12.37 The operating frequencies of the different activities are described in **section 4.10** and are summarised in **Table 4.23**.

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

## Sensitivity of receptor

### Harbour Porpoise

4.12.39 Harbour porpoise sensitivity to disturbance from anthropogenic noise is described in **section 4.10**.The sensitivity of the receptor is **medium**.

### Bottlenose Dolphin

4.12.40 Bottlenose dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Risso's Dolphin

4.12.41 Risso's dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Common Dolphin

4.12.42 Common dolphin sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Minke Whale

4.12.43 Minke whale sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Grey Seal

4.12.44 Grey seal sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Leatherback Turtle

4.12.45 Leatherback turtle sensitivity to disturbance from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **negligible.**

## Magnitude of impact

4.12.46 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 4.23**.

4.12.47 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 to those assessed in the construction phase (this is considered a worst case).

### Harbour Porpoise

4.12.48 The magnitude of impact to harbour porpoise from anthropogenic noise is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low (adverse)**.

### Bottlenose Dolphin

4.12.49 The magnitude of impact to bottlenose dolphin from anthropogenic noise is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low (adverse)**.

### Risso's Dolphin

4.12.50 The magnitude of impact to Risso's dolphin from anthropogenic noise is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low (adverse)**.

### Common Dolphin

4.12.51 The magnitude of impact to common dolphin from anthropogenic noise is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low (adverse)**.

### Minke Whale

4.12.52 The magnitude of impact to minke whale from anthropogenic noise is described in **section 4.10**. The sensitivity of the receptor is **low (adverse)**.

### Grey Seal

4.12.53 The magnitude of impact to grey seal from anthropogenic noise is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low (adverse)**.

### Leatherback Turtle

4.12.54 The magnitude of impact to leatherback turtle from anthropogenic noise is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low (adverse)**.

## Significance of effect

### Harbour Porpoise

4.12.55 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.

4.12.56 Overall, the magnitude of the impact is **low (adverse),** 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

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

4.12.58 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.

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

### Risso's Dolphin

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

4.12.61 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.

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

### Common Dolphin

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

4.12.64 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 anthropogenic noise are unlikely.

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

### Minke Whale

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

4.12.67 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.

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

### Grey Seal

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

4.12.70 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.

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

### Leatherback Turtle

4.12.72 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 anthropogenic noise are unlikely.

4.12.73 Overall, the magnitude of the impact is **low (adverse),** 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

4.12.74 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. No further mitigation is proposed.

### Future Monitoring

4.12.75 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

4.12.76 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.

4.12.77 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 90 vessels recorded per day, with approximately 74 vessels per day recorded crossing the Offshore Cable Corridor. The busiest day recorded 122 vessels. The most common vessel type was cargo vessels, accounting for 50% of vessels within the study area with an average of 44 vessels per day. Tankers (20%), fishing vessels (15%) and recreational vessels (7%) also accounted for a large proportion of vessel traffic (See Volume 3, Chapter 5: Shipping and Navigation of the ES for further information).

4.12.78 Vessel traffic at the time of decommissioning is uncertain (given it will be 50 years distant), however is assumed to be of similar scale to the current baseline.

### Sensitivity of receptor

#### Harbour Porpoise

4.12.79 Harbour porpoise sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low**.

#### Bottlenose Dolphin

4.12.80 Bottlenose dolphin sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low**.

#### Risso's Dolphin

4.12.81 Risso's dolphin sensitivity to increased vessel disturbance is described in **section 4.10.** The sensitivity of the receptor is **low**.

### Common Dolphin

4.12.82 Common dolphin sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Minke Whale

4.12.83 Minke whale sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Grey Seal

4.12.84 Grey seal sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low**.

### Leatherback Turtle

4.12.85 Leatherback turtle sensitivity to increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **negligible**.

## Magnitude of impact

4.12.86 During the decommissioning phase, for assessment purposes it is assumed that the same number and type of Proposed Development vessels is present as during the construction phase (considered worst case assumption).

4.12.87 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

4.12.88 The magnitude of impact to harbour porpoise from increased vessel disturbance is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low (adverse)**.

### Bottlenose Dolphin

4.12.89 The magnitude of impact to bottlenose dolphin from increased vessel disturbance is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low (adverse)**.

### Risso's Dolphin

4.12.90 The magnitude of impact to Risso's dolphin from increased vessel disturbance is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low (adverse)**.

### Common Dolphin

4.12.91 The magnitude of impact to common dolphin from increased vessel disturbance is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low (adverse)**.

### Minke Whale

4.12.92 The magnitude of impact to minke whale from increased vessel disturbance is described in **section 4.10**. The sensitivity of the receptor is **low (adverse)**.

### Grey Seal

4.12.93 The magnitude of impact to grey seal from increased vessel disturbance is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **low (adverse)**.

### Leatherback Turtle

4.12.94 The magnitude of impact to leatherback turtle from increased vessel disturbance is described in **section 4.10**. The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible (adverse)**.

## Significance of effect

### Harbour Porpoise

4.12.95 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 increased vessel disturbance are unlikely.

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

### Bottlenose Dolphin

4.12.97 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.

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

### Risso's Dolphin

4.12.99 For the reasons discussed at sensitivity of the receptor above (within **Section 4.10**), 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.

4.12.100 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.

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

### Common Dolphin

4.12.102 For the reasons discussed at sensitivity of the receptor above (within **Section 4.10**), 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.

4.12.103 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 increased vessel disturbance are unlikely.

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

### Minke Whale

4.12.105 For the reasons discussed at sensitivity of the receptor above (within **Section 4.10**), 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.

4.12.106 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.

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

### Grey Seal

4.12.108 For the reasons discussed at sensitivity of the receptor above (within **Section 4.10**), 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.

4.12.109 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.

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

### Leatherback Turtle

4.12.111 For the reasons discussed at sensitivity of the receptor above (within **Section 4.10**), 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.

4.12.112 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.

4.12.113 Overall, the magnitude of the impact is **negligible (adverse),** 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

4.12.114 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. No further mitigation is proposed.

### Future Monitoring

4.12.115 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.

## Vessel collision risk

4.12.116 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 injury or death due to collision with vessels due to increased vessel presence.

4.12.117 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 90 vessels recorded per day, with approximately 74 vessels per day recorded crossing the Offshore Cable Corridor. The busiest day recorded 122 vessels. The most common vessel type was cargo vessels, accounting for 50% of vessels within the study area with an average of 44 vessels per day. Tankers (20%), fishing vessels (15%) and recreational vessels (7%) also accounted for a large proportion of vessel traffic (See Volume 3, Chapter 5: Shipping and Navigation of the ES for further information).

### Sensitivity of receptor

4.12.118 Marine mammal and sea turtle receptors sensitivity to vessel collision risk is described in **section 4.10.** The sensitivity of the receptors is **high.**

### Magnitude of impact

4.12.119 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 (worst case).

4.12.120 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.

4.12.121 The magnitude of impact to marine mammals and sea turtles from vessel collision risk is described in **section 4.10**. The impact is predicted to be of local

spatial extent, short term duration and intermittent. The magnitude is therefore **negligible (adverse)**.

## Significance of effect

### Harbour Porpoise

4.12.122 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Bottlenose Dolphin

4.12.124 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Risso's Dolphin

4.12.126 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Common Dolphin

4.12.128 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Minke Whale

4.12.130 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Grey Seal

4.12.132 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

### Leatherback Turtle

4.12.134 Although a risk of collision may occur, it will be temporary and localised. When considered together with the short-term and transient nature of the activities and implementation of a NSVMP, effects from increased vessel collision risk are unlikely.

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

## Further Mitigation

4.12.136 The significance of effect from vessel collision risks to marine mammals and sea turtles during the decommissioning phase is not significant in EIA terms. No further mitigation is proposed.

## Future monitoring

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

# Indirect effects on prey species

4.12.138 Effects on prey species as a result of cable removal activities could potentially have an impact on marine mammals and sea turtles, similar in nature to those associated with the construction phase.

4.12.139 Given that marine mammals and sea turtles are dependent on prey, there is the potential for indirect effects on these receptors as a result of impacts upon prey species or the habitats that support them. **Table 4.26** lists the key prey species of each receptor.

## Sensitivity of receptor

4.12.140 Marine mammal and sea turtle sensitivity to impacts resulting from indirect effects on prey species is described in **section 4.10**. The sensitivity of all receptors is **low**.

## Magnitude of Impact

4.12.141 As the decommissioning process will include similar activities to the construction phase, the magnitude of impact is assessed as similar to those assessed in the construction phase. This is considered a worst case.

4.12.142 The magnitude of impact to marine mammals and sea turtles from impacts on prey species is described in **section 4.10**. The impact is therefore predicted to be of local spatial extent, short term duration and intermittent. The magnitude is therefore **negligible (adverse)**.

## Significance of Effect

### Harbour Porpoise

4.12.143 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Bottlenose Dolphins

4.12.145 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Risso's Dolphin

4.12.147 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Common Dolphin

4.12.149 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Minke Whale

4.12.151 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Grey Seal

4.12.153 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

### Leatherback Turtle

4.12.155 Although impacts may occur as a result of indirect effects on prey species, they will be temporary and localised. When considered together with the short-term and transient nature of the activities, effects from indirect impacts on prey species are unlikely.

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

## Further Mitigation

4.12.157 The significance of effect from indirect effects on prey species as a result of decommissioning of the Proposed Development is not significant in EIA terms. No further mitigation is proposed.

## Future monitoring

4.12.158 The significance of effect from indirect effects on prey species as a result of decommissioning of the Proposed Development is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

### Removal of hard substrate

4.12.159 The addition of cables and associated cable protection (during the Construction Phase) constitutes new hard substrate that will likely be colonised by a variety of marine organisms. Research has shown that almost all man-made structures are rapidly colonised by marine organisms (Linley *et al.*, 2007). Current best practice for cable decommissioning, 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.

4.12.160 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. Given that marine mammals and sea turtles are dependent on fish prey, there is the potential for indirect effects on marine mammals as a result of impacts upon fish species or the habitats that support them.

## Sensitivity of receptor

### Harbour Porpoise

4.12.161 Harbour porpoises are potentially vulnerable to removal of hard substrates as a result of cable decommissioning. If the cables and, where used, associated cable protection are removed as part of the decommissioning process, harbour porpoise foraging may be indirectly impaired by a change in prey community composition in proximity to the Proposed Development.

4.12.162 Harbour porpoises 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). They are generalist feeders and are therefore considered to be resilient to changes in prey abundance and distribution.

4.12.163 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

4.12.164 Bottlenose dolphins are potentially vulnerable to removal of hard substrates as a result of cable decommissioning. If the cables and, where used, associated cable protection are removed as part of the decommissioning process, bottlenose dolphin foraging may be indirectly impaired by a change in prey community composition in proximity to the Proposed Development. Bottlenose dolphins have the capability to adapt their behaviour and tolerate certain levels of temporary

disturbance, including from changes in prey distribution. They are generalist feeders and are therefore considered to be resilient to changes in prey abundance and distribution.

4.12.165 Based on the above, bottlenose 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**.

### Risso's Dolphin

4.12.166 Risso's dolphins are potentially vulnerable to removal of hard substrates as a result of cable decommissioning. If the cables and, where used, associated cable protection are removed as part of the decommissioning process, Risso's dolphin foraging may be indirectly impaired by a change in prey community composition in proximity to the Proposed Development. Unlike the other marine mammals in this assessment, Risso's dolphins are less generalist in their diet than other species, feeding on cephalopods. However, due to the highly localised potential effects of decommissioning on prey abundance and community composition, they are considered to be resilient to these changes.

4.12.167 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

4.12.168 Common dolphins are potentially vulnerable to removal of hard substrates as a result of cable decommissioning. If the cables and, where used, associated cable protection are removed as part of the decommissioning process, bottlenose dolphin foraging may be indirectly impaired by a change in prey community composition in proximity to the Proposed Development. Common dolphins have the capability to adapt their behaviour and tolerate certain levels of temporary disturbance, including from changes in prey distribution. They are generalist feeders and are therefore considered to be resilient to changes in prey abundance and distribution.

4.12.169 Based on the above, 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

4.12.170 Minke whales are potentially vulnerable to removal of hard substrates as a result of cable decommissioning. If the cables and, where used, associated cable protection are removed as part of the decommissioning process, minke whale foraging may be indirectly impaired by a change in prey community composition in proximity to the Proposed Development. Minke whales have the capability to adapt their behaviour and tolerate certain levels of temporary disturbance, including from changes in prey distribution. They are generalist feeders and are therefore considered to be resilient to changes in prey abundance and distribution.

4.12.171 Based on the above, 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

4.12.172 Grey seals are potentially vulnerable to removal of hard substrates as a result of cable decommissioning. If the cables and, where used, associated cable protection are removed as part of the decommissioning process, grey seal foraging may be indirectly impaired by a change in prey community composition in proximity to the Proposed Development. Grey seals have the capability to adapt their behaviour and tolerate certain levels of temporary disturbance, including from changes in prey distribution. They are generalist feeders and are therefore considered to be resilient to changes in prey abundance and distribution.

4.12.173 Based on the above, grey seals 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.**

### Leatherback Turtle

4.12.174 Leatherback turtles are potentially vulnerable to removal of hard substrates as a result of cable decommissioning. If the cables and, where used, associated cable protection are removed as part of the decommissioning process, leatherback turtle foraging may be indirectly impaired by a change in prey community composition in proximity to the Proposed Development. Leatherback turtles have the capability to adapt their behaviour and tolerate certain levels of temporary disturbance, including from changes in prey distribution. They feed on a variety of gelatinous species (Medusozoa spp.) and are therefore considered to be resilient to changes in prey abundance and distribution.

Based on the above, leatherback turtles 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.**

## Magnitude of impact

4.12.175 Potential impacts of removal of hard substrate (long-term habitat loss/change) during the decommissioning phase of the of the Proposed Development are described in Volume 3, Chapter 1: Benthic Ecology of the ES, as being similar to the ones from the construction phase. The quantification of habitat loss/change is set out within the Benthic Ecology Study Area. The assessment concluded that will be no significant effects arising from the Proposed Development on the benthic receptors.

4.12.176 It is likely that following the removal of the hard substrates, the habitat will return to the baseline conditions and therefore will restore the balance from any sift in community structure as a result of the Proposed Development construction.

4.12.177 In addition, Volume 3, Chapter 2: Fish and Shellfish Ecology of the ES concluded that there are no significant impacts to fish species predicted during decommissioning.

4.12.178 The impact to all marine mammal and sea turtle receptors from removal of hard substrate (and therefore effects on prey species) is considered to be highly localised, to occur frequently throughout the decommissioning phase, and is unlikely to occur as there is expected to be no significant impacts on benthic receptors or fish and shellfish species.

4.12.179 The impact is therefore predicted to be of local spatial extent and short term duration. The magnitude is therefore **negligible (adverse)**.

## Significance of effect

### Harbour Porpoise

4.12.180 Although impact pathways are possible as a result of removal of hard substrate, they will be localised. When considered together with the small spatial scale of the activities, effects, from removal of hard substrate are unlikely.

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

### Bottlenose Dolphin

4.12.182 Although impact pathways are possible as a result of removal of hard substrate, they will be localised. When considered together with the small spatial scale of the activities, effects, from removal of hard substrate are unlikely.

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

### Risso's Dolphin

4.12.184 Although impact pathways are possible as a result of removal of hard substrate, they will be localised. When considered together with the small spatial scale of the activities, effects, from removal of hard substrate are unlikely.

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

### Common Dolphin

4.12.186 Although impact pathways are possible as a result of removal of hard substrate, they will be localised. When considered together with the small spatial scale of the activities, effects, from removal of hard substrate are unlikely.

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

### Minke Whale

4.12.188 Although impact pathways are possible as a result of removal of hard substrate, they will be localised. When considered together with the small spatial scale of the activities, effects, from removal of hard substrate are unlikely.

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

### Grey Seal

4.12.190 Although impact pathways are possible as a result of removal of hard substrate, they will be localised. When considered together with the small spatial scale of the activities, effects, from removal of hard substrate are unlikely.

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

### Leatherback Turtle

4.12.192 Although impact pathways are possible as a result of removal of hard substrate, they will be localised. When considered together with the small spatial scale of the activities, effects, from removal of hard substrate are unlikely.

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

### Further Mitigation

4.12.194 The significance of effect from removal of hard substrate to marine mammals and sea turtles from changes to the seabed during the decommissioning phase is not significant in EIA terms. No further mitigation is proposed.

### Future monitoring

4.12.195 The significance of effect from removal of hard substrate to marine mammals and sea turtles from changes to the seabed during the decommissioning phase is not significant in EIA terms. Therefore, no future monitoring is considered necessary.

## 4.13 Cumulative Environmental Assessment

4.13.1 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 ES). 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. For marine mammals and sea turtles, the ZoI for CEA is defined as within 5 km of the Offshore Cable Corridor (up to the UK EEZ boundary).

4.13.2 The marine mammal and sea turtle CEA methodology has followed the methodology set out in Volume 1, Chapter 5: EIA methodology of the ES. 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.

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

4.13.4 The CEA also considers the Proposed Development and the anticipated National Grid Electricity Transmission (NGET) substation (which will be implemented by NGET and thus, does not form part of the Proposed Development) together. This is because the NGET substation will be required for the connection of the Proposed Development to the national grid.

4.13.5 The specific projects, plans and activities scoped into the CEA, are outlined in **Table 4.34**. The locations of such projects, plans and activities are presented on Figure 1.2 within Volume 1, Appendix .3: CEA Screening Matrix of the ES.

**Table 4.34: 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 | Under Construction | 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.<br><br>The UK elements of the Celtic Interconnector comprise:<br>• 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.<br>• 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.<br>• A fibre optic link shall be laid along the cable route for operational control, communication and telemetry purposes. | 2025 | 2026 | Not within construction phase<br>but will overlap during<br>operational and maintenance 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 marine surveys will commence in 2024, installation phase of the offshore route will commence in 2025, for it to become fully operational by 2026. | | | |
| Shellfish cultivation pilot at seaweed farm | Permitted | 1 | Algapelago Marine Limited intend to trial a shellfish cultivation pilot to establish the commercial feasibility of shellfish cultivation at their existing site in Bideford Bay. The shellfish pilot study will last four years, to enable species to reach full market size. Two species are in scope for the cultivation pilot trials: i) *Mytilus edulis* - spat sourced from natural settlement and ii) *Pecten maximus* - spat sourced from Scallop Ranch Ltd. The pilot trial is anticipated to run from August 2024 to August 2028.<br><br>Infrastructure: installation of 4 x 200m submerged longlines for the propagation of shellfish. All infrastructure will be deployed within the existing licenced area. | 2024 | 2024 - 2028 | Not within construction phase<br>but will overlap during<br>operational and maintenance phase |
| New dwelling and flood defence wall | Permitted | 4.5 | The project involves the construction of a new four bedroom, three-storey residential dwelling with ground floor parking, | 2024 | 2025 | Not within construction 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? |
|---|---|---|---|---|---|---|
| flanking River Torridge | | | driveway, and landscaped border. As part of the proposed development, it is proposed to modify and extend the existing flood defence wall which runs for a 40 m length along the eastern site boundary. These works are required to provide necessary flood protection to the proposed dwelling. The works are proposed to take place from August 2024 to March 2025. | | | but will overlap during operational and maintenance phase |
| 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 $km^2$.<br><br>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.<br><br>Currently planning for offshore cable lay to take place in spring/summer 2028 and offshore | 2028 – 2029 | 2029+ | Yes, for both construction and operational and maintenance phases |

| 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? |
|---|---|---|---|---|---|---|
| | | | installation of the floating WTGs to take place in spring/summer 2029. | | | |
| 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 bays which equate to an area of 100 hectares.<br><br>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. | 2024 | 2025 | Not within construction phase<br>but will overlap during<br>operational and maintenance phase |
| The TwinHub Floating Offshore Wind Demonstration Project | Permitted | 29.5 | Wave Hub Limited is seeking consent to construct and deploy two semisubmersible platforms with two turbines each (with a maximum tip height of 22m m) in order to generate up to 40 MW power from renewable floating offshore wind energy. The site already consists of existing cables | 2028 | 2029 | Yes, for both construction and operation and maintenance phases |

| 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? |
|---|---|---|---|---|---|---|
| | | | and onshore infrastructure which was originally granted consent in 2007. No further work to existing infrastructure is anticipated.<br><br>The Applicant was successfully awarded a Contracts for Difference (CfD) in 2022, with a target delivery window ending in March 2028 and a long stop delivery date ending in March 2029. The operational life of the project is 30 years. | | | |
| **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 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 surveys are planned as follows:<br>• Geophysics: summer 2023 / summer 2024 | Unknown | Unknown | Unknown at this stage |

| 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? |
|---|---|---|---|---|---|---|
| | | | • Shallow geotechnical: summer 2024<br>• Digital aerial surveys for birds and marine mammals: 2 years from September 2023<br>• Metocean: 1 year of data acquisition with deployments planned for spring 2024 | | | |
| 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 surveys are planned as follows:<br>• Geophysics: summer 2023 / summer 2024<br>• Shallow geotechnical: summer 2024<br>• Digital aerial surveys for birds and marine mammals: 2 years from September 2023<br>• Metocean: 1 year of data acquisition with deployments planned for spring 2024 | Unknown | Unknown | Unknown at this stage |

| 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? |
|---|---|---|---|---|---|---|
| Isles of Scilly Seawater Reverse Osmosis (SWRO) plant | Future planned development | 40 | The construction of a SWRO plant on four sites across the Isles of Scilly - Tresco and Bryher, St Mary's & St Agness. The project includes the installation of a sea water abstraction point and pipeline and a waste outfall for the SWRO plant. The proposed location for the abstraction point, waste outfall and pipeline are in the lower intertidal/shallow subtidal zone. The schedule for the project is currently unknown, however environmental surveys to characterise the intertidal and subtidal ecology baseline at, and in the vicinity of the project, are proposed from June 2024 to July 2025. | Unknown | Unknown | Unknown at this stage |

## Scope of Cumulative Effects Assessment

4.13.6 The cumulative effects presented and assessed in this section have been based on the Project Design Envelope set out in Volume 1, Chapter 3: Project Description of the ES as well as the information available on other projects and plans. The maximum design scenario as described for the Proposed Development (see **Table 4.19**) has been assessed cumulatively with the following types of projects/plans:

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

4.13.7 At the time of writing this ES, no military or aviation 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.

4.13.8 The CEA has considered the Proposed Development, alongside the NGET substation to be developed at the existing Alverdiscott Substation Site. The assessed design of NGET substation has been based upon a combination of reasonable worst case parameters, as detailed within Volume 1, Chapter 3: Project Description of the ES. The development area for the NGET substation would comprise up to 3.8 ha of land. Within that area it is assumed that the substation itself will occupy a footprint of approximately 2.8 ha, with a maximum height of 15 m, excluding connecting tower structures. If further information is available for the proposal before the Proposed Development receives development consent, the Applicant will review the information and provide any update needed to the CEA.

4.13.9 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.

4.13.10 Certain project-alone impacts are not factored into the marine mammal and sea turtle CEA due to the following factors:

- The impacts are highly localised in nature;
- Existing commitments and mitigation measures implemented at the Proposed Development and other projects will effectively diminish the likelihood of these impacts; and

- The potential significance of the impact from the Proposed Development alone has been evaluated not significant in EIA terms.

4.13.11 The impacts excluded from this CEA for these reasons are:

- **Injury and temporary changes in hearing from anthropogenic noise**: It has been concluded in **sections 4.10, 4.11 and 4.12** that PTS-onset thresholds are not exceeded for all marine mammal and sea turtle receptors assessed. While for TTS, it has been detailed that no project-alone assessment of receptor sensitivity, impact magnitude or significance was conducted as there are no thresholds to determine a biologically significant effect from TTS-onset. Both PTS and TTS impacts for all project phases are therefore not considered further for CEA.
- **Vessel collision risk**: It is anticipated that all other projects screened in will adopt a NSVMP or adhere to vessel codes of conduct to further reduce the risk of vessel collision to marine mammals and sea turtles. As such, the potential for significant cumulative effects is minimal and this impact is not considered further.
- **Indirect impacts through changes to the seabed**: Indirect impacts on prey availability from changes to the seabed are anticipated to be highly localised across all projects. The project-alone impact has also been assessed as Negligible adverse significance which is not significant in EIA terms. As such, the potential for significant cumulative effects is minimal and this impact is not considered further.
- **EMF impacts**: The impact is estimated to be of local spatial extent. When also considering the transient nature of the activities, the project-alone impact has also been assessed as Minor adverse which is not significant in EIA terms. As such, the potential for significant cumulative effects is minimal and this impact is not considered further.
- **Removal of hard substrate**: This decommissioning phase impact on all marine mammal and sea turtle receptors assessed is estimated to be of local spatial extent. The project-alone impact has also been assessed as Negligible adverse significance which is not significant in EIA terms. As such, the potential for significant cumulative effects is minimal and this impact is not considered further.

4.13.12 Consequently, the impacts considered within this CEA are primarily focused on disturbance from anthropogenic noise, increased vessel disturbance and indirect effects on prey species throughout all project phases of the Proposed Development.

## Cumulative Effects Assessment

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

## Construction

### Tier 1 Projects

4.13.14 Most projects listed under Tier 1 have an estimated construction programme ending before 2026 (**Table 4.34**), except for the White Cross Offshore Windfarm and the TwinHub Floating Offshore Wind Demonstration Project. The construction programmes of these two projects temporally overlap with that of the Proposed Development, which is estimated to start from 2028 onwards.

4.13.15 Due to the distance of the Tier 1 projects to the ES boundary, the White Cross export cable, Celtic Interconnector, shellfish cultivation pilot at seaweed farm, and the flood defence wall works flanking River Torridge spatially fall within the marine mammal and sea turtle ZoI (5 km of the Offshore Cable Corridor, up to the UK EEZ boundary).

4.13.16 The installation of White Cross export cable is therefore the only Tier 1 project situated within the CEA ZoI with construction period estimated to overlap with that of the Proposed Development.

4.13.17 When considering noise from cable installation works on a cumulative basis, the associated disturbance impact, of very localised spatial extent, is not likely to significantly impact marine mammal or sea turtle receptors which are highly mobile. In addition, it is estimated that the cumulative disturbance impact will be primarily dominated by vessel activity.

4.13.18 It is however 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 cable projects are likely to be limited and relatively slow, resulting in less risk to marine mammal and sea turtle receptors.

4.13.19 In addition, it has been stated in the draft Marine Mammals Mitigation Protocols as part of the Environmental Statement of the White Cross Offshore Windfarm that vessel management measures would be implemented to minimise any potential vessel 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).

4.13.20 For all marine mammal and sea turtle receptors, the cumulative impact of increased disturbance from cable installation and associated works vessels is predicted to be of local spatial extent, intermittent (cable installation or vessel activity will not be constant in reality) and disturbance effects are expected to be temporary. Therefore, the magnitude of cumulative noise disturbance from cable installation and vessels is considered to be low (adverse), 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.

4.13.21 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 ES notes that this area is important for various marine mammal prey species, such as mackerel (*Scomber scombrus*), herring (*Clupea harengus*) and sprat (*Sprattus sprattus*). Construction activities associated with cable installation 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 low (adverse) for all marine mammal and sea turtle receptors.

4.13.22 As detailed in **section 4.10,** the sensitivity of minke whale, dolphin species and grey seals is assessed as low to disturbance from anthropogenic noise, while harbour porpoise is estimated to have medium sensitivity. The sensitivity of sea turtle to disturbance from anthropogenic noise is considered to be negligible.

4.13.23 As detailed in **section 4.10,** the sensitivity to increased vessel disturbance is assessed as low for all marine mammal receptors, and negligible for sea turtle.

4.13.24 As detailed in **section 4.10,** the sensitivity of marine mammal and sea turtle receptors to indirect effects on prey species is assessed as low.

**Table 4.35: 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 | Shellfish cultivation pilot at seaweed farm | | | | | | | | | | | | | | | | | | | | |
| 1 | New dwelling and flood defence wall flanking River Torridge | | | | | | | | | | | | | | | | | | | | |
| 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 (blue), 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

4.13.25 The operational and maintenance phases of all Tier 1 projects highlighted in **Table 4.35** will overlap with the Proposed Development's construction and/or operation and maintenance phases. Considering the distance of the Tier 1 projects to the ES boundary, the Celtic Interconnector project, shellfish cultivation pilot at seaweed farm and White Cross export cable fall within the 5 km of marine mammal and sea turtle ZoI from the cable corridor, and have the potential to impact marine mammal and sea turtle receptors. Although the operation of flood defence wall flanking River Torridge temporally overlaps with the operational and maintenance phase of the Proposed Development, it is estimated that no further potential for impact would result following the completion of the wall construction.

4.13.26 Relevant cable works to be conducted at operational phase is estimated to involve similar aspects to the Proposed Development, such as routine post installation inspection surveys under the proposed survey schedule outlined in **Table 4.19**. Periodic survey and repair works (cable cut, recovery, and burial activities) are anticipated to be similar to the cable installation works carried out at construction phase (noting on a localised scale), although in much more limited areas. Therefore, it is anticipated that cumulative operational and maintenance phase impacts, when also considering shellfish cultivation at seaweed farm, would still be similar in nature to those of construction.

4.13.27 The magnitude of cumulative disturbance from anthropogenic noise is considered to be low (adverse). The magnitude of cumulative increased disturbance from vessel is considered to be low (adverse). The magnitude of cumulative indirect effects on prey species to marine mammal and sea turtle receptors is also considered to be low (adverse).

4.13.28 As detailed in **section 4.11,** the sensitivity of minke whale, dolphin species and grey seals is assessed as low to disturbance from anthropogenic noise, while harbour porpoise is estimated to have medium sensitivity. A negligible sensitivity to disturbance from anthropogenic noise is estimated for sea turtles.

4.13.29 As detailed in **section 4.11,** the sensitivity to increased vessel disturbance is assessed as low for all marine mammal receptors, and negligible for sea turtle.

4.13.30 As detailed in **4.11,** the sensitivity of marine mammal and sea turtle receptors to indirect effects on prey species is assessed as low.

## Decommissioning

### Tier 1 Projects

4.13.31 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 likely 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.*

4.13.32 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.

4.13.33 The cumulative impacts of disturbance from anthropogenic noise, increased vessel disturbance and indirect effects on prey species have all been assessed as low (adverse) for all receptors.

4.13.34 As detailed in **section 4.12,** the sensitivity of minke whale, dolphin species and grey seals is assessed as low to disturbance from anthropogenic noise, while harbour porpoise is estimated to have medium sensitivity. A negligible sensitivity to disturbance from anthropogenic noise is estimated for sea turtles.

4.13.35 As detailed in **section 4.12,** the sensitivity to increased vessel disturbance is assessed as low for all marine mammal receptors, and negligible for sea turtle.

4.13.36 As detailed in **section 4.12,** the sensitivity of marine mammal and sea turtle receptors to indirect effects on prey species is assessed as low.

# 4.14 Transboundary Effects

4.14.1 A screening of transboundary impacts has been carried out and any potential for significant transboundary effects with regard to marine mammals and sea turtles from the Proposed Development upon the interests of other states has been assessed as part of this ES.

4.14.2 The potential transboundary impacts assessed within Volume 1, Appendix 5.2: Transboundary Screening of the ES are summarised below.

4.14.3 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 maintenance 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.

4.14.4 Following JNCC (2020a) 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.

4.14.5 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.

4.14.6 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).

4.14.7 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).

4.14.8 Any transboundary impacts that do occur as a result of the Proposed Development are predicted to be short-term and will be limited in spatial extent in close proximity to the jurisdictional boundary, with any disturbance to marine mammal and sea turtles being highly temporary and associated with short-term vessel activities only i.e. no lasting disturbance or impacts. Therefore, it is predicted to result in transboundary effects of minor or negligible adverse significance.

4.14.9 The linear nature of the overall Xlinks' MUPP means that any potential for transboundary effects will, by definition of geographic proximity, be less than (of lesser significance than) the relevant jurisdiction only assessments. The entire Xlinks' MUPP would be constructed and operated as a single whole using the same construction methods, and not delivered in discrete jurisdiction construction packages. Thus, the maximum effect on any marine mammal and turtle receptors in French waters will derive from the activities undertaken in those waters, which will be assessed against French environmental impact assessment procedures and legislation. A schedule of Other Consents and Licences is provided with the application documents (PINS reference EN010164/APP/3.3).

## 4.15 Inter-related Effects

4.15.1 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, and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three phases.
- Receptor led effects: Assessment of the scope for all relevant effects (including inter-relationships between environmental topics) to interact, spatially and temporally, to create inter-related effects on a receptor.

4.15.2 A description of the likely interactive effects arising from the Proposed Development on marine mammals and sea turtles is provided in Volume 4, Chapter 5: Inter-related effects of the ES.

## 4.16 Summary of Impacts, Mitigation Measures and Monitoring

4.16.1 Information on marine mammals and sea turtles within the study area 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.

4.16.2 **Table 4.36** 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 include:

- Injury and temporary changes in hearing from underwater noise;

- Disturbance from underwater noise (e.g. cable laying, dredging, rock-dumping);
- Disturbance from increased vessel presence;
- Risk of vessel collision with marine mammals and sea turtles;
- Indirect impacts on marine mammals and sea turtles as a result of impacts on their prey;
- Indirect impacts on marine mammals and sea turtles through changes to the seabed;
- EMF impacts on leatherback turtles; and
- Removal of hard substrate during Decommissioning Phase.

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

4.16.4 **Table 4.37** presents a summary of the cumulative impacts, mitigation measures and residual effects. The cumulative impacts assessed include:

- Disturbance from underwater noise (e.g. cable laying, dredging, rock-dumping);
- Disturbance from increased vessel presence; and
- Indirect effects on marine mammals and sea turtles as a result of impacts on their prey.

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

4.16.6 The following transboundary impacts 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.

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

**Table 4.36: Summary of environmental effects**

| Description of Impact | Phase[a] | | | Embedded Mitigation | Sensitivity of receptor | Magnitude of impact | Significance of Effect | Further Mitigation | Residual Effect | Proposed Monitoring |
|---|---|---|---|---|---|---|---|---|---|---|
| | C | O | D | | | | | | | |
| Injury and temporary changes in hearing from anthropogenic noise on common dolphin and minke whale | ✓ | ✓ | ✓ | *None* | *C: Medium*<br>*O: Medium*<br>*D: Medium* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse*<br>*(not significant)* | *None* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse*<br>*(not significant)* | *None* |
| Injury and temporary changes in hearing from anthropogenic noise on harbour porpoise, bottlenose dolphins, Risso's dolphin and grey seal | ✓ | ✓ | ✓ | *None* | *C: Low*<br>*O: Low*<br>*D: Low* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse*<br>*(not significant)* | *None* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse*<br>*(not significant)* | *None* |
| Injury and temporary changes in hearing from anthropogenic noise effects on leatherback turtle | ✓ | ✓ | ✓ | *None* | *C: Negligible*<br>*O: Negligible*<br>*D: Negligible* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse*<br>*(not significant)* | *None* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse*<br>*(not significant)* | *None* |
| Disturbance from anthropogenic noise on harbour porpoise | ✓ | ✓ | ✓ | *None* | *C: Medium*<br>*O: Medium*<br>*D: Medium* | *C: Low Adverse*<br>*O: Low Adverse*<br>*D: Low Adverse* | *C: Minor Adverse*<br>*O: Minor Adverse*<br>*D: Minor Adverse*<br>*(not significant)* | *None* | *C: Minor Adverse*<br>*O: Minor Adverse*<br>*D: Minor Adverse*<br>*(not significant)* | *None* |

| Description of Impact | Phase[a] | | | Embedded Mitigation | Sensitivity of receptor | Magnitude of impact | Significance of Effect | Further Mitigation | Residual Effect | Proposed Monitoring |
|---|---|---|---|---|---|---|---|---|---|---|
| | C | O | D | | | | | | | |
| Disturbance from anthropogenic noise on dolphin species, minke whale and grey seal | ✓ | ✓ | ✓ | *None* | *C: Low*<br>*O: Low*<br>*D: Low* | *C: Low Adverse*<br>*O: Low Adverse*<br>*D: Low Adverse* | *C: Minor Adverse*<br>*O: Minor Adverse*<br>*D: Minor Adverse*<br>*(not significant)* | *None* | *C: Minor Adverse*<br>*O: Minor Adverse*<br>*D: Minor Adverse*<br>*(not significant)* | *None* |
| Disturbance from anthropogenic noise on leatherback turtle | ✓ | ✓ | ✓ | *None* | *C: Negligible*<br>*O: Negligible*<br>*D: Negligible* | *C: Low Adverse*<br>*O: Low Adverse*<br>*D: Low Adverse* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse*<br>*(not significant)* | *None* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse*<br>*(not significant)* | *None* |
| Increased vessel disturbance on marine mammals | ✓ | ✓ | ✓ | OFF11 (**see Table 4.18**) | *C: Low*<br>*O: Low*<br>*D: Low* | *C: Low Adverse*<br>*O: Low Adverse*<br>*D: Low Adverse* | *C: Minor Adverse*<br>*O: Minor Adverse*<br>*D: Minor Adverse*<br>*(not significant)* | *None* | *C: Minor Adverse*<br>*O: Minor Adverse*<br>*D: Minor Adverse*<br>*(not significant)* | *None* |
| Increased vessel disturbance on leatherback turtle | ✓ | ✓ | ✓ | OFF11 (**see Table 4.18**) | *C: Negligible*<br>*O: Negligible*<br>*D: Negligible* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse*<br>*(not significant)* | *None* | *C: Negligible Adverse*<br>*D: Negligible Adverse*<br>*O: Negligible Adverse*<br>*(not significant)* | *None* |
| Vessel collision risk on marine mammals and sea turtles | ✓ | ✓ | ✓ | OFF11 (**see Table 4.18**) | *C: High*<br>*O: High*<br>*D: High* | *C: Negligible Adverse*<br>*O: Negligible Adverse* | *C: Minor Adverse*<br>*O: Minor Adverse* | *None* | *C: Minor Adverse*<br>*O: Minor Adverse*<br>*D: Minor Adverse*<br>*(not significant)* | *None* |

| Description of Impact | Phase[a] | | | Embedded Mitigation | Sensitivity of receptor | Magnitude of impact | Significance of Effect | Further Mitigation | Residual Effect | Proposed Monitoring |
|---|---|---|---|---|---|---|---|---|---|---|
| | C | O | D | | | | | | | |
| | | | | | | *D: Negligible Adverse* | *D: Minor Adverse (not significant)* | | | |
| Indirect effects on prey species of marine mammals and sea turtles | ✓ | ✓ | ✓ | *None* | *C: Low*<br>*O: Low*<br>*D: Low* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse (not significant)* | *None* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse (not significant)* | *None* |
| Indirect impacts through changes to the seabed on marine mammals and sea turtles | × | ✓ | × | *None* | *O: Low* | *O: Negligible Adverse* | *O: Negligible Adverse (not significant)* | *None* | *O: Negligible Adverse (not significant)* | *None* |
| EMF impacts on marine mammals and sea turtles | × | ✓ | × | *None* | *O: Negligible* | *O: Low Adverse* | *O: Minor Adverse (not significant)* | *None* | *O: Negligible Adverse (not significant)* | *None* |
| Removal of hard substrate on marine mammals and sea turtles | × | × | ✓ | *None* | *D: Low* | *D: Negligible Adverse* | *D: Negligible Adverse (not significant)* | *None* | *D: Negligible Adverse (not significant)* | *None* |

**Table 4.37: Summary of cumulative environmental effects**

| Description of Impact | Phase[a] | | | Embedded Mitigation | Sensitivity of receptor | Magnitude of impact | Significance of Effect | Further Mitigation | Residual Effect | Proposed Monitoring |
|---|---|---|---|---|---|---|---|---|---|---|
| | C | O | D | | | | | | | |
| **Tier 1** | | | | | | | | | | |
| Disturbance from anthropogenic noise on harbour porpoise | ✓ | ✓ | ✓ | *None* | *C: Medium*<br>*O: Medium*<br>*D: Medium* | *C: Low Adverse*<br>*O: Low Adverse*<br>*D: Low Adverse* | *C: Minor*<br>*O: Minor*<br>*D: Minor*<br>*(not significant)* | *None* | *C: Minor Adverse*<br>*O: Minor Adverse*<br>*D: Minor Adverse*<br>*(not significant)* | *None* |
| Disturbance from anthropogenic noise on dolphin species, minke whale and grey seal | ✓ | ✓ | ✓ | *None* | *C: Low*<br>*O: Low*<br>*D: Low* | *C: Low Adverse*<br>*O: Low Adverse*<br>*D: Low Adverse* | *C: Negligible or Minor*<br>*O: Negligible or Minor*<br>*D: Negligible or Minor*<br>*(not significant)* | *None* | *C: Negligible or Minor Adverse*<br>*O: Negligible or Minor Adverse*<br>*D: Negligible or Minor Adverse*<br>*(not significant)* | *None* |
| Disturbance from anthropogenic noise on leatherback turtle | ✓ | ✓ | ✓ | *None* | *C: Negligible*<br>*O: Negligible*<br>*D: Negligible* | *C: Low Adverse*<br>*O: Low Adverse*<br>*D: Low Adverse* | *C: Negligible or Minor*<br>*O: Negligible or Minor*<br>*D: Negligible or Minor*<br>*(not significant)* | *None* | *C: Negligible or Minor Adverse*<br>*O: Negligible or Minor Adverse*<br>*D: Negligible or Minor Adverse*<br>*(not significant)* | *None* |
| Increased vessel disturbance on marine mammals | ✓ | ✓ | ✓ | OFF11 (**see Table 4.18**) | *C: Low*<br>*O: Low*<br>*D: Low* | *C: Low Adverse*<br>*O: Low Adverse*<br>*D: Low Adverse* | *C: Negligible or Minor*<br>*O: Negligible or Minor*<br>*D: Negligible or Minor*<br>*(not significant)* | *None* | *C: Negligible or Minor Adverse*<br>*O: Negligible or Minor Adverse*<br>*D: Negligible or Minor Adverse*<br>*(not significant)* | *None* |
| Increased vessel disturbance on leatherback turtle | ✓ | ✓ | ✓ | OFF11 (**see Table 4.18**) | *C: Negligible*<br>*O: Negligible* | *C: Low Adverse* | *C: Negligible or Minor* | *None* | *C: Negligible or Minor Adverse* | *None* |

| Description of Impact | Phase[a] | | | Embedded Mitigation | Sensitivity of receptor | Magnitude of impact | Significance of Effect | Further Mitigation | Residual Effect | Proposed Monitoring |
|---|---|---|---|---|---|---|---|---|---|---|
| | C | O | D | | | | | | | |
| | | | | | *D: Negligible* | *O: Low Adverse*<br>*D: Low Adverse* | *O: Negligible or Minor*<br>*D: Negligible or Minor*<br>*(not significant)* | | *O: Negligible or Minor Adverse*<br>*D: Negligible or Minor Adverse*<br>*(not significant)* | |
| Indirect effects on prey species on marine mammals and leatherback turtle | ✓ | ✓ | ✓ | *None* | *C: Low*<br>*O: Low*<br>*D: Low* | *C: Negligible Adverse*<br>*O: Negligible Adverse*<br>*D: Negligible Adverse* | *C: Negligible or Minor*<br>*O: Negligible or Minor*<br>*D: Negligible or Minor*<br>*(not significant)* | *None* | *C: Negligible or Minor Adverse*<br>*O: Negligible or Minor Adverse*<br>*D: Negligible or Minor Adverse*<br>*(not significant)* | *None* |
| **Tier 2/3** | | | | | | | | | | |
| 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. | | | | | | | | | | |

# 4.17 References

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

Albuoy, C., Delattre, V., Donati, G., Frolicher, T.L., Albuoy-Boyer, S., Rufino, M., Pellisier, L., Mouillot, D., Leprieur, F. (2020). Global vulnerability of marine mammals to global warming, Scientific Reports, 19, 548.

Amplitude Consultants (2021) Xlinks HVDC Interconnector: Electromagnetic Field and Thermal Study. Ref PAU0147-REPT-001.

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.

Authier, M., Peltier, H., Dorémus, G., Dabin, W., Canneyt, O. V. and Ridoux, V. (2014). How much are stranding records affected by variation in reporting rates? A case study of small delphinids in the Bay of Biscay. Biodiversity and Conservation. 23.

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.

Boisseau, O., McGarry, T., Stephenson, S., Compton, R., Cucknell, A.C., Ryan, C., McLanaghan, R. and Moscrop, A. (2021), 'Minke whales *Balaenoptera acutorostrata* avoid a 15 kHz acoustic deterrent device (ADD). Marine Ecology Progress Series', 667:191-206.

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'.

Booth, C. and Heinis, F. (2018), 'Updating the Interim PCoD Model: Workshop Report - New transfer functions for the effects of permanent threshold shifts on vital rates in marine mammal species' Available at: https://www.researchgate.net/profile/Cormac-Booth/publication/362172971_Updating_the_Interim_PCoD_Model_Workshop_Report_-New_transfer_functions_for_the_effects_of_permanent_threshold_shifts_on_vital_rates_in_marine_mammal_species/links/62da2e09aa5823729ed56774/Updating-the-Interim-PCoD-Model-Workshop-Report-New-transfer-functions-for-the-effects-of-permanent-threshold-shifts-on-vital-rates-in-marine-mammal-species.pdf [Accessed September 2024].

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.

Boyd, I., Hanson, N. (2021). Impacts of Climate Change on Marine Mammals, SMRU.

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.

Brophy, J.T., Murphy, S. and Rogan, E. (2009). The diet and feeding ecology of the short-beaked common dolphin (*Delphinus delphis*) in the northeast Atlantic. Report to the International Whaling Commission. SC/61/SM14.

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.

Cates, K., Demaster, D., Brownell, R., Gende, S., Ritter, F. and Panigada, S. (2017). Strategic Plan to Mitigate the Impacts of Ship Strikes on Cetacean Populations: 2017-2020.

Centre for Marine and Coastal Studies (CMACs) (2003), 'A Baseline Assessment of Electromagnetic fields Generated by Offshore Windfarm Cables', Report No. COWRIE EMF-01-2002, 66. (Birkenhead, UK: Centre for Marine and Coastal Studies).

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.

Chen, F., 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.

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.

Clarke, M. R. and Pascoe, P. (1985). The stomach contents of a Risso's dolphin (Grampus griseus) stranded at Thurlestone, South Devon. Journal of the Marine Biological Association of the United Kingdom, 65: 663-665.

Climate Change Committee (CCC). 2023 Progress Report to Parliament. 2023 Progress Report to Parliament - Climate Change Committee (theccc.org.uk) [Accessed: September 2024].

CMACS (2003) A baseline assessment of electromagnetic fields generated by offshore windfarm cables. COWRIE Report EMF - 01-2002 66.

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. Available at: https://sealsanctuary.sealifetrust.org/en/about-us/sanctuary-news/confused-cornish-seals-give-up-on-wash-out-summer-amid-changing-weather/ [Accessed: September 2024].

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.

Cranford, T.W. and Krysl, P. (2015) 'Fin Whale Sound Reception Mechanisms: Skull Vibration Enables Low-Frequency Hearing'. PLOS ONE 10(1): e0116222.

CSA Ocean Sciences Inc. and Exponent (2019), 'Evaluation of Potential EMF Effects on Fish Species of Commercial or Recreational Fishing Importance in Southern New England', U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Headquarters, Sterling, VA. OCS Study BOEM 2019- 049. 59 pp.

CSIP, (2016). Annual Report for the period 1st January – 31st December 2015 (Contract number MB0111). Compiled by R. Deaville (ZSL). Contributing Authors: P.D. Jepson and M. Perkins (ZSL) A. Brownlow, N. Davison and M. ten Doeschate (SRUC) B. Smith, R. Lyal, L. Allan and R.C. Sabin (NHM) R. Penrose (MEM).

CSIP, (2017). Annual Report for the period 1st January – 31st December 2016 (Contract number MB0111). Compiled by R. Deaville (ZSL). Contributing authors: P.D. Jepson and M. Perkins (ZSL), A. Brownlow, N. Davison and M. ten Doeschate (SRUC), B. Smith, L. Allan and R.C. Sabin (NHM), R. Penrose (MEM), J.E.F. Barnett, N. Clear, A. Crosby and R. Williams (CWTMSN/UoE).

CSIP, (2018). Annual Report for the period 1st January – 31st December 2017 (Contract numbers MB0111 and ME6008). Compiled by R. Deaville (ZSL). Contributing Authors: P.D. Jepson and M. Perkins (ZSL), A. Brownlow, N. Davison and M. ten Doeschate (SRUC), B. Smith, L. Allan, S. Wilson, K. Swindells and R.C. Sabin (NHM), R. Penrose (MEM), J.E.F. Barnett, K. Astley, N. Clear, A. Crosby and R. Williams (UoE/CWTMSN).

CSIP, (2019). Annual Report for the period 1st January – 31st December 2018 (Contract number ME6008). Compiled by R. Deaville (ZSL). Contributing Authors: P.D. Jepson, M. Perkins and R. Williams (ZSL), A. Brownlow, N. Davison, M. ten Doeschate and E. MacLennan (SRUC), B. Smith, K. Swindells and R.C. Sabin (NHM), R. Penrose (MEM), J.E.F. Barnett, K. Astley, N. Clear, A. Crosby and R. Williams (UoE/CWTMSN).

CSIP, (2020). Annual Report for the period 1st January – 31st December 2019 (Contract number ME6008). Compiled by R. Deaville (ZSL). Contributing Authors: P.D. Jepson, M. Perkins and R. Williams (ZSL), A. Brownlow, N. Davison, M. ten Doeschate and E. MacLennan (SRUC), B. Smith, A. Baillie and R.C. Sabin (NHM), R. Penrose (MEM), J.E.F. Barnett, K. Astley, N. Clear, A. Hawtrey-Collier, A. Crosby and R. Williams (UoE/CWTMSN).

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.

Czech-Damal, N. U., Dehnhardt, G., Manger, P. and Hanke, W. (2013). Passive electroreception in aquatic mammals. *Journal of Comparative Physiology A*, *199*, pp.555-563.

David, J. A. (2006), Likely sensitivity of bottlenose dolphins to pile-driving noise, Water and Environment Journal, 20(1): 48-54.

De Boer, M. N. and Simmonds, M. P. (2003), 'WDCS/Greenpeace Survey Report Small cetaceans along the coasts of Wales and Southwest England'.

Deecke, V. B., Slater, P. J. and Ford, J. K. (2002), 'Selective habituation shapes acoustic predator recognition in harbour seals', Nature, 420/6912: 171-173.

Dehnhardt, G., Mauck, B., Hanke, W., and Bleckmann, H. (2001), 'Hydrodynamic trail-following in harbor seals (*Phoca vitulina*)', Science, 293: 102–104.

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: September 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: September 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: September 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: September 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 (Accessed: September 2024).

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.

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.

Dodge, K.L., Logan, J.M. and Lutcavage, M.E. (2011). Foraging ecology of leatherback sea turtles in the Western North Atlantic determined through multi-tissue stable isotope analyses. Marine Biology, 158.

Dogruer, G., Kramer, N.I., Schaap, I.L., Hollert, H., Caus, C., van de Merse, J.P. (2021). An integrative approach to define chemical exposure threshold limits for endangered sea turtles, Journal of Hazardous Materials, 420, 126512.

Douglas A. B., Calambokidis J., Raverty S., Jeffries S. J., Lambourn D. M. and Norman S. A. (2008) 'Incidence of ship strikes of large whales in Washington State', Journal of the Marine Biological Association of the United Kingdom, 88(6), pp. 1121–1132.

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.

Edds-Walton, P. L. (2000), 'Vocalizations Of Minke Whales *Balaenoptera Acutorostrata* In The St. Lawrence Estuary', Bioacoustics, 11: 31-50.

Ellison, W. T., Southall, B. L., Clark, C. W., and Frankel A. S. (2012). A new context-based approach to assess marine mammal behavioral responses to anthropogenic sounds. Conservation Biology, 26(1):21-28.

European Environment Agency (EEA) (2023). How Climate Change Impacts Marine Life How climate change impacts marine life — European Environment Agency (europa.eu) [Accessed: June 2024].

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. H. and Bjørge, A. (2013), 'Impacts of climate change on marine mammals', MCCIP Science Review 2013: 134-148.

Evans, P. G. H., Waggitt, J.J. (2020) Impacts of climate change on marine mammals, relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 421–455.

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.

Faber Maunsell and Metoc, (2007). Scottish Marine Renewables Strategic Environmental Assessment Environmental Report. Report for Scottish Government.

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.

Gedamke, J., Costa, D. P. and Dunstan, A. (2001), 'Localization and visual verification of a complex minke whale vocalization', The Journal of the Acoustical Society of America, 109:3038-3047.

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.

Goldstein, T., Johnson, S., Phillips, A., Hanni, K., Fauquier, D. and Gulland, F. (1999) 'Human-related injuries observed in live stranded pinnipeds along the central California coast 1986-1998', Aquatic Mammals, 25(1), pp. 43-51.

Graham, I. M., Farcas, A., Merchant, N. D. and Thompson, P. (2017). Beatrice Offshore Wind Farm: An interim estimate of the probability of porpoise displacement at different unweighted single-pulse sound exposure levels. Prepared by the University of Aberdeen for Beatrice Offshore Windfarm Ltd.

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.

Gubbay S., Earll R., (2000). Review of literature on the effects of oil spills on cetaceans. SNH Review No. 3.

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.

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.

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/search/0f6e0b6a-d08e-4673-8691-cab564d4a60a [Accessed: September 2024].

HM Government (2011) UK Marine Policy Statement. Available at: https://assets.publishing.service.gov.uk/media/5a795700ed915d042206795b/pb3654-marine-policy-statement-110316.pdf [Accessed: September 2024].

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.

Houser, D. S., Noble, L., Fougeres, E., Mulsow, J. and Finneran, J. J. (2022). Audiograms and click spectra of seven novel and seldom-tested odontocetes. Frontiers in Marine Science, 9: 984333.

Hutchinson, Z.L., Gill, A.B., Sigray, P., He, H., King, J.W. (2021). A modelling evaluation of electromagnetic fields emitted by buried subsea power cables and encountered by marine

animals: Considerations for marine renewable energy development, Renewable Energy, 177, pp. 72-81.

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 at: https://www.iema.net/download-document/7014. (Accessed: September 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.

Jensen, A. S., and Silber, G. K. (2003). Large whale ship strike database. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-F/OPR-25.

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 at: https://assets.publishing.service.gov.uk/media/5dea1d35e5274a06dee23a34/Draft_Guidance_on_the_Protection_of_Marine_European_Protected_Species_from_Injurt_and_Disturbance.pdf [Accessed: September 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 (2020a) 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 (2020b), 'MPA Mapper'. Available at: https://jncc.gov.uk/mpa-mapper [Accessed September 2024].

Johnson, C. S. (1967) Sound detection thresholds in marine mammals. In: Tavolga, W.N., Ed., Marine Bio-Acoustics II, Pergamon Press, Oxford, 247-260.

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.

Ketten D. and Mountain D. (2011) 'Modelling minke whale hearing', Final report submitted to the Joint Industry Program by WHOI & Boston University.

Kirschvink, J. L., Dizon, A. E. and Westphal, J. A. (1986). Evidence from strandings for geomagnetic sensitivity in cetaceans. Journal of Experimental Biology 120:1-24.

Klinowska, M., (1985). Cetacean live stranding sites relate to geomagnetic topography. *Aquatic Mammals*, *1*(1), pp.27-32.

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.

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.

Lenhardt, M. L., Klinger, R. C. and Musick, J. A. (1985). Marine turtle middle-ear anatomy. The Journal of Auditory Research, 25:66-72.

Linley, A., Wilding, T., Black, K., Hawkins, S. J., & Mangi, S. (2007). Review of the reef effects of offshore windfarm structures and potential for enhancement and mitigation. *Peer-reviewed report*, 132.

Lohmann, K. (1991). Magnetic Orientation By Hatchling Loggerhead Sea Turtles (*Caretta caretta*), Journal of Experimental Biology, 155(1), 37-49.

Lohmann, K.J. and Lohmann, C.M. (1996). Detection of magnetic field intensity by sea turtles. *Nature*, *380*(6569), pp.59-61.

Luksenburg, J. A. (2014) Prevalence of External Injuries in Small Cetaceans in Aruban Waters, Southern Caribbean. PLOS ONE 9(2): e88988.

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. (2006). The short-term behavioral reactions of bottlenose dolphins to interactions with boats in Doubtful Sound, New Zealand, *Marine Mammal Science*, 22: 802-818.

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.

Maragoni, L., Rodiguez, A., Duarte, C., Pendoley, K. (2022). Impacts of Artificial Light at Night (ALAN) in marine ecosystems – a review, Global Change Biology, 1-22.

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.

Martay, B., Macphie, K.H., Bowgen, K.M., Pearce-Higgins, J.W., Robinson, R.A., Scott, S.E., Williams, J.M. (2023). Climate change and migratory species: a review of impacts, conservation actions, indicators and ecosystem services. Part 1 – Impacts of climate change on migratory species. JNCC, Peterborough, ISBN 978-0-86139-001-4.

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.

Martins, S., Patino, J., Abella, E., de Santos Loureiro, N., Clarke, L. J. and Marco, A. (2022) 'Potential impacts of sea level rise and beach flooding on reproduction of sea turtles', *Climate Change Ecology,* 3, pp. 100053.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J. and McCabe, K. (2000). Marine seismic surveys—a study of environmental implications. *The APPEA Journal*, *40*(1), pp.692-708.

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.

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.

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.

Meager, J.J. & Limpus, C. 2014. Mortality of inshore marine mammals in eastern Australia is predicted by freshwater discharge and air temperature. PLoS One, 9, e94849.

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.

Mellinger, D. K., Carson, C. D. and Clark, C. W. (2000), 'Characteristics of minke whale (*Balaenoptera acutorostrata*) pulse trains recorded near Puerto Rico', Marine Mammal Science, 16:739-756.

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 (Accessed: August 2024).

Moein, S.E., Musick, J.A., Keinath, J.A., Barnard, D.E., Lenhardt, M., and George, R. (1995). Evaluation of seismic sources for repelling sea turtles from hopper dredges. In: Hales, L.Z. ed. Sea Turtle Research Program: Summary Report. Prepared for U. S. Army Corps of Engineers, 24 South Atlantic. Pp. 75-78. Altanta, GA and U. S. Naval Submarine Base, Kings Bay, GA. Technical Report CERC-95-31.

Mooney, T. A., Yang, W. C., Yu, H. Y., Ketten, D. R. and Jen, I. F. (2015). Hearing abilities and sound reception of broadband sounds in an adult Risso's dolphin (*Grampus griseus*). Journal of Comparative Physiology A, 201: 751-761.

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.

Nachtigall, P. E., Supin, A. Y., Smith, A. B. and Pacini, A. F. (2016). Expectancy and conditioned hearing levels in the bottlenose dolphin (*Tursiops truncatus*). Journal of Experimental Biology, 219(6): 844-850.

National Marine Fisheries Service (NMFS) (2018). 2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-59: 167

National Oceanic and Atmospheric Administration (2020), 'US/UK World Magnetic Model - Epoch 2020.0 Main Field Total Intensity (F)'. https://www.ngdc.noaa.gov/geomag/WMM/data/WMM2020/WMM2020_F_BoZ_MILL.pdf [Accessed: September 2024].

National Biodiversity Network (NBN) Atlas (2024), NBN Atlas Biodiversity Network Trust Species Search. https://species.nbnatlas.org/ [Accessed: September 2024]

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. and 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).

NMFS. (2023) "National Marine Fisheries Service: Summary of Endangered Species Act Acoustic Thresholds (Marine Mammals, Fishes, and Sea Turtles)." Available at: https://www.fisheries.noaa.gov/s3/2023-

02/ESA%20all%20species%20threshold%20summary_508_OPR1.pdf [Accessed September 2024]

Normandeau Associates Inc, Exponent Inc, Tricas, T. and Gill, A. (2011), 'Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species'. (Camarillo, CA: U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement).

North Devon Biosphere (2024). North Devon Marine Nature Recovery Plan 2022 – 2027. Available at: https://www.northdevonbiosphere.org.uk/uploads/1/5/4/4/15448192/revised_north_devon_marine_natre_recovery_plan.pdf [Accessed: September 2024]

North Devon UNESCO Biosphere Reserve (2020). North Devon Marine Natural Capital Plan. Final Report. June 2020. Available: https://www.northdevonbiosphere.org.uk/uploads/1/5/4/4/15448192/north_devon_marine_plan_final_version_approval__1_.pdf [Accessed: September 2024]

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.

Onoufriou, J., Jones, E., Hastie, G. and Thompson, D. (2016) Investigations into the interactions between harbour seals (Phoca vitulina) and vessels in the inner Moray Firth. Marine Scotland Science.

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: September 2024].

OSPAR (2023). Climate change and ocean acidification are drivers of major change, OSPAR's Quality Status Report. Available at: https://www.ospar.org/site/assets/files/50662/fact_sheet_cocoa_print_2023.pdf [Accessed: September 2024].

Palomino-Gonzalez, Lopez-Martinez, S., Rivas, M. (2020). Influence of climate and tides on the nesting behaviour of sea turtles, Journal of Experimental Marine Biology and Ecology, 257, 151378.

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.

Peltier, H., Dabin, W., Cécile, D., Fabien, D., Dorémus, G., Canneyt, O. V., Laran, S., Fernandez, P. M., Spitz, J., Matthieu, A., Daniel, P. and Ridoux, V. (2019). Can modelling the drift of bycaught dolphin stranded carcasses help identify involved fisheries? An exploratory study. Global Ecology and Conservation. 21. e00843.

Penrose, R. S. and Westfield, M. J. B. (2023), 'British & Irish Marine Turtle Strandings & Sightings Annual Report 2020'. Ceredigion.

Pierce, G., M. Santos, R. Reid, I. Patterson, and Ross, H. (2004). Diet of minke whales *Balaenoptera acutorostrata* in Scottish (UK) waters with notes on strandings of this species in Scotland 1992–2002. Journal of the Marine Biological Association of the UK, 84: 1241-1244.

Pierce, G. J., Santos, M. B. and Cervino, S. (2007). Assessing sources of variation underlying estimates of cetacean diet composition: a simulation study on analysis of harbour porpoise diet in Scottish (UK) waters. Journal of the Marine Biological Association of the United Kingdom, 87: 213-221.

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.

PNNL (2021). Does Light Affect Underwater Wildlife? | Research Highlight | PNNL Available at: https://www.pnnl.gov/publications/does-light-affect-underwater-wildlife#:~:text=Light%20may%20confuse%20or%20attract,the%20prey%20to%20seek%20shelter. [Accessed: September 2024].

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.

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.

Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D. A., Bartol, S., Carlson, T. J., Coombs, S., Ellison, W. T., Gentry, R. L., Halvorsen, M. B., Løkkeborg, S., Rogers, P. H., Southall, B. L., Zeddies, D. G. & Tavolga, W. N. (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 Cham, Briefs in Oceanography.

Rapp, R.J. (2014). Cable laying and repair – cable ship operations. TE SubCom. Available at: http://www.sargassoseacommission.org/storage/documents/Cable_Installation_and_Maintenance_-_TE_SubCom_Sargasso_Sea_Final1.pdf [Accessed: September 2024]

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.

Ridgway, S. H., Wever, E. G., McCormick, J. G., Palin, J. and Anderson, J. H. (1969). Hearing in the giant sea turtle, Chelonia mydas. Proceedings of the National Academy of Science of the United States of America, 64: 884-890.

Risch, D., Siebert, U. and Van Parijs, S. M. (2014), 'Individual calling behaviour and movements of North Atlantic minke whales (*Balaenoptera acutorostrata*)', Behaviour, 151:1335-1360.

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).

Rias, M.L., Santidrian Tomillo, P.S., Dieguez Uribeonda, J., Marco, A. (2015). Leatherback hatchling sea-finding in response to artificial lighting: Interaction between wavelength and moonlight. Journal of Experimental Marine Biology and Ecology, 463, 143-149.

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.

Ridgway, S.H., Wever, E.G., McCormick, J.G., Palin, J. and Anderson, J.H. (1969). Hearing in the giant sea turtle, Chelonia mydas. *Proceedings of the National Academy of Sciences*, *64*(3), pp.884-890.

Risch, D., Clark, C.W., Dugan, P.J., Popescu, M., Siebert, U. and Van Parijs, S.M. (2013). Minke whale acoustic behavior and multi-year seasonal and diel vocalization patterns in Massachusetts Bay, USA. *Marine Ecology Progress Series*, *489*, pp.279-295.

Risch, D., Siebert, U. and Van Parijs, S.M. (2014). Individual calling behaviour and movements of North Atlantic minke whales (Balaenoptera acutorostrata). *Behaviour*, *151*(9), pp.1335-1360.

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.

Robards, M.D., Silber, G.K., Adams, J.D., Arroyo, J., Lorenzini, D., Schwehr, K. and Amos, J. (2016). Conservation science and policy applications of the marine vessel Automatic Identification System (AIS)—a review. *Bulletin of Marine Science*, *92*(1), pp.75-103.

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.

Roberts. D.C., Mintenbeck, K., Alegria, A., Craig, M.H. (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

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., Brasseur, S. M., Thompson, D., Hastie, G. D., Janik, V .M., Aarts, G., McClintock, B. T., Matthiopoulos, J., Moss, S. E. and McConnell, B., (2014). Marine mammals trace anthropogenic structures at sea. *Current Biology*, *24*(14), pp.R638-R639.

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.

Salas, A.K., Capuano, A.M., Harms, C.A., Piniak, W.E. and Mooney, T.A. (2023). Temporary noise-induced underwater hearing loss in an aquatic turtle (*Trachemys scripta elegans*). *The Journal of the Acoustical Society of America*, *154*(2), pp.1003-1017.

Santos, M.B., Pierce, G.J., Reid, R.J., Patterson, I.A.P., Ross, H.M. and Mente. E. (2001). Stomach contents of bottlenose dolphins (*Tursiops truncatus*) in Scottish waters. Journal of the Marine Biological Association of the United Kingdom, 81: 873-878.

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.

Schulte-Pelkum, N., Wieskotten, S., Hanke, W., Dehnhardt, G. and Mauck, B. (2007), 'Tracking of biogenic hydrodynamic trails in harbour seals (Phoca vitulina)', Journal of Experimental Biology, 210/5: 781-787.

SCOS (2017). 'Scientific Advice on Matters Related to the Management of Seal Populations: 2016'.

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. (2012). Risso's Dolphin in UK Waters. Available at: https://seawatchfoundation.org.uk/wp-content/uploads/2012/07/Rissos_Dolphin.pdf [Accessed September 2024].

Sea Watch Foundation. (2024). Recent sightings: South-west England and South Wales. Available at: https://www.seawatchfoundation.org.uk/recentsightings/. [Accessed September 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 [Accessed: September 2024].

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.

Simmonds, M.P. & Isaac, S.J. (2007). The impacts of climate change on marine mammals: early signs of significant problems. Oryx, 41, 19-26.

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. Available at: https://apps.dtic.mil/sti/pdfs/ADA538910.pdf [Accessed: September 2024].

Southall, B. L., Nowacek, D. P., Miller, P. J. O., and Tyack, P. L. (2016). Experimental field studies to measure behavioral responses of cetaceans to sonar. Endangered Species Research, 31: 293-315.

Southall, B. L., Finneran, J. J., Reichmuth, C., Nachtigall, P. E., Ketten, D. R., Bowles, A. E., Ellison, W. T., Nowacek, D. P. And Tyack, P. L. (2019). Marine mammal noise exposure criteria: Updated scientific recommendations for residual hearing effects, Aquatic Mammals, 45/2: 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.

Swails, K. S. (2005) 'Patterns of seal strandings and human interactions in Cape Cod, Massachuettes'.

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.

Tasker, M. L., Amundin, M., Andre, M., Hawkins, A., Lang, W., Merck, T., & Zakharia, M. (2010), 'Marine Strategy Framework Directive Task Group 11 Report Underwater noise and other forms of energy', Report No. EUR, 24341, 2010.

The Planning Inspectorate (2017) Nationally Significant Infrastructure Projects: Advice on Habitats Regulations Assessments. Available at: https://www.gov.uk/guidance/nationally-significant-infrastructure-projects-advice-on-habitats-regulations-assessments [Accessed: September 2024].

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.

Tricas, T. C. and Gill, A. B. (2011), 'Effects of EMFs from Undersea Power Cables on Elasmobranchs and other marine species', OSC Study (Pacific OCS Region, California: US Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement).

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.

Truchon, M.H., Measures, L., L'Hérault, V., Brethes, J.C., Galbraith, P.S., Harvey, M., ... & Lecomte, N. 2013. Marine mammal strandings and environmental changes: a 15-year study in the St. Lawrence ecosystem. PLoS One, 8, e59311.

Tubelli, A.A., Zosuls, A., Ketten, D.R., Yamato, M. and Mountain, D.C. (2012). A prediction of the minke whale (*Balaenoptera acutorostrata*) middle-ear transfer function. *The Journal of the Acoustical Society of America*, *132*(5), pp.3263-3272.

Tulloch, V.J., Plagányi, É.E., Brown, C., Richardson, A.J. & Matear, R. 2019. Future recovery of baleen whales is imperiled by climate change. Global Change Biology, 25, 1263-1281.

Tyson, R. B., Piniak, W. E., Domit, C., Mann, D., Hall, M., Nowacek, D. P. and Fuentes, M. M. (2017) 'Novel bio-logging tool for studying fine-scale behaviors of marine turtles in response to sound', Frontiers in Marine Science*,* 4: 219.

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.

Vanderlaan, A. S. M., Serdynska, A. R. and Brown, M. W. (2008). Reducing the risk of lethal encounters: Vessels and right whales in the Bay of Fundy and on the Scotian Shelf. Endangered Species Research. 4(3). 283-297.

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

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.

Walstron, I., Hammar, L., Robert Hume, D., Almroth-Rosell. (2022). Projected climate change impact on a coastal sea-As significant as all current pressures combined. Global Change Biology, 28(17).

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.

Wells, R. S., Early, G. A., Gannon, J. G., Lingenfelser, R. G. and Sweeney, P. (2008). Tagging and tracking of rough-toothed dolphins (Steno bredanensis) from the March 2005 mass stranding in the Florida Keys. NOAA Technical Memorandum NMFS-SEFSC-574.

Wever, E. G. (1978). The Reptile Ear. Princeton, NJ: Princeton University Press.

Whyte, K. F., Russel, D. J. F., Sparling, C. E., Binnerts, B. and Hastie, G. D. (2020). Estimating the effects of pile driving sounds on seals: pitfalls and possibilities. Journal of the Acoustical Society of America, 147:3948.

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).

Wild Seas Wales. (2024). Respect. Available at: https://wildseas.wales/respect/?location=anglesey [Accessed: September 2024].

Williams, R.S., Brownlow, A., Baille, A., Barber, J.L., Barnett, J., Davison, N.J., Deaville, R., Doeschate, M., Penrose, R., Perkins, M., Williams, R., Jepson, P.D., Lyashevska, O., Murphy, S. (2023). Evaluation of a marine mammal status and trends contaminants indicator for European waters, Science of the Total Environment, 866.

Willis-Norton, E., Hazen, E.L., Fossette, S., Shillinger, G., Rykaczewski, R.R., Foley, D.G., Dunne, J.P., Boagrad, S.J. (2015). Climate change impacts on leatherback turtle pelagic habitat in the Southeast Pacific, Deep Sea Research part: Tropical Studies in Oceanography, 260-267.

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.

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.