The Great Grid Upgrade

Sea Link

Sea Link

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Part 4 Marine
Chapter 4
Marine Mammals

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Version History

Date	Issue	Status	Description/ Changes
March 2025	A	Final	For DCO submission
May 2025	B	Final	Update to reflect s51 Advice
July 2025	C	Final	Update to reflect Procedural Decision from the Examining Authority
August 2025	D	Final	Update to reflect S89(3) Procedural Decision from the Examining Authority
September 2025	E	Final	Update to reflect responses to Relevant Representations for Deadline 1
January 2026	F	Final	Update to reflect Written Questions for Deadline 3

4. Marine Mammals

4.1 Introduction

4.1.1 This chapter of the Environmental Statement (ES) presents information about the environmental assessment of the likely significant marine mammal effects that could result from the Proposed Project (as described in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**).

4.1.2 This chapter describes the methodology used, the datasets that have informed the environmental assessment, baseline conditions, mitigation measures and marine mammal residual significant effects that could result from the Proposed Project.

4.1.3 The Order Limits, which illustrate the boundary of the Proposed Project, are illustrated on **Application Document 2.2.1 Overall Location Plan.**

4.1.4 This chapter should be read in conjunction with:

- **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**;
- **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology**;
- **Application Document 6.2.1.6 Part 1 Introduction Chapter 6 Scoping Opinion and EIA Consultation**;
- **Application Document 6.2.4.3 Part 4 Marine Chapter 3 Fish and Shellfish**;
- **Application Document 6.6 (E) Habitats Regulations Assessment Report**, submitted at Deadline 3;
- **Application Document 6.3.4.4.A (B) Pegwell Bay Seal Survey Report [REP1-003]**;
- **Application Document 6.5 Electric and Magnetic Field Compliance Report;**
- **Application Document 7.5.2 Outline Offshore Construction Environmental Management Plan**;
- **Application Document 7.5.3.1 CEMP Appendix A Outline Code of Construction Practice**;
- **Application Document 7.5.3.2 CEMP Appendix B Register of Environmental Actions and Commitments (REAC)**;
- **Application Document 9.13 Pegwell Bay Construction Method Technical Note [REP2-011]**; and
- **Application Document 9.49 Seals and Airborne Sound Disturbance Technical Note [REP1-122]**.

4.1.5 This chapter is supported by the following figures:

- **Application Document 6.4.4.4 (C) ES Figures Marine Mammals [REP1-011]**.

4.2 Regulatory and Planning Context

4.2.1 This section sets out the legislation and planning policy that is relevant to the marine mammal assessment. A full review of compliance with relevant national and local planning policy is provided within the Planning Statement submitted as part of the application for Development Consent.

4.2.2 Policy generally seeks to minimise marine mammal effects from development and to avoid significant adverse effects to marine biodiversity, including marine mammals. This applies particularly where project activities have the potential to interfere with protection and conservation initiatives for local populations, and species/habitats of conservation importance.

Legislation

Marine and Coastal Access Act 2009

4.2.3 The Marine and Coastal Access Act (2009) provides the legal mechanism to help ensure clean, healthy, safe, and productive and biologically diverse oceans and seas.

The Conservation of Habitats and Species Regulations 2017 (amended 2019) and The Conservation of Offshore Marine Habitats and Species Regulations 2017

4.2.4 The Conservation of Habitats and Species Regulations (2017) (amended 2019) transposes the Habitats Directive (92/43/EEC) into UK legislation out to the 12 nautical mile (NM) limit and the Offshore Regulations beyond 12 NM:

- All cetaceans (whales, dolphins, and porpoises) are listed as European Protected Species (EPS) on Schedule 2 of the Habitats Directive.
- Pinnipeds (seals): grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina* are listed as Annex II (as are harbour porpoise *Phocoena phocoena* and bottlenose dolphin *Tursiops truncatus*).

The Wildlife and Countryside Act 1981

4.2.5 The Wildlife and Countryside Act (1981) includes provisions relating to nature conservation, including species of marine mammals.

The Marine Strategy Regulations 2010

4.2.6 The Marine Strategy Regulations (2010) transposes the Marine Strategy Framework Directive (2008/56/EC) into UK legislation.

Conservation of Seals Act 1970

4.2.7 The Conservation of Seals Act (1970) provides seasonal protection and, with some exceptions, prohibits the taking, injuring, and killing of seals.

Section 41 of the NERC 2006

4.2.8 Section 41 of the NERC (2006) lists species of principal importance, including marine mammals, for the purpose of conservation of biodiversity.

Environment Act 2021

4.2.9 The Environment Act (2021) sets clear statutory targets for the recovery of the natural world in four priority areas: air quality, biodiversity, water and waste, and includes the introduction of Biodiversity Net Gain (BNG).

National Policy

National Policy Statements

4.2.10 National Policy Statements (NPS) set out the primary policy tests against which the application for a Development Consent Order (DCO) for the Proposed Project would be considered. Table 4.1, Table 4.2 and Table 4.3 below provides details of the elements of NPS for Energy (EN-1) (Department of Energy and Climate Change, Overarching National Policy Statement for Energy (EN-1), 2011) NPS for Renewable Energy Infrastructure (EN-3) (Department of Energy and Climate Change, 2023) and NPS for Electricity Networks Infrastructure (EN-5) (Change, 2011) that are relevant to this chapter.

Table 4.1 NPS EN-1 requirements relevant to marine mammals

NPS EN-1 section	Where this is covered in the ES
4.5.7…"*Applicants are encouraged to approach the marine licensing regulator (MMO in England and Natural Resources Wales in Wales) in pre-application, to ensure that they are aware of any needs for additional marine licenses alongside their Development Consent Order application*".	Consultation with Natural England was undertaken during the scoping and PEIR stages. Relevant comments are provided in **Application Document 6.2.1.6 Part 1 Introduction Chapter 6 Scoping Opinion and EIA Consultation.**
4.5.8…"*Applicants for a Development Consent Order must take account of any relevant Marine Plans and are expected to complete a Marine Plan assessment as part of their project development, using this information to support an application for development consent*".	Marine Plans are identified in Table 4.5.5 and considered in Section 4.9 Assessment of Impacts and Likely Significant Effects.
4.5.9…"*Applicants are encouraged to refer to Marine Plans at an early stage, such as in pre-application, to inform project planning, for example to avoid less favourable locations as a result of other uses or environmental constraints".*	Marine Plans are identified in Table 4.5.5 and considered in Section 4.9 Assessment of Impacts and Likely Significant Effects.
5.4.17*…"Where the development is subject to EIA, the applicant should ensure that the ES 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, including irreplaceable habitats".*	Identification of designated sites can be found in Section 4.7 Baseline Conditions and an impact assessment can be found in Section 4.9 Assessment of Impacts and Likely Significant Effects. An assessment of impacts to designated sites is available in **Application Document 6.6 (E) Habitats Regulations Assessment Report**, submitted at Deadline 3.

NPS EN-1 section	Where this is covered in the ES
5.4.18…*"The applicant should provide environmental information proportionate to the infrastructure where EIA is not required to help the Secretary of State consider thoroughly the potential effects of a proposed project".*	Consultation with Natural England was undertaken during the scoping and PEIR stages. Relevant comments are provided in **Application Document 6.2.1.6 Part 1 Introduction Chapter 6 Scoping Opinion and EIA Consultation.**
5.4.19…*"The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests".*	The Proposed Project will adopt a range of measures to conserve biodiversity as detailed in Section 4.8 Proposed Project Design and Embedded Mitigation.
5.4.35…"*Applicants should include appropriate avoidance, mitigation, compensation and enhancement measures as an integral part of the proposed development*".	The Proposed Project follows the mitigation hierarchy (see **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology**) and will adopt a range of measures to conserve biodiversity as detailed in Section 4.8 Proposed Project Design and Embedded Mitigation.
5.4.22 (part)..." 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.	All features of conservation importance including designated sites and protected species have been considered in both the initial baseline (Section 4.7) assessment of impacts and likely effects (Section 4.9), as well as in **Application Document 6.6 (E) Habitats Regulations Assessment Report**, submitted at Deadline 3.
5.4.23 "…Energy projects will need to ensure vessels used by the project follow existing regulations and guidelines to manage ballast water".	Relevant mitigation measures identified at this stage are provided in Section 4.8 Proposed Project Design and Embedded Mitigation.

Table 4.2 NPS EN-3 requirements relevant to marine mammals

NPS EN-3 section	Where this is covered in the ES
2.8.101…*"Applicants must undertake a detailed assessment of the offshore ecological, biodiversity and physical impacts of their proposed development, for all phases of the lifespan of that development, in accordance with the appropriate policy for offshore wind farm EIAs, HRAs and MCZ assessments"*	An assessment of impacts from all phases of the Proposed Project is provided in Section 4.9 Assessment of Impacts and Likely Significant Effects.

NPS EN-3 section	Where this is covered in the ES
2.8.104…“*Applicants should consult at an early stage of pre-application with relevant statutory consultees and energy not-for profit organisations/non governmental organisations as appropriate, on the assessment methodologies, baseline data collection, and potential avoidance, mitigation and compensation options which should be undertaken”.*	Consultation with statutory consultees was undertaken during the scoping stage. Comments are provided in **Application Document 6.2.1.6 Part 1 Introduction Chapter 6 Scoping Opinion and EIA Consultation**.
2.8.119…“*Applicant assessment of the effects of installing offshore transmission infrastructure across the intertidal/coastal zone should demonstrate compliance with mitigation measures in any relevant plan-level HRA including those prepared by The Crown Estate as part of its leasing round, and include information, where relevant, about: • any alternative landfall sites that have been considered by the applicant during the design phase and an explanation for the final choice; • any alternative cable installation methods that have been considered by the applicant during the design phase and an explanation for the final choice; • potential loss of habitat; • disturbance during cable installation, maintenance/repairs and removal (decommissioning); • increased suspended sediment loads in the intertidal zone during installation and maintenance/repairs; • potential risk from invasive and non-native species; • predicted rates at which the intertidal zone might recover from temporary effects, based on existing monitoring data; and • protected sites”.*	Although no specific Round 4 Plan Level Habitat Regulation Assessments cover the outer Thames region, installation of the cable in the intertidal has been considered. At the Suffolk landfall the cable is installed via HDD between the terrestrial and marine environments, completely avoiding all impacts to the intertidal zone (**Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**). At Pegwell Bay in Kent, HDD beneath the intertidal is not possible due to the presence of extensive mudflats extending well over a 3 km from MHWS. All impact pathways referred to have been considered in Section 4.9.
2.8.131…“*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. ”*	Section 4.9 Assessment of Impacts and Likely Significant Effects presents the assessments of impacts on prey species and habitat, haul-out sites, protected sites, collision risk, as well as an assessment of underwater noise on marine mammals, including PTS, TTS, and behavioural disturbance. Cumulative/in-combination effects with other plans and projects are provided in **Application Document 6.2.4.11 Part 4 Marine Chapter 11 Inter-Project Cumulative Effects**.
2.8.133…”*The applicant should discuss any proposed noisy activities with the relevant statutory body and must reference the joint JNCC and SNCB underwater noise guidance, and any successor of this guidance, in relation to noisy*	Section 4.9 Assessment of Impacts and Likely Significant Effects present the assessments of underwater noise on marine mammals and references the

NPS EN-3 section	Where this is covered in the ES
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".	JNCC and SNCB underwater noise guidance as appropriate.
2.8.134…*"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) or an offence as described in paragraph 2.8.127-129 above, the applicant will be expected to look at possible alternatives or appropriate mitigation".*	Section 4.9 Assessment of Impacts and Likely Significant Effects present the assessments of underwater noise on marine mammals. A separate marine licence application will be made for any unexploded ordinance (UXO) detonation in line with MMO advice to allow for appropriate consideration of potential UXO impacts once sufficient information is available to identify any potential UXO risk. Impact pathways in relation to UXO noise are therefore not considered in the current assessment. Project mitigation is presented in Section 4.8 Proposed Project Design and Embedded Mitigation.
3.3.22 "As part of marine licensing, impacts on marine protected areas (MPAs) will be considered. Further guidance on marine licensing is set out in Section 1.2 of EN-1."	Marine protected areas relevant to the Proposed Project are discussed in 4.7 Baseline Conditions, with an assessment of likely impacts discussed in Section 4.9 Assessment of Impacts and Likely Significant Effects.

Table 4.3 NPS EN-5 requirements relevant to marine mammals

NPS EN-5 section	Where this is covered in the ES
2.2.10 "...*As well as having duties under Section 9 of the Electricity Act 1989, (in relation to developing and maintaining an economical and efficient network), applicants must take into account Schedule 9 to the Electricity Act 1989, which places a duty on all transmission and distribution licence holders, in formulating proposals for new electricity networks infrastructure, to "have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest … and …do what [they] reasonably can to mitigate any effect which the proposals would have on the natural*	The project undertook a detailed routeing and siting study (**Application Document 6.2.1.3 Part 1 Introduction Chapter 3, Main Alternatives Considered**) which considered a wide range of environmental factors including biodiversity.

NPS EN-5 section	Where this is covered in the ES
beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects".	
2.13.21 *"…The sensitivities of many coastal locations and of the marine environment as well as the potential environmental, community and other impacts in neighbouring onshore areas must be considered in the identification onshore connection points."*	Landfall design is summarised in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project** and installation methods have been selected to minimise impacts on marine mammals (e.g. the use of trenchless techniques for the transition zone between the offshore and onshore elements). Other mitigation relevant to marine mammals is provided in section 4.8 Proposed Project Design and Embedded Mitigation.
2.14.2...(Part) "*In the assessments of their designs, applicants should demonstrate how environmental, community and other impacts have been considered and how adverse impacts have followed the mitigation hierarchy i.e. avoidance, reduction and mitigation of adverse impacts through good design; how the mitigation hierarchy has been followed, in particular to avoid the need for compensatory measures for coastal, inshore and offshore developments affecting SACs SPAs, and Ramsar sites".*	Landfall design is summarised in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project** and installation methods have been selected to minimise impacts on marine mammals (e.g. the use of trenchless techniques for the transition zone between the offshore and onshore elements). Other mitigation relevant to marine mammals is provided in section 4.8 Proposed Project Design and Embedded Mitigation.

National Planning Policy Framework

4.2.11 The National Planning Policy Framework (NPPF) as revised in December 2024 (Ministry of Housing, Communities and Local Government, 2024), sets out national planning policies that reflect priorities of the Government for operation of the planning system and the economic, social, and environmental aspects of the development and use of land. The NPPF has a strong emphasis on sustainable development, with a presumption in favour of such development. The NPPF has the potential to be considered important and relevant to the Secretary of State (SoS)' consideration of the Proposed Project.

4.2.12 Table 4.4 below provides details of the elements of the NPPF that are relevant to this chapter, and how and where they are covered in the ES.

Table 4.4 NPPF requirements relevant to marine mammals

NPPF section	Where this is covered in the ES
Paragraph 187 "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 put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability".	Statutory protected sites and their associated features of interest which would be impacted by project activities are considered in section 4.7 Baseline Conditions and section 4.9 Assessment of Impacts and Likely Significant Effects. Relevant designated sites have been further subjected to assessment in **Application Document 6.6 (E) Habitats Regulations Assessment Report**, submitted at Deadline 3.
Paragraph 188 "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 Baseline Conditions and **Application Document 6.6 (E) Habitats Regulations Assessment Report**, submitted at Deadline 3.
Paragraph 192 "To protect and enhance biodiversity and geodiversity, plans should: 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 creation; [and] 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 section 4.9 Assessment of Impacts and Likely Significant Effects and **Application Document 6.6 (E) Habitats Regulations Assessment Report**, submitted at Deadline 3.
Paragraph 193 *"When determining planning applications, local planning authorities should apply the following principles: 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*	Consideration has been given to relevant designated sites in the project design. At the time of writing, no SSSIs have been identified near the Offshore Scheme that are relevant to the

NPPF section	Where this is covered in the ES
planning permission should be refused; [and] development on land within or outside a Site of Special Scientific Interest, 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 interest, and any broader impacts on the national network of Sites of Special Scientific Interest; [and] 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."	protection of marine mammals. An assessment of potential impacts to biodiversity are considered in section 4.9 Assessment of Impacts and Likely Significant Effects, with mitigation measures relevant to marine mammals provided in section 4.8 Proposed Project Design and Embedded Mitigation.
Paragraph 194 *"The following should be given the same protection as habitats sites: possible Special Areas of Conservation; [and] listed or proposed Ramsar sites; [and] 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."*	The nearest SAC to the Offshore Scheme relevant to marine mammals is the Southern North Sea SAC. Potential impacts to this and other sites designated for marine mammals are considered in section 4.9 Assessment of Impacts and Likely Significant Effects. These sites have also been subject to further assessment in **Application Document 6.6 (E) Habitats Regulations Assessment Report**, submitted at Deadline 3.

National Planning Practice Guidance

4.2.13 No additional national planning guidance has been identified which is relevant to marine mammals.

Marine Planning Policy

4.2.14 The following marine plans are relevant to marine mammals and have informed the assessment of preliminary effects in this chapter:

- The UK Marine Policy Statement (MPS), which 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 (DEFRA, UK Marine Policy, 2020);
- East Inshore and East Offshore Marine Plan (DEFRA, 2014); and

- South East Inshore Marine Plan (DEFRA, 2021).

Table 4.5 Marine Planning Policies relevant to marine mammals

<table>
<tr><th>Marine Plan</th><th>Where this is covered in the ES</th></tr>
<tr><td>The UK MPS ensures that marine resources are used in a sustainable way by ensuring biodiversity is protected and conserved by using the precautionary principle and relying on sound evidence.</td><td>Where possible, consideration as been given to conserving marine mammal biodiversity and avoiding harm to marine ecology through siting, mitigation, and consideration of reasonable alternatives. Adverse effects to designated sites and protected features are avoided where possible. Species and site designations are provided in Section 4.7 Baseline Conditions, with an assessment of potential impacts in Section 4.9 Assessment of Impacts and Likely Significant Effects. Relevant mitigation provided in Section 4.8 Proposed Project Design and Embedded Mitigation.</td></tr>
<tr><td>East Inshore and East Offshore Marine Plan ensures biodiversity is protected and conserved between Flamborough Head and Felixstowe.</td><td rowspan="2">The routing of the Offshore Scheme has been carefully designed to avoid ecologically sensitive habitats. An ecosystem-based approach has been implemented, with cumulative impacts thoroughly assessed to ensure that project activities do not negatively affect local or regional marine mammal populations.</td></tr>
<tr><td>South East Inshore Marine Plan ensures biodiversity is protected and conserved between Felixstowe and Dover.</td></tr>
</table>

Local Planning Policy

4.2.15 The intertidal area of the Offshore Scheme lies within the jurisdiction of Suffolk County Council, East Suffolk Council, Suffolk Coastal Local Plan, Kent County Council and within the boundary of Thanet District Council Local Plan and Dover District Local Plan.

4.3 Scoping Opinion and Consultation

Scoping

4.3.1 A Scoping Report (National Grid, 2022) for the Proposed Project was issued to the Planning Inspectorate (PINS) on 24 October 2022 and a Scoping Opinion was received from the SoS on 1 December 2022. Table 4.6 sets out the comments raised in the Scoping Opinion and how these have been addressed in this ES. The Scoping Opinion takes account of responses from prescribed consultees as appropriate. **Application Document 6.2.1.6 Part 1 Introduction Chapter 6 Scoping Opinion and EIA Consultation** provides responses to the comments made by the prescribed consultees at scoping stage and how each comment has been considered.

Table 4.6 Comments raised in the Scoping Opinion

ID	Inspectorate's comments	Response
5.4.1	The Scoping Report seeks to scope out this matter on the grounds that embedded mitigation and good practice measures would ensure that accidental spills/leaks would be very limited. The Inspectorate agrees that, provided the measures to mitigate the risks of leaks and spills are clearly described in the ES and secured in the dDCO, this matter can be scoped out of further assessment.	Mitigation measures to be adhered to include the development of an offshore Construction Environmental Management Plan (CEMP) and compliance with International Regulations for Preventing Collisions at Sea to avoid the likelihood of any accidental spills/leaks. An outline Code of Construction Practice (CoCP) is provided in **Application Document 7.5.3.1 CEMP Appendix A Outline Code of Construction Practice.**
5.4.2	The Scoping Report seeks to scope this matter out on the grounds that increases in suspended sediment concentration (SSC) are expected to be minimal and confined to the lower reaches of the water column. In addition, it cites research which indicates that marine mammals do not typically experience severe impacts from increased SSC. The Inspectorate agrees that this matter can be scoped out from further assessment in the ES.	The effect of increased SSC on marine mammals has been scoped out of this assessment.
5.4.3	The Scoping Report seeks to scope out this matter (impact from thermal effects of HVDC cable) on the grounds that cables have a negligible capacity to heat the overlying water column. The Inspectorate agrees that this matter can be scoped out of further assessment in the ES.	The effect of thermal emissions from the operational cable on marine mammals has been scoped out of the assessment.
5.4.4	The Inspectorate queries whether relying on a screening distance of 50 km will be sufficient to identify all the relevant designated sites with cetacean qualifying features, given that harbour porpoise and bottlenose dolphin are highly mobile. We note that Natural England shares this concern and has also flagged the potential for grey and harbour seals to travel over greater distances than have been identified in the Scoping Report (see Appendix 2 of this Opinion). The Applicant should seek to agree the species to be included in the assessments and the appropriate screening distances to be	Following stakeholder consultations, the screening of sites designated for marine mammals has transitioned to a regional approach rather than applying a fixed 50 km buffer. This method incorporates considerations of relevant ecological factors, habitat connectivity, and marine mammal management units to determine which sites should be included. A comprehensive list of designated sites and their associated protected features is provided in Section 4.7 Baseline Conditions.

ID	Inspectorate's comments	Response
	used with relevant stakeholders, particularly Natural England.	
5.4.5	The Scoping Report only refers to published sources of data so it appears (although this is not explicitly stated) that the baseline would be entirely based on published data rather than any surveys of the study area. The Applicant's attention is drawn to the comments from Natural England (see Appendix 2 of this Opinion) on the need to clarify which species are actually being included in the assessments in the ES and the data used to characterise the baseline environment. The Applicant should seek to agree the approach to gathering baseline data with relevant stakeholders and provide evidence of that agreement in the ES. The ES must present the baseline data clearly, including information on the predicted numbers of individuals of each species likely to be affected by the Proposed Development. The ES must also explain how the baseline data has been derived from published sources.	The baseline data used in this assessment has been discussed with relevant stakeholders. Due to the availability of systematic marine mammal survey data collected over time (e.g. SCANS data), there is sufficient data available in the literature for a suitable marine mammal baseline and no project specific field surveys for marine mammals will be undertaken. Therefore, the baseline will rely entirely on desk-based sources as described in Section 4.4 Approach and Methodology. There are a number of cetaceans and seal species that are known to occur within the Study Area, and these are discussed in detail in Section 4.7 Baseline Conditions, with a detailed impact assessment discussed in Section 4.9 Assessment of Impacts and Likely Significant Effects.
5.4.6	Table 4.5.3 identifies various sources of underwater noise which could affect marine mammals but does not include any reference to noise from any underwater surveys (such as geophysical surveys). Where such surveys are proposed at the pre-construction stage then the related underwater noise impacts should be assessed in the ES.	An assessment of impacts from pre-installation geophysical surveys is discussed in section 4.9 Assessment of Impacts and Likely Significant Effects.
5.4.7	The Scoping Report provides a detailed explanation of how the significance of effects would be determined, based on the CIEEM guidance. However, no description has been provided of the methods that will be used to assess impacts and whether these will be quantitative or qualitative. Unless otherwise agreed with relevant stakeholders (and evidence of that agreement is provided in the ES), the assessment should include modelling of underwater noise propagation during construction and decommissioning and the area affected by increased noise levels should be shown on figures within the ES.	The methods used in this assessment have been discussed with relevant stakeholders. Methods for assessing receptor sensitivity, impact magnitude, and overall significance are provided in Section 4.4 Approach and Methodology. Sound source levels from cable installation and associated activities are significantly lower than activities such as impact piling and seismic surveys. Therefore, simple geometric spreading calculations have been used to determine likely injury effect (PTS)

ID	Inspectorate's comments	Response
		zones. Disturbance effects have also been considered using Effective Deterrent Ranges (zone of influence) provided in JNCC guidance (JNCC, 2020). EDRs are recommended specifically for harbour porpoise but since this species is the marine mammal species with the highest sensitivity to underwater sound in the UK, EDRs are used as a conservative measure covering all other species.

Statutory Consultation

4.3.2 Statutory consultation for the Proposed Project took place between 24 October and 18 December 2023. A further targeted consultation exercise on the main changes to the Proposed Project introduced after the 2023 statutory consultation, was undertaken between 8 July and 11 August 2024. A summary of relevant feedback received during statutory consultation relating to marine mammals is provided in the paragraph below. Further details on how consultation responses have informed the assessment can be found in **Application Document 5.1 Consultation Report** and **Application Document 5.1.9 Appendix H Summary 2023 Response**.

4.3.3 Statutory consultees providing feedback relevant to marine mammals included JNCC, MMO, and Natural England. Overall, it was agreed that all noise-generating sources have been appropriately identified. However, consultees recommended that the Environmental Statement reference the most up-to-date guidance and datasets. Additionally, a precautionary approach should be adopted when estimating marine mammal abundances in proximity to the Offshore Scheme, and project activities should avoid periods associated with peak abundance.

Further Engagement

4.3.4 No further engagement specifically to marine mammals was conducted.

Summary of Scope of Assessment

4.3.5 Following on from the PEIR, impact pathways that have been assessed are:

- Underwater sound (excluding UXO).
- Potential for indirect effects through impacts to prey species.
- Vessel collision risk.
- Airborne sound and visual disturbance.
- Reduction in water quality due to discharges and unplanned releases, accidental leaks, and spills from vessels.
- Disturbance from electromagnetic field (EMF) emissions.

4.3.6 As agreed with stakeholders, impacts that have been scoped out from further assessment, as supported by the Planning Inspectorate, are:

- Underwater sound from UXO detonation – to be considered in separate Marine License Application.
- Effect of increased suspended sediment concentration.
- Effects of thermal emissions from cable operation.

4.4 Approach and Methodology

4.4.1 **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology** sets out the overarching approach which has been used in developing the environmental assessment. This section describes the technical methods used to determine the baseline conditions, sensitivity of the receptors and magnitude of effects and sets out the significance criteria that have been used for the marine mammal assessment.

Guidance Specific to the Marine Mammals Assessment

4.4.2 In addition to the legislation and policies outlined in Section 4.2, the marine mammal assessment has been carried out in accordance with the following good practice guidance documents:

- Chartered Institute for Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in Britain and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018).
- Guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC, JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys, 2017).
- DRAFT Guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC, 2025).
- Guidelines for minimising the risk of injury to marine mammals from using explosives (JNCC, 2010).
- Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise Special Areas of Conservation (SACs) (JNCC, 2020).
- ‘Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas’ (ASCOBANS) 1992 - makes provision for the protection of cetaceans through monitoring, research, public awareness, pollution control and data sharing. This agreement has been signed by eight European countries bordering the Baltic and North Seas (including the English Channel) and includes the United Kingdom (UK). A number of guidance documents are also available on the ASCOBANS website (ASCOBANS, 2022).

Baseline Data Gathering and Forecasting Methods

4.4.3 Detailed baseline conditions were established by undertaking a desktop review of published and publicly available information and through consultation with relevant organisations. As outlined at scoping, no offshore marine mammal field surveys were undertaken as the information collected through the desktop review was considered sufficient for an assessment of the project activities.

4.4.4 Key data sources were used to inform the understanding of the relative importance and functionality of the Study Area in the regional context of marine mammal populations in the wider central and southern North Sea. The data sources reviewed include, but may not be limited to:

- SCANS (Small Cetacean Abundance in the European Atlantic and North Sea) data (Gilles, et al., 2023) – see full description below.
- Inter-Agency Marine Mammal Working Group (IAMMWG, JNCC Report 734, 2023).
- Sea Mammal Research Unit Special Committee on Seals Annual Reports[1], in particular the most recent publication from 2024 (SCOS, 2024).
- Population trends of harbour and grey seals in the Greater Thames Estuary (Cox, et al., 2020).
- Habitat-based predictions of at-sea distributions for grey and harbour seals in the British Isles (Carter, et al., 2022).
- Distribution models for 12 species of cetacean covering the North-east Atlantic (Waggitt, Evans, Andrade, Banks, & Bolton, 2019).
- The Sea Watch Foundation marine mammal sightings distribution maps[2]).
- Publicly available academic journals and online reports.
- Relevant Environmental Statements from other developments.

SCANS Data (IV)

4.4.5 The SCANS project is a large-scale ship and aerial based survey effort to quantify cetacean abundance and distribution in UK and European Atlantic Waters. It first began in 1994 (SCANS I) with boat-based line and aerial line transect surveys following methods of Hiby and Lovell 1998 (1998), initially in the North and Celtic seas. It has evolved since and has been repeated in 2005 (SCANS II), 2016 (SCANS III), and 2022 (SCANS IV). Abundance estimates are divided into blocks. The block areas changed between SCANS III and SCANS IV surveys, making direct comparisons of abundance estimates difficult. However, SCANS III data were reviewed; abundance data in the Survey Area were only available for harbour porpoise, and thus SCANS IV data is considered the most up-to-date and relevant for the cetacean baseline for this ES chapter. The relevant SCANS IV blocks containing the Offshore Scheme are Blocks NS-A and NS-B, although as marine mammals are highly mobile and wide ranging, consideration is also given to the adjacent blocks NS-C and NS-S (see **Figure 6.4.4.4.2 Harbour Porpoise Density** in **Application Document 6.4.4.4 ES Figures Marine Mammals**).

4.4.6 It should be noted that SCANS surveys have been conducted in the summer (predominantly July) and there is, therefore, a limited understanding of species distribution and abundance in other seasons. Thus, where available other data sources have also been reviewed to determine the most precautionary density estimates. In

[1] https://www.smru.st-andrews.ac.uk/scos/scos-reports/index.html

[2] https://www.seawatchfoundation.org.uk/

particular, strong seasonal movements of harbor porpoise are known to occur in the southern North Sea, and data from a further SCANS survey, undertaken in the winter of 2024 specifically to investigate seasonal differences in cetacean distribution and abundance (Ramirez-Martinez, et al., 2025) provides winter abundance data for the Study Area. and these maximum density estimates have been used for assessment purposes.

Assessment Criteria

4.4.7 Several factors have been considered when assessing the impact on marine mammals resulting from the Offshore Scheme including sensitivity of the receptors and the magnitude of the impact. Together these have been used to assess the overall significance of effects. The magnitude of impacts considers both the scale and duration of the impact. Consideration is also given to whether the damage caused by an impact is reversible or not.

4.4.8 This chapter applies the appraisal methodology as detailed in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology** in combination with CIEEM guidelines for ecological assessment in the UK (2018), professional judgement, and the application of relevant guidance as discussed in the above sections. Thus, whilst the significance matrix is used as the basis for assigning significance to an effect, the final identification of significance also requires the application of professional judgement. This allows for a more comprehensive consideration of ecological context and the absence of defined quantitative threshold for many effects in ecological systems. Potential impacts and significance of effects is based on a discussion of receptor sensitivity, importance, and magnitude, for which assessment methodologies for each are described in further detail below.

Sensitivity of marine mammal receptors

4.4.9 When defining sensitivity, the criteria set out in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology** have been considered. To determine sensitivity of the receptor, the vulnerability of the receptor to the impact and its ability to recover and adapt are considered. Vulnerability differs between different groups and species of marine mammals and also varies depending on the impact pathway. For example, slow moving large whales may be more vulnerable to collisions with vessels than fast moving agile species such as the harbour porpoise. Similarly, seals are much more sensitive to visual disturbance than cetaceans.

4.4.10 The importance, or value, of the receptor on an international, national and local scale has also been considered in assessing sensitivity. All cetaceans are EPS species and therefore are considered to be of very high importance. The two species of pinniped, or seal, in the UK are nationally protected and are also considered to be of high importance.

4.4.11 When defining the sensitivity of the impact, criteria detailed in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology** has been followed: very high, high, medium, low, and negligible.

Magnitude of marine mammal effects

4.4.12 The magnitude of an impact which could affect marine mammals is influenced by several key factors, including the scale of the change (for example at the individual or population level), the spatial extent over which the impact is likely to occur, and the duration and frequency of the impact.

4.4.13 Marine mammals are highly mobile species and are likely to swim away from an affected area for the duration of an impact, returning once the impact is removed. However, some life stages of seals require females and pups to remain on the shore for several weeks, and thus avoidance of an impact in the nearshore may not be possible. Similarly, there may be key foraging grounds that cetacean populations may be unwilling to move away from. Thus, when determining the magnitude of impacts on marine mammals, the life history and ecology of the receptor has been considered. Factors such as the distance at which effects could occur and the duration and frequency of the impact were also assessed.

4.4.14 When defining the magnitude of the impact, criteria detailed in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology** have been followed: large, medium, small, and negligible.

Significance of marine mammal effects

4.4.15 As set out in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology**, the general approach taken to determining the significance of effect in this assessment is only to state whether effects are likely or unlikely to be significant, rather than assigning significance levels.

4.4.16 When determining whether an effect is significant, the magnitude of impact and sensitivity of the receptor is accounted for. Professional judgement has also been applied to allow for consideration of previous project knowledge and ecological context. Additionally, a precautionary approach has been taken with the worst-case scenario assessed for each impact, such as estimating the intensity of underwater sound produced by project activities, in order to account for any uncertainty or lack of baseline survey data in the assessment. In addition, the assessments have considered a range of data sources to identify the most up-to-date and precautionary density estimates.

4.4.17 The criteria for assessing effects and residual significance are presented in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology**.

Assumptions and Limitations

4.4.18 The availability of data for marine mammals within the North Sea region is considered sufficient to characterise the baseline and as such provides a good understanding of the existing environment. There are, however, some limitations to marine mammal surveys, which form the basis of the baseline. This is primarily due to the highly mobile nature of marine mammal species and the potential variability in usage of the area.

4.4.19 SCANS surveys are conducted in the summer (predominantly July) and therefore data regarding cetacean abundance and distribution are representative of summer distributions only. Where available, other data sources are also used to identify the highest estimated abundance. However, there is a limited understanding of distribution and abundance in other seasons for some species.

4.4.20 Similarly, at-sea seal distributions presented in Carter et al. (2022) were estimated for harbour and grey seals during their foraging seasons, when they are anticipated to spend most of their time at sea. As such, although the available data only provides snapshots in time, the abundances presented in Section 4.7 are the upper 95% confidence interval density is used, which is considered to represent the worst-case scenario and indicate the greatest abundance of at-sea seals likely to be encountered within the Study Area.

4.5 Basis of Assessment

4.5.1 This section sets out the assumptions that have been made in respect of design flexibility maintained within the Proposed Project and the consideration that has been given to alternative scenarios and the sensitivity of the assessment to changes in the construction commencement year.

4.5.2 Details of the available flexibility and assessment scenarios are presented in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project** and **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology**.

Flexibility Assumptions

4.5.3 The environmental assessments have been undertaken based on the description of the Proposed Project provided in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**. To take account of the flexibility allowed in the Proposed Project, consideration has been given to the potential for effects to be of greater or different significance should any of the permanent or temporary infrastructure elements be moved within the Limits of Deviation (LoD) or Offshore Scheme Boundary.

4.5.4 The assumptions made regarding the use of flexibility for the main assessment, and any alternatives assumptions are set out in Table 4.7 below.

Table 4.7 Flexibility assumptions

Element of flexibility	How it has been considered within the assessment?
Lateral LoD marine HVDC cable	The worst-case scenario assessed for the Offshore Scheme is one bundled HVDC (x2) and one fibre optic cable in one trench. This bundled scenario may be placed anywhere within the Offshore Scheme Boundary.

Sensitivity Test

4.5.5 It is likely that under the terms of the draft DCO, construction could commence in any year up to five years from the granting of the DCO which is assumed to be 2026. Consideration has been given to whether the effects reported would be any different if the works were to commence in any year up to year five. Where there is a difference, this is reported in paragraph 4.10.1.

4.6 Study Area

4.6.1 Marine mammals are highly mobile and transient species, meaning that localised impacts can have implications for wider populations. Consequently, the Study Area has been defined at a scale that reflects the distribution ranges of relevant marine mammal populations (see **Figure 6.4.4.4.1 Marine Mammal Study Area** in **Application Document 6.4.4.4 ES Figures Marine Mammals**).

4.6.2 Given the wide-ranging nature of these species and their varying ecology, distribution, and density, separate areas have been defined for each species. These areas have been delineated based on Management Units (MUs) which have been defined by relevant conservation organisations. An 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. An MU may be smaller than what is believed to be a 'population' to reflect spatial differences in human activities and their management.

4.6.3 There are two main organisations defining MUs in relation to cetaceans. The Inter Agency Marine Mammal Working Group (IAMMWG) has established MUs for the seven most common species in UK waters, defined according to biological population structure, movement, habitat use, and relevant management boundaries (IAMMWG, JNCC Report 734, 2023). The extent of the MU for each of the seven species are summarised in Table 4.8 below.

Table 4.8 IAMMWG MUs for the seven most common cetacean species in the UK

Common Name	Latin Name	MU Name	MU Description
Harbour porpoise	*Phocoena phocoena*	North Sea	Entire territorial waters (TW) of east coast of England and Scotland including the Western Channel
Bottlenose dolphin	*Tursiops truncates*	Greater North Sea	Entire TW of east coast of England and Scotland (excluding coastal waters of east Scotland
Short-beaked common dolphin	*Delphinus delphis*	Celtic and Greater North Sea	All TW around Great Britain and beyond
White-beaked dolphin	*Lagenorhynchus albirostris*		
Atlantic white-sided dolphin	*Lagenorhycnhus acutus*		
Risso's dolphin	*Grampus griseus*		

Common Name	Latin Name	MU Name	MU Description
Minke whale	*Balaenoptera acutorostrata*		

4.6.4 The International Council for the Exploration of the Seas (ICES) also has MUs relevant to cetaceans. It has divided European waters into ecoregions, which set boundaries for monitoring the ecosystem based on biogeographic and oceanographic features, as well as existing political, social, economic, and management divisions. The Offshore Scheme is located within the ICES Greater North Sea ecoregion (ICES, 2020) which is more relevant for the location of the project within the North Sea. Within this region, there are four cetacean species the commonly occur commonly or are resident in the:

- harbour porpoise (*Phocoena phocoena*);
- bottlenose dolphin (*Tursiops truncatus*);
- minke whale (*Balaenoptera acutorostrata*; and,
- white-beaked dolphin (*Lagenorhynchus albirostris*).

4.6.5 A further six cetacean species, for which a management unit has not been specified, are also considered based on observations of these species in the North Sea.

4.6.6 For pinnipeds, the Special Committee on Seals (SCOS) has outlined Seal Management Units (SMUs) based on expert knowledge and opinion of seal ecology in the UK, using a pragmatic approach to management without inferring discrete populations (SCOS, 2024). The Offshore Scheme falls entirely within the South East England SMU for harbour and grey seals (SCOS, 2024), within which impacts to local seal populations and relevant designated sites are considered. The North East England SMU has also been considered, known as foraging ranges of harbour and grey seals (273 km and 448 km respectively) (Carter, et al., 2022) include this SMU, as connectivity between these areas may occur.

As such, the initial Study Area is species-specific, with different sized study areas for each species relating to the MU, in conjunction with a review of species ecology to determine which sites or populations exhibit connectivity with the Offshore Scheme and the likely Zone of Influence for project activities, particularly underwater sound which is likely to be the most wide-ranging effect.

4.7 Baseline Conditions

4.7.1 In the UK, two groups of marine mammals occur: cetaceans (whales, dolphins, and porpoises) and pinnipeds (seals). Most marine mammals are wide ranging and those recorded within the Study Area are likely to be individuals from larger biological populations originating from other points along the UK coast. This baseline characterises marine mammal species known, or likely, to be present within the Study Area, including the waters surrounding the Offshore Scheme and any intertidal habitats near landfall locations where project activities may occur between MLWS and MHWS.

4.7.2 All cetaceans are EPS species and therefore are considered to be of very high importance, and thus of high value. The two species of pinniped, or seal, in the UK are nationally protected and are also considered to be of high importance and of high value.

Cetaceans

4.7.3 On the basis of the ICES Greater North Sea ecoregion (ICES, 2020) the assessment considers a number of species within the Study Area. These are the four most common species listed below. An additional six species occur regularly in the ecoregion but are less common: Atlantic white-sided dolphin, common dolphin, humpback whale (*Megaptera noveangliae*), killer whale (*Orcinus orca*), long-finned pilot whale (*Globicephala melas*), and Risso's dolphin.

- harbour porpoise (*Phocoena phocoena*);
- bottlenose dolphin (*Tursiops truncatus*);
- minke whale (*Balaenoptera acutorostrata*; and,
- white-beaked dolphin (*Lagenorhynchus albirostris*).

4.7.4 A summary of conservation protection afforded to the four most common species is presented in Table 4.9.

Table 4.9 Protection status for the most common cetaceans present in the Study Area

Common Name	Wildlife and Countryside Act 1981	EC Habitats Directive (Annex)	Bonn Convention (Appendix)	Bern Convention (Appendix)	ASCOBANS
Harbour porpoise	✓	II, IV	II	II	✓
Bottlenose dolphin	✓	II, IV	II	II	✓
Minke whale	✓	IV	-	II	-
White-beaked dolphin	✓	IV	II	II	✓

Harbour Porpoise

4.7.5 Harbour porpoise are widespread and abundant throughout UK waters including the North Sea. They most commonly occur in continental shelf waters less than 100 m deep and are frequently observed in coastal bays and estuaries. Along the east coast of the UK, the highest densities occur in the southern region of the North Sea, which is reflected in the delineation of the Southern North Sea SAC, a site designated specifically for harbour porpoise. The Offshore Scheme passes through a section approximately 70 km long, close to the southeastern boundary of the site (**Figure 6.4.4.4.2 Harbour Porpoise Density** in **Application Document 6.4.4.4 ES Figures Marine Mammals**). The greatest densities are predicted to occur in coastal Suffolk waters in winter, a pattern of shifting distribution from summer months, that has been observed in several studies (e.g. see also Heinänen & Skov (2015)).

4.7.6 The Offshore Scheme falls within the IAMMWG North Sea MU for harbour porpoise. The most recent abundance estimates for the UK portion of this region as well as the relevant SCANS IV (Gilles, et al., 2023) blocks are provided in Table 4.10 and shown in (**Figure 6.4.4.4.2 Harbour Porpoise Density** in **Application Document 6.4.4.4 ES Figures Marine Mammals**). In addition to the summer SCANS IV survey, undertaken in the month of July as for previous SCANS survey campaigns, a winter SCANS survey was undertaken in the southern North Sea in 2024 (Ramirez-Martinez, et al., 2025), The greatest concentrations of harbour porpoise occur further north and east of the Offshore Scheme, in blocks NS-H and NS-C. However, moderate harbour porpoise abundance is still present within the block containing the Offshore Scheme (NS-B).

Table 4.10 Abundance and density estimate for harbour porpoise in the Study Area

Assessment Area	Estimated Abundance	Estimated Summer Density (individuals km^{-2})#	Estimated Winter Density (individuals km^{-2})$
North Sea Harbour Porpoise MU	346,601	-	-
UK EEZ portion of the North Sea MU	159,632	-	-
NS-B	7,982	0.31	0.83
NS-A	4,053	0.10	-
NS-C	36,286	0.60	0.38
NS-H	55,691	0.80	0.69

Data from SCANS IV
$ Data from Winter SCANS 2025

4.7.7 The greatest densities of harbour porpoise are likely to occur within the Southern North Sea SAC. However, modelling of harbour porpoise distribution in the North Sea has indicated seasonal differences in the relative use of the SAC. In winter months, harbour porpoises are concentrated in the innermost North Sea (Waggitt, Evans, Andrade, Banks, & Bolton, 2019). In spring, densities are concentrated in the northern portion of the SAC around Dogger Bank, as well as along the northwestern European coastline, with higher concentrations predicted to occur near the Offshore Scheme (Gilles, et al., 2016). In summer, hotspots shift westward towards the UK coastline (Waggitt, Evans, Andrade, Banks, & Bolton, 2019). In autumn, predicted densities decline to about a third lower than spring and summer and distribution becomes spatially heterogeneous (Waggitt, Evans, Andrade, Banks, & Bolton, 2019). Although individuals are present year-round, the greatest densities are predicted to occur in coastal Suffolk waters in winter (October-March) (**Figure 6.4.4.4.2 Harbour Porpoise Density** in **Application Document 6.4.4.4 ES Figures Marine Mammals**) (Waggitt, Evans, Andrade, Banks, & Bolton, 2019).

4.7.8 Further modelling of harbour porpoise distribution in the North Sea indicates that sea surface temperature, distance to coast, depth, and distance to sandeel grounds are important predictor variables in describing their distribution (Gilles, et al., 2016). Harbour porpoise forage mainly for sandeel (Maeda, et al., 2021). Several sandeel grounds have been identified in the central and southern North Sea (Gilles, et al., 2016), with some potential sandeel grounds found within the Offshore Scheme, based on project survey data (**Application Document 6.2.4.3 Part 4 Marine Chapter 3 Fish and Shellfish Ecology**). Additionally, Margate and Long Sands SAC, which is 2 km from the Offshore Scheme, is designated for a sediment type known to be preferred sandeel habitat.

4.7.9 Harbour porpoise were considered to be 'threatened and declining' in the Greater North Sea by the OSPAR commission (2008), however, the range and future prospect of the harbour porpoise in the UK is now considered to be of 'favourable' conservation status (JNCC, 2019). Globally, this species is considered 'least concern,' despite previously being considered vulnerable (IUCN, 2024).

Bottlenose Dolphin

4.7.10 The bottlenose dolphin has a near global distribution and is common throughout UK waters. In the North Sea, resident populations exist in the Moray and Cromarty firths in Scotland but are relatively uncommon off eastern English coasts and occur only occasionally within the English Channel (Sea Watch Foundation, 2012).

4.7.11 The Offshore Scheme occurs within the IAMMWG Greater North Sea MU for bottlenose dolphin. The most recent abundance estimate for this region was 1,885 individuals (IAMMWG, JNCC Report 734, 2023), however, there are very few observational records (Thompson, et al., 2011). There were no records of bottlenose dolphins within the relevant SCANS Block (Block NS-B), but individuals were reported in all adjacent blocks (Table 4.11).

Table 4.11 Abundance and density estimates for bottlenose dolphin in the Study Area

Assessment Area	Estimated Abundance	Estimated Density (individuals km^{-2})
Greater North Sea MU	2,022	-
UK EEZ portion of the ICES Greater North Sea MU	1,885	-
NS-B	0	0
NS-A	114	<0.01
NS-C	2,520	0.04
NS-H	96	0.99

4.7.12 There are two recognised ecotypes of bottlenose dolphin – a coastal ecotype which primarily occurs within 30 km of the coastline and exhibits habitat fidelity, and a wide-ranging offshore ecotype (Hague, Sinclair, & Sparling, 2020). The coastal ecotype is more common in the UK, with an estimated 700 individuals distributed across four regions: the greater North Sea, coastal southwest England, western Scotland, and coastal Wales. Predicted density and distribution of the offshore ecotype is extremely low in the southern North Sea, with a lack of any seasonal variation (**Figure 6.4.4.4.3 Bottlenose Dolphin Density** in **Application Document 6.4.4.4 ES Figures Marine Mammals**) (Waggitt, Evans, Andrade, Banks, & Bolton, 2019).

4.7.13 Therefore, any individuals present are likely to be of the coastal ecotype, however, given the paucity of records for the region and predicted distribution modelling, this species is unlikely to occur within the Study Area. It is important to note that data indicate the bottlenose dolphin population along the eastern coast of England has been increasing in size and expanding in range, with future expansion and distribution shifts likely to occur, possibly resulting in future interactions with the Offshore Scheme (Arso Civil, et al., 2021).

4.7.14 At present, the range of bottlenose dolphin is considered to be at ‘favorable’ conservation status in UK waters (JNCC, 2019) and is of ‘least concern’ globally (IUCN, 2024)

Minke Whale

4.7.15 The minke whale is relatively common in UK waters. Much of its distribution is concentrated in coastal waters around Scotland, although seasonal aggregations have been observed as far south as Dogger Bank in the central North Sea, but they are considered uncommon in the southern North Sea.

4.7.16 The Offshore Scheme falls within the IAMMWG Celtic and Greater North Sea MU for minke whales. The most recent abundance estimates for this region and within the relevant SCANS blocks indicate that whilst minke whale are abundant around the UK, abundance is relatively low around the Offshore Scheme with no individuals observed in the SCANS IV Block containing the Offshore Scheme (NS-B; Table 4.12).

Table 4.12 Abundance and density estimate for minke whale in the Study Area

Assessment Area	Estimated Abundance	Estimated Density (individuals km^{-2})
Celtic and Greater North Sea MU	20,118	-
UK EEZ portion of Celtic and Greater North Sea MU	10,288	-
NS-B	0	0
NS-A	0	0
NS-C	412	<0.01
NS-H	1,061	0.02

4.7.17 Predicted densities of minke whale in the North Sea indicate that their distribution is likely to be limited to the central and northern North Sea and the western English

Channel (**Figure 6.4.4.4.4 Minke Whale Density** in **Application Document 6.4.4.4 ES Figures Marine Mammals**) (Waggitt, Evans, Andrade, Banks, & Bolton, 2019). Furthermore, minke whale show preference for areas of high primary productivity (Hodgson, 2014) with their dominant prey item being sandeel, but also feed on herring, haddock, and mackerel (Olsen & Holst, 2001). A number of broadscale sandeel grounds have been identified in the central and southern North Sea, with some potential sandeel grounds based on project survey data, found within the Offshore Scheme (**Application Document 6.2.4.3 Part 4 Marine Chapter 3 Fish and Shellfish Ecology**). Additionally, Margate and Long Sands SAC occurs 2 km from the Offshore Scheme, which is designated for a habitat known to be preferred sandeel habitat.

4.7.18 When considering the lack of observations of minke whales within the SCANS-IV block containing the Offshore Scheme, the low density of individuals in the surrounding blocks, and the predicted seasonality indicating even lower numbers of individuals in winter months, it is unlikely that minke whales will occur near the Offshore Scheme.

4.7.19 This species is considered to have a 'favourable' conservation status in UK waters with respect to its range (JNCC, 2019) and is of 'least concern' globally (IUCN, 2024).

White-beaked Dolphin

4.7.20 The white-beaked dolphin is endemic to the northern Atlantic and North Sea. It occurs primarily in continental shelf waters less than 200 m deep and is common in the waters of western Ireland and Scotland, and in the central and northern North Sea, rarely occurring in the southern North Sea.

4.7.21 The Offshore Scheme falls within the IAMMWG Celtic and Greater North Sea MU for white-beaked dolphin. The most recent abundance estimates for this region as well as within the relevant SCANS blocks indicate that although they are abundant throughout the UK, they are not present in great abundances near the Offshore Scheme (Table 4.13; **Figure 6.4.4.4.5 White Beaked Dolphin Density** in **Application Document 6.4.4.4 ES Figures Marine Mammals**).

Table 4.13 Abundance and density estimate for white-beaked dolphin in the Study Area (MUs and SCANS IV Survey Blocks)

Assessment Area	Estimated Abundance	Estimated Density (individuals km^{-2})
Celtic and Greater North Sea MU	43,951	-
UK EEZ portion of Celtic and Greater North Sea MU	34,025	-
NS-B	0	0
NS-A	104	<0.01
NS-C	894	0.01
NS-H	157	0.06

4.7.22 In the North Sea, it is estimated that around 36,000 individuals occur (Ijsselddijk, et al., 2018). Modelling of white-beaked dolphin density in the North Sea (**Figure 6.4.4.4.5 White Beaked Dolphin Density** in **Application Document 6.4.4.4 ES Figures Marine Mammals**) indicates that individuals are concentrated in the northern North Sea near Shetland and Orkney in both winter and summer months. Their distribution extends southwards to the Yorkshire coast year-round, with moderate to high densities noted in summer months. In the southern North Sea (including the Offshore Scheme) there is a distinct lack of individuals year-round.

4.7.23 When considering the lack of observations within the SCANS-IV block containing the Offshore Scheme, low abundance in adjacent blocks, and the predicted absence of individuals in the seasonal modelling, it is unlikely that individuals of this species will be present in the Study Area.

4.7.24 At present this species is considered to have a 'favorable' conservation status in UK waters (JNCC, Article 17 Habitats Directive Report, 2019) and globally it is of 'least concern' (IUCN, 2024).

Other Cetaceans

4.7.25 In addition to the four most common species described above, an additional six species could occur within the North Sea

- Atlantic white-sided dolphin.
- common dolphin.
- humpback whale.
- killer whale.
- long-finned pilot whale; and
- Risso's dolphin.

Atlantic White-Sided Dolphin

4.7.26 Atlantic white-sided dolphin occurs primarily in temperate and subarctic waters of the northern Atlantic, rarely present south of the English Channel (Sea Watch Foundation, 2012). They are most common in the waters offshore of western Ireland and north and northwest of Britain along the continental slope but migrate to the coastal waters of northwest and northern Scotland in summer months.

4.7.27 The IAMMWG MU for this species is the Celtic and Greater North Sea, within which 12,293 individuals are believed to occur within the UK EEZ (IAMMWG, JNCC Report 734, 2023). However, no individuals were observed in the relevant SCANS-IV blocks and density modelling of the region indicates they are absent from the southern North Sea and English Channel year-round (Waggitt, Evans, Andrade, Banks, & Bolton, 2019; Gilles, et al., 2023). As such, they are unlikely to occur in the Study Area.

Common Dolphin

4.7.28 The common dolphin is widely distributed throughout temperate and tropical waters of the Atlantic and Pacific oceans. In the UK, they are particularly common in the Western Approaches, including the Irish Sea and Hebridean islands of Scotland. In recent years, their range has extended into the northern North Sea (Sea Watch Foundation, 2012).

4.7.29 SCANS-IV survey data revealed no observations within Block NS-B, but individuals were present in the adjacent blocks NS-A (n=539) and NS-C (n=192). Modelling indicates common dolphin are largely absent from the North Sea, but they do occur in low numbers in the English Channel (Waggitt, Evans, Andrade, Banks, & Bolton, 2019). In summer months, their range extends marginally eastward towards the outer Thames estuary and as such, individuals may occur near the Offshore Scheme, however it is likely only infrequently or in small numbers.

Humpback Whale

4.7.30 Humpback whales have a global distribution, with a known population in the eastern North Atlantic that occupies the continental shelf waters of northern Europe. In the UK, sightings have primarily occurred in the northern Irish Sea and western Scotland, the Celtic Sea, and the North Sea, with observations in the southern North Sea increasing in recent years (Sea Watch Foundation, 2020).

4.7.31 There is currently no abundance estimate for humpback whales in the North Sea, but they are highly migratory, with observations in European waters peaking throughout May-September before declining between January and May. As such, they may occur near the Offshore Scheme but are likely to occur only infrequently and/or in small numbers.

Orca

4.7.32 In UK waters, orcas are common in northern and western Scotland, with low densities observed in the northern North Sea. Modelling of their distribution throughout the North Sea indicates that they are present year-round with little seasonal variation (Waggitt, Evans, Andrade, Banks, & Bolton, 2019). However, Orca are rarely observed in the central North Sea and are likely absent from the southern North Sea. Abundance or density estimates for orca were not reported in SCANS data and as such, they are unlikely to occur within the Study Area.

Long-finned Pilot Whale

4.7.33 The long-finned pilot whale is a deep-water species (greater than 200 m) typically occurring to the west of the UK. There is no established IAMMWG MU for this species nor are there any abundance or density estimates available for the relevant SCANS blocks (Gilles, et al., 2023). Modelling of their distribution in the northeast Atlantic indicates very low densities in the North Sea (Waggitt, Evans, Andrade, Banks, & Bolton, 2019). These data indicate they are likely absent from the area surrounding the Offshore Scheme.

Risso’s Dolphin

4.7.34 The Risso's dolphin is widely distributed in UK waters along the continental shelf (Frantzis & Herzing, 2002; Reid, Evans, & Northridge, 2003; Sea Watch Foundaiton, 2012). The IAMMWG MU for this species is Celtic and Greater North Seas MU, with which 8,687 individuals are predicted to occur within the UK EEZ (IAMMWG, JNCC Report 734, 2023).

4.7.35 They are most common north and west of the British Isles and in coastal waters of the western English Channel (Jefferson, et al., 2014), with few records within the central and southern North Sea. SCANS-IV data did not report any individuals within the relevant blocks (Gilles, et al., 2023). This is supported by density modelling in the region, which further indicates a lack of individuals within the Study Area, despite seasonal extensions in their distribution (Waggitt, Evans, Andrade, Banks, & Bolton, 2019). As such, it is unlikely this species will be present within the Study Area.

Summary of Cetacean Abundance and Density Estimates

4.7.36 Estimated abundance and densities for the four key cetacean species by relevant SCANS-IV survey block in proximity to the Offshore Scheme are provided in Table 4.14.

Table 4.14 Abundance and density estimate for the four key cetacean species in UK waters

SCANS IV Block	Species	Estimated Abundance	Estimated Maximum Density (individuals km^{-2})
Block NS-B	Harbour porpoise	7,982	0.83
	Bottlenose dolphin	0	0
	Minke whale	0	0
	White-beaked dolphin	0	0
Block NS-A	Harbour porpoise	4,053	0.10
	Bottlenose dolphin	114	<0.01
	Minke whale	0	0
	White-beaked dolphin	104	<0.01
Block NS-C	Harbour porpoise	36,286	0.60
	Bottlenose dolphin	2,520	0.04
	Minke whale	412	<0.01
	White-beaked dolphin	894	0.01
Block NS-H	Harbour porpoise	55,691	0.80
	Bottlenose dolphin	96	0.99
	Minke whale	1,061	0.02
	White-beaked dolphin	157	0.06

4.7.37 Among the cetacean species identified, the harbour porpoise is the most likely to occur within the Offshore Scheme Boundary, although occasional visits by small numbers of other cetacean species may also take place. Given the high level of protection afforded to all cetacean species, the sensitivity of this receptor is assessed as *very high*.

Pinnipeds

4.7.38 Two seal species are known to occur in the northeast Atlantic, the harbour seal *Phoca vitulina* and grey seal *Halichoerus grypus,* with UK waters supporting important populations of both species.

Harbour Seal

4.7.39 Approximately 32% of the European harbour seal population is found in the UK, with a current population estimate in UK waters of 40,525 individuals (a 95% confidence interval range of 33,157 to 54,033) (SCOS, 2024). Most of the harbour seals in England are found on the Lincolnshire and Norfolk coast (Southeastern England SMU). The Offshore Scheme falls within the Southeast England SCOS SMU. Within this SMU, the most recent harbour seal population estimate is 3,361 individuals, which shows a decline from previous years, for unknown reasons (SCOS, 2024).

4.7.40 Harbour seals live in discrete regional populations, usually staying within 50 km of the coast (Russell & McConnell, 2014; Russell, Jones, & Morris, 2017). They come onshore at haul-out sites, where they rest, breed, and moult. On the east coast of England, the most important haul-out sites occur around the Wash and Humber estuaries (Plate 4.1). They are, however, also known to haul-out within the Greater Thames Estuary and at Pegwell Bay.

4.7.41 There were an estimated 932 harbour seals within the Greater Thames Estuary in 2019 (Cox, et al., 2020). In 2022, there were 854 harbour seals recorded in the Greater Thames areas (SCOS, 2024). They are observed in great concentrations along the coastal sites of Dengie Flats, Hamford Water, Swale Estuary, and Pegwell Bay, as well as along the outer sandbanks of Margate Sands, Goodwin Knoll, and Goodwin Sands (Plate 4.2) (Cox, et al., 2020). The mean at-sea usage (i.e., the mean count of seals in the water at any point) for harbour seals in the Greater Thames Estuary (the area of sea between the Swale Estuary and the River Stour) is moderate to high, with 1-10 individuals per 25 km^2 occurring within the project Study Area (**Figure 6.4.4.4.6 Harbour and Grey Seal Distribution in 5 X 5 km Grid Cell at Any One Time** in **Application Document 6.4.4.4 ES Figures Marine Mammals**) (Carter, et al., 2022). The higher density of seals at sea is used for the assessment of underwater sound impacts to seals.

4.7.42 The hauling-out of harbour seals is seasonal, peaking in August – September during the moulting season, with lower numbers in June – July during the pupping season, in which site abundance is primarily composed of breeding females (Cox, et al., 2020). Harbour seals are reported to breed and pup at Pegwell Bay and Goodwin Sands haul-out sites.

4.7.43 When harbour seals leave haul-out sites to forage, though most remain in close proximity to haul-out sites, some individuals have been observed to travel up to 273 km away (Carter, et al., 2022).These tracking data for harbour seals, show strong connectivity between Pegwell Bay and the Greater Thames Estuary; with the majority of individual tracks linking Pegwell Bay with Margate Sands, Swale Estuary, and the coastal sites of Dengie Flats. However, one individual was observed moving between the Wash SAC and Pegwell Bay, spending extended periods in the Greater Thames Estuary and along the coast near Happisburgh in Norfolk.

4.7.44 Although the sample size for the movement of Pegwell Bay seals is limited, these data suggest that a small proportion of harbour seals do have some connection to the population located in the Wash SAC. Notably, a greater number of individuals were observed moving between the Greater Thames Estuary and the Wash SAC, without visiting Pegwell Bay. However, given the strong connection between the Greater Thames Estuary and Pegwell Bay, and the limited transmitter lifespan used during these investigations, there may be more individuals that make an additional leg of their journey to / from Pegwell Bay than the data suggest.

4.7.45 Within Pegwell Bay, the most recent counts by ZSL were in August 2021, where 97 seals were observed hauled-out along the sandbanks (ZSL, 2021). A survey during the pupping season in the same year recorded 3 pups at the Pegwell Bay haul-out. Anecdotal data from a local commercial seal watching vessel operating regularly around the River Stour reports seeing up to and over 200 seals in some months (e.g. in December 2023) and observed 11 pups in 2023 and 12 in the 2024 pupping season.

4.7.46 Project specific monthly surveys were also undertaken in the period September to November 2024, and a further survey in August 2025, with the primary aim of determining the specific haul-out locations of the Pegwell Bay seals (**Appendix 6.4.4.4.A (B) Pegwell Bay Seal Survey Report [REP1-003]**). These were boat based surveys covering the River Stour and outer Pegwell Bay. Binoculars were used to survey the shores of the wider bay and the banks of the river though counts could be made by eye once in the river.

4.7.47 During all three surveys hauled-out seals were only found in a relatively restricted area of the lower River Stour (**Figure 6.4.4.4.7 Harbour Seals Observed During September – November and August Surveys** in **Application Document 6.4.4.4 (C) ES Figures Marine Mammals [REP1-011]**). At low tide, seals were observed resting on sandbanks within the river channel, positioned below the main line of sight from Pegwell Bay. During high tide, seals remained within the river channel, moving up to the top of the riverbank to rest on the saltmarsh. Many individuals continued to haul-out even when much of the area was inundated with shallow water. There were fewer seals overall counted at high tide and many more individuals were in the water compared to low tide. The occasional seal was observed, in the water, outside of the river within the main Pegwell Bay but there were no haul-out sites outside of the river.

4.7.48 The number of seals observed was higher at low tide, with 68 in September and 64 in October, with a lower number of 33 seals observed in November 2024. The number of seals observed on the high tide ranged from 45 in September and 46 in October, with a lower number of 18 seals observed in November. Around 97% of all observations (both high and low tide) were harbour seals. A small number of juveniles were observed in all months.

4.7.49 The haul-out locations are over 1,000 m away (as the crow flies) from works in Pegwell Bay, including the exit pit for the trenchless installation from the onshore and at low tide seals are out of direct line of site of Pegwell Bay as they haul-out on the low tide riverbank. For cable installation in the intertidal the closest point between works and the haul-out locations is also over 1,000 m (**Figure 6.4.4.4.7 Harbour Seals Observed During September – November and August Surveys** in **Application Document 6.4.4.4 (C) ES Figures Marine Mammals [REP1-011]**).

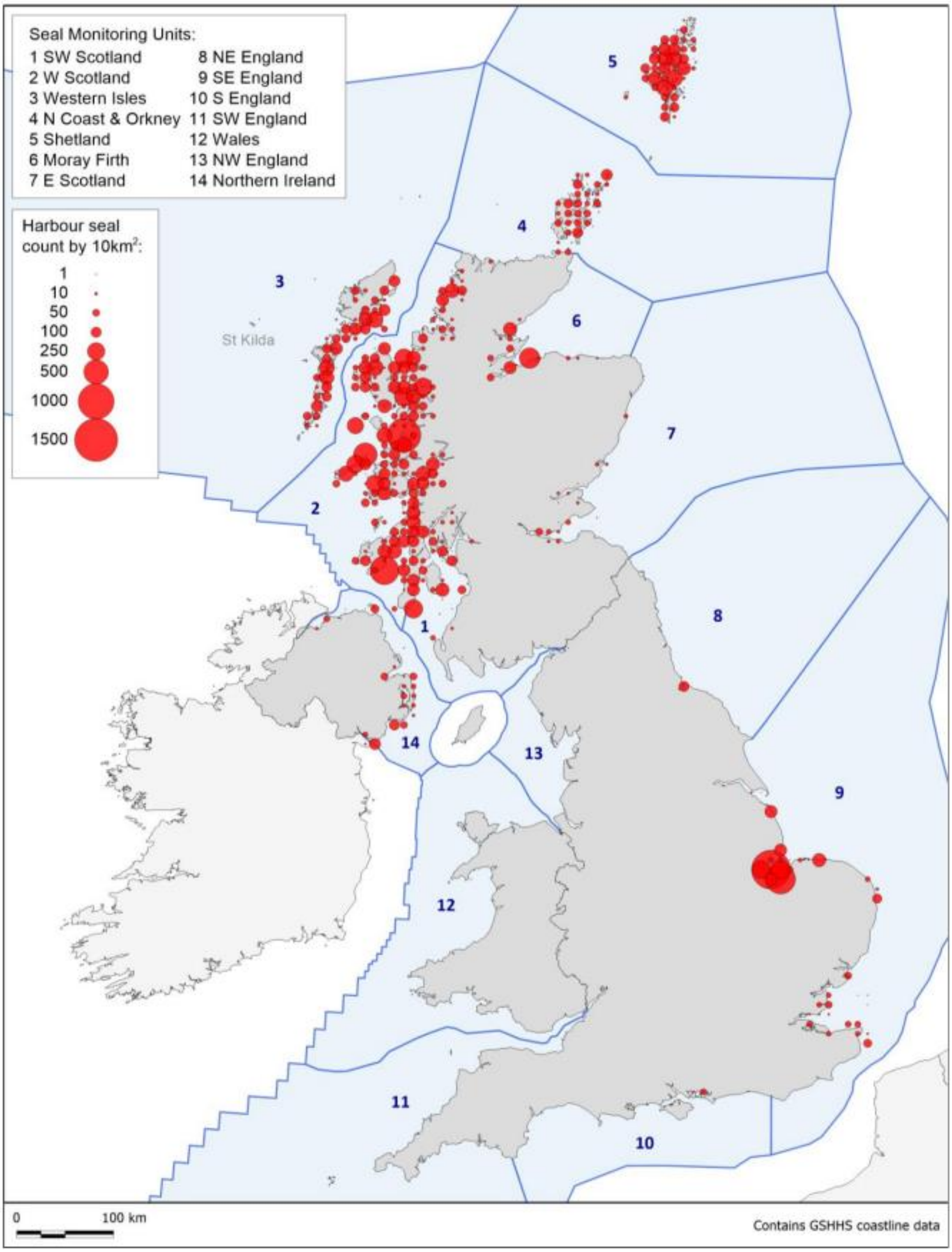

Plate 4.1 UK haul-out sites for harbour seals by MU (SCOS, 2024)

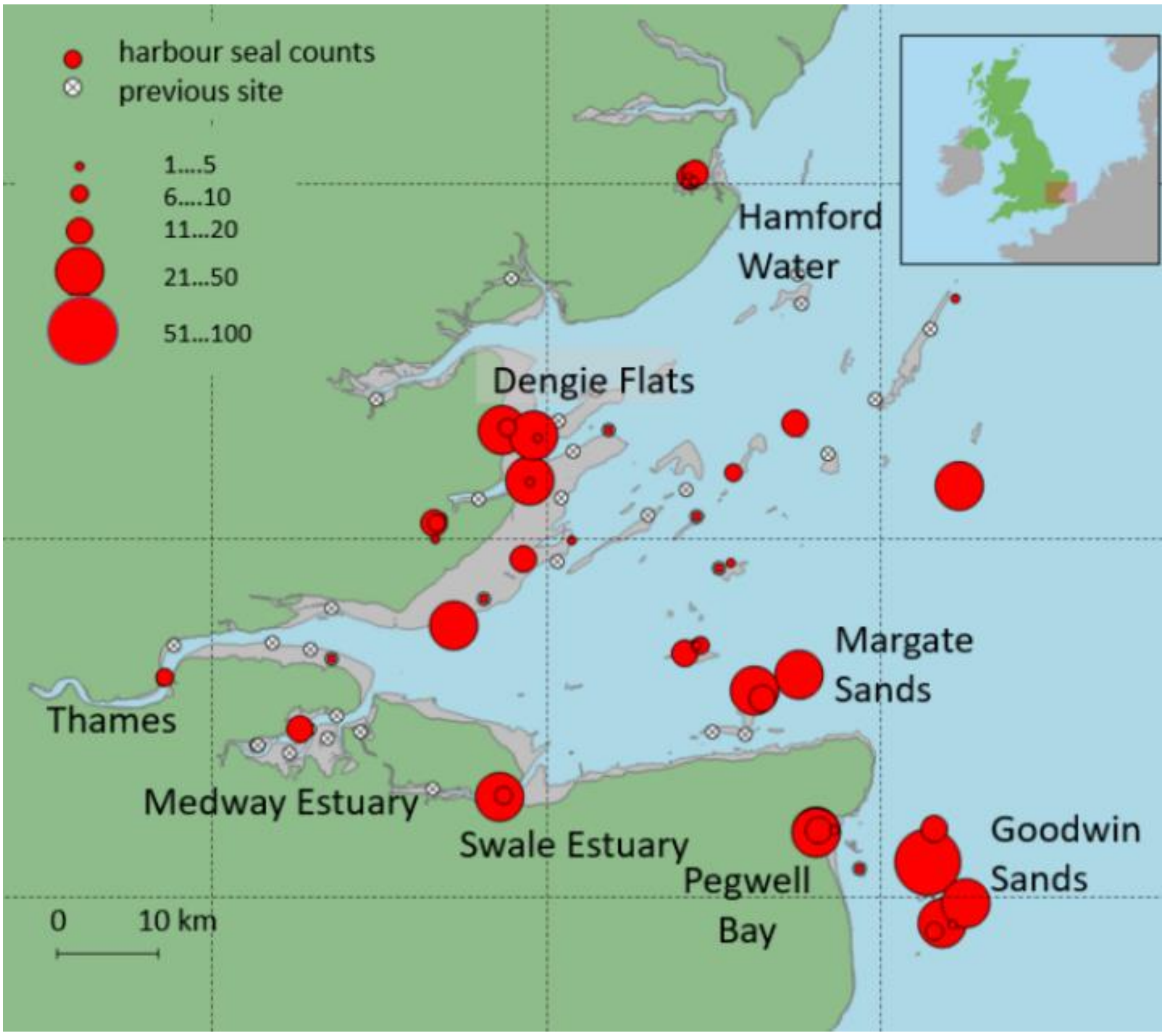

Plate 4.2 Haul-out sites for harbour seal within the greater Thames Estuary (Cox, et al., 2020)

4.7.50 The harbour seal is an Annex II species of the EU habitats directive and is a qualifying feature for a number of SACs, the nearest of which is the Wash and North Norfolk Coast SAC, a distance of 110 km to the north of the Offshore Scheme. The SAC hosts extensive tidal flats, which support harbour seal breeding and hauling-out. It is considered to host the largest colony of harbour seals in the UK, supporting approximately 7% of the total UK population (JNCC, 2021). Tagged seals within the region have indicated connectivity between the Greater Thames Estuary and the Wash populations, suggesting individuals from this site may occur within the Offshore Scheme Boundary (Barker, Seymour, Mowat, & Debney, 2014; Carter, et al., 2022).

4.7.51 As harbour seals have a presence at Goodwin Sands and Pegwell Bay, with known haul-out sites near the Offshore Scheme, they are considered likely to occur within the vicinity of project works though. Locally, the population is considered to be increasing, and the conservation status of this species is of 'least concern' (IUCN, 2024). However, when considering the high level of protection afforded by this receptor, the value of this receptor is assessed as high.

Grey Seal

4.7.52 Approximately 36% of the world's grey seal population breeds in the UK. The most recent population estimate for grey seals in the UK is 168,400 individuals though approximately 80% of this population reside in Scottish waters (SCOS, Scientific Advice on Matters Related to the Management of Seal Populations: 2022, 2022). Within the Southeast England SCOS MU the most recent grey seal count was 10,692 individuals (SCOS, 2022; SCOS, 2024).

4.7.53 Grey seals also use haul-out sites for breeding, resting, and moulting. Most of the important haul-out sites for grey seals occur in Scotland, but there are some that are important for the English seal population within the Humber estuary and along the northern Norfolk coastline (Plate 4.3).

4.7.54 Several haul-out sites have also been observed within the Greater Thames Estuary (Plate 4.4). It is estimated that 3,243 grey seals inhabit the area, with an increase in the long-term population trend (Barker & Obregon, 2015; Cox, et al., 2020). They occur in their greatest numbers along offshore sandbanks, such as at Kentish Knock and Goodwin Sands, but are also observed on sandbanks further within the estuary and along the coast. Grey seals are thought not to breed in the area and are likely seasonal visitors to the Greater Thames Estuary, avoiding the peak breeding season (Wilson S. , Population growth, reproductive rate and neo-natal morbidity in a re-establishing harbour seal colony, 2001; Barker & Obregon, 2015; Cox, et al., 2020).

4.7.55 Within Pegwell Bay, the most recent August counts observed 3 seals hauled-out along the sandbanks (ZSL, 2021). During project specific seal surveys a few grey seals were observed within the river, mostly in the water rather than hauled-out. A single seal observed in the wider bay in September 2024 was thought to be a grey seal, but it was not possible to confirm the identification (**Application Document 6.4.4.4.A (B) Pegwell Bay Seal Survey Report [REP1-003]**).

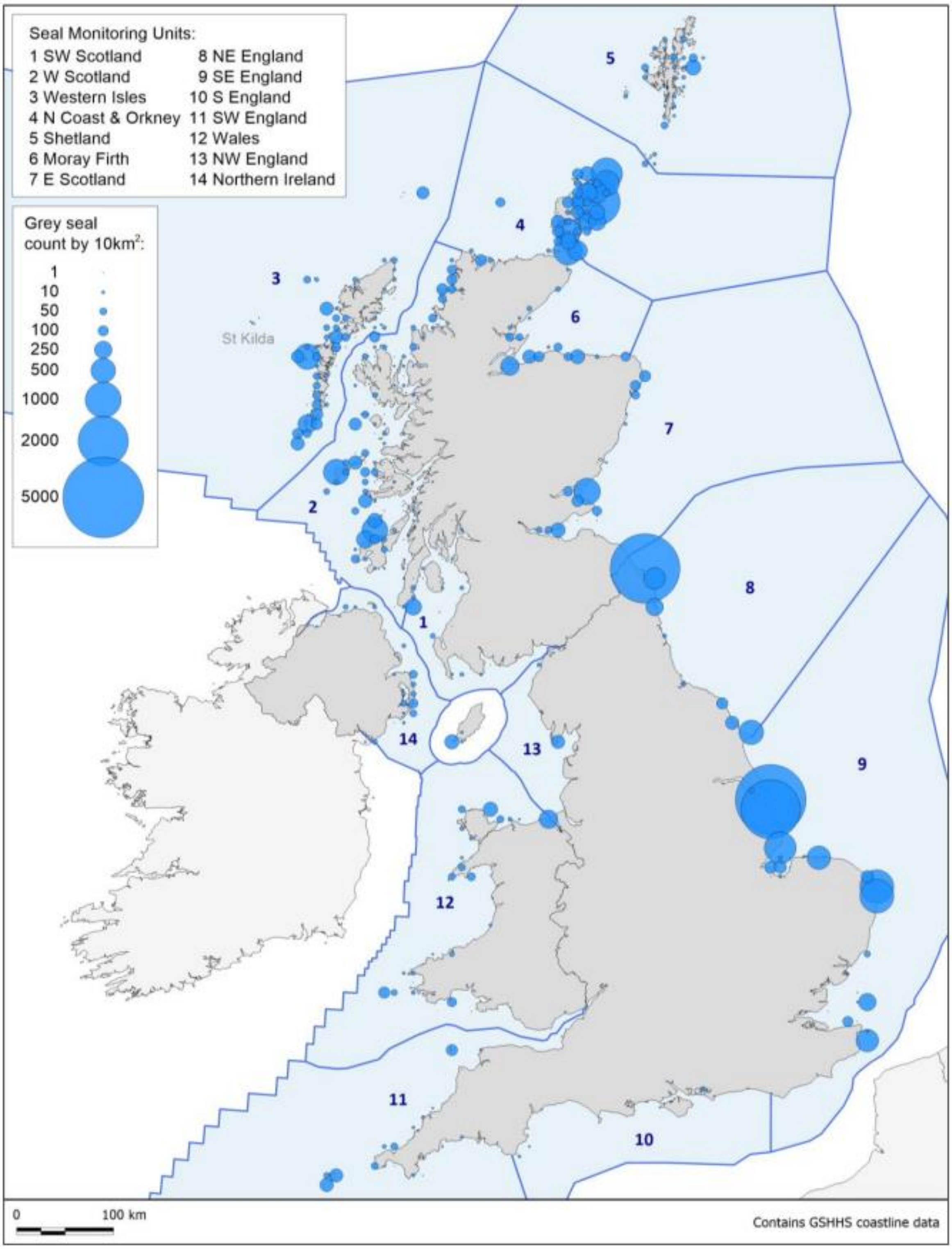

Plate 4.3 UK haul-out sites for grey seals by MU (SCOS, 2024)

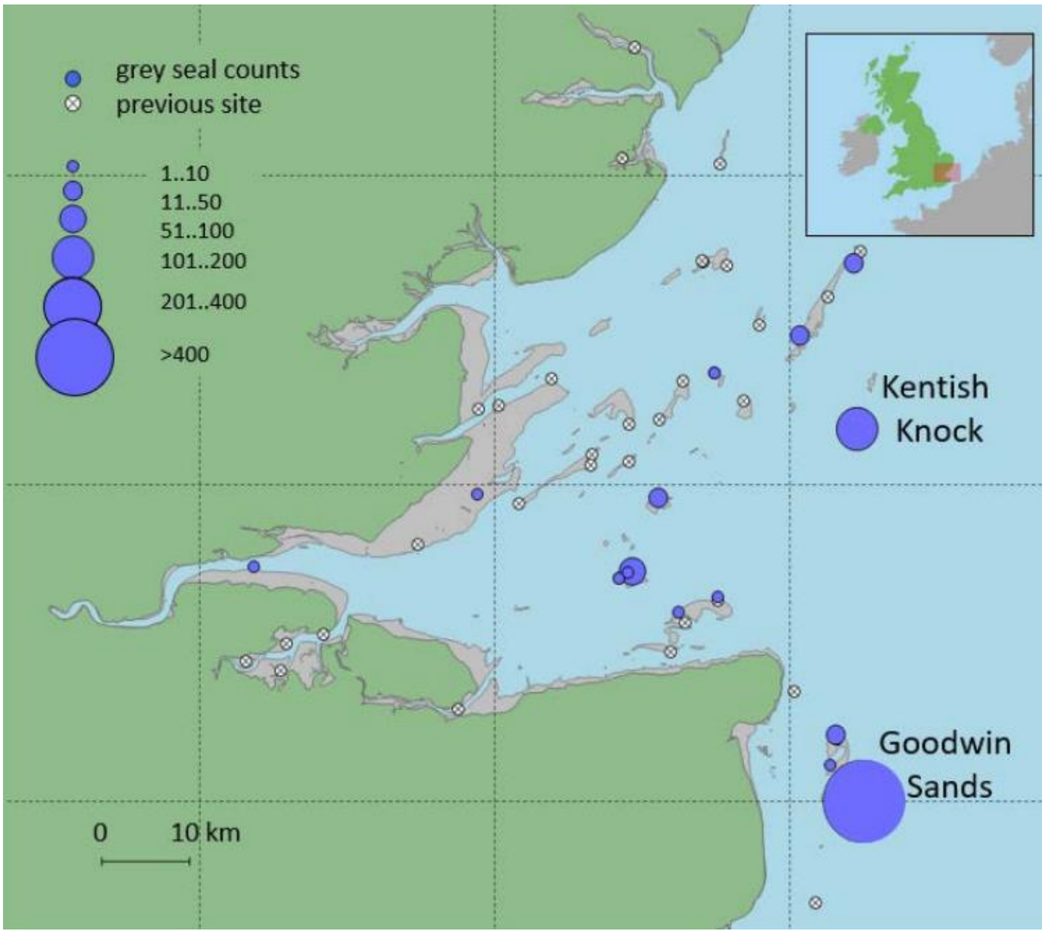

Plate 4.4 Haul-out sites within the Greater Thames Estuary for grey seal (Cox, et al., 2020)

4.7.56 When grey seals leave haul-out sites for foraging, they can range over much greater distances than harbour seals, having been observed foraging up to 448 km without returning to haul-out sites (Carter, et al., 2022). Tagging studies have revealed some connectivity between populations of the Humber region and the Greater Thames Estuary, but that most individuals appear to migrate northward and offshore to deeper waters (Russell & McConnell, 2014). Mean at-sea distributions for grey seal indicate that between 0 and 1 individuals per 25 km^2 occur within the Greater Thames Estuary and the study area (**Figure 6.4.4.4.6 Harbour and Grey Seal at-Sea Distribution in 5 X 5km Grid Cell at Any One Time** in **Application Document 6.4.4.4 ES Figures Marine Mammals**) (Carter, et al., 2022).

4.7.57 The grey seal is an Annex II species of the EU habitats directive and is a qualifying feature for several SACs, though none occur within the Study Area for which grey seal are a primary feature. The nearest SAC in which grey seal is present as a qualifying feature, but is not the primary reason for site selection, is the Humber Estuary SAC. The Humber Estuary SAC contains some of the largest haul-out sites for grey seal (Donna Nook and the Wash), but the local pup production is thought to be declining (SCOS, 2024).

4.7.58 Although they are not considered to breed within the Greater Thames Estuary, evidence indicates that grey seals migrate to haul-out sites within the Study Area and may travel across the Offshore Scheme. Given the foraging distances of this species, it is likely some are from the Humber and Wash populations, which are nationally important.

4.7.59 The UK grey seal population is considered stable and increasing, particularly within the eastern England colonies. Overall, this species is at 'favourable' conservation status in the UK (JNCC, 2019). Globally, populations are also considered to be increasing and therefore the conservation status of this species is of 'least concern' (IUCN, 2024). However, when considering the high level of protection afforded by this receptor, the value of this receptor is assessed as high.

Designated Sites

4.7.60 Key sites designated for the protection of marine mammals have been initially screened in using the relevant MUs defined by IAMMWG for each species. The sites within each MU have been considered, based on available knowledge of species ecology and connectivity, for relevance to project activities.

4.7.61 For cetaceans, relevant guidance regarding the disturbance from underwater sound has been used to determine a preliminary screening distance (JNCC, 2020), whilst for pinnipeds, screening distances have been selected based on known foraging ranges (273 km for harbour seals, 448 km for grey seals) (Carter, et al., 2022).

4.7.62 The key sites designated for the protection of marine mammals, screened in for assessment, are presented in (Table 4.15) along with the distance from the Offshore Scheme. Marine mammal species designated as biodiversity features are highlighted in **blue.**

4.7.63 An assessment of impacts on European designated sites is provided in **Application Document 6.6 (E) Habitats Regulations Assessment Report**, submitted at Deadline 3 and **Application Document 6.11 Marine Conservation Zone Assessment**.

Table 4.15 Designated sites for marine mammals within the Study Area

Site name	Distance from nearest cable route option	Summary
Southern North Sea SAC	0 km	The Offshore Scheme passes through the Southern North Sea (SNS) SAC, which has been designated for the protection of the Annex II species **harbour porpoise**. A total of 6 other SACs are designated for this species, however, they occur in Scotland or the Irish or Celtic Seas, with no connectivity identified between any of these populations and the SNS SAC.
Wash and North Norfolk Coast SAC	110 km	The Wash and North Norfolk Coast SAC is designated for the protection of the Annex II species **harbour seal**. This site

Site name	Distance from nearest cable route option	Summary
		has been included as telemetry data indicate that harbour seals from the greater Thames Estuary may be associated with this site.
Humber Estuary SAC	160 km	The Humber Estuary SAC includes Annex II species **grey seal** as a qualifying feature, although not the primary reason for site selection. Telemetry data indicate that grey seals from this area frequent the greater Thames Estuary (Carter, et al., 2022).
Berwickshire and North Northumberland Coast SAC	412 km	The Berwickshire and North Northumberland Coast SAC includes Annex II species **grey seal** as a primary reason for site selection. Based on known foraging distances of this species, it is possible that individuals from this site may migrate to the Offshore Scheme during foraging activities (Carter, et al., 2022).

Future Baseline

4.7.64 Data indicate that the bottlenose dolphin population is increasing in size and expanding in range (Arso Civil, et al., 2021), with similar trends noted for grey seals in the Study Area (Barker & Obregon, 2015; Cox, et al., 2020). However, these species currently are only present in very small numbers within the Study Area, and thus these changes are not anticipated to substantially alter the baseline. Moreover, it is noted that variables such as sea surface temperature may influence the distribution of marine mammals (Gilles, et al., 2016). Thus, as sea temperatures rise with predicted climate change, there may be shifts and/or expansions of the distribution of marine mammal populations.

4.7.65 The lifetime of the Proposed Project is 40-60 years; it is expected that this baseline is likely to remain relevant for the duration of the Project and unlikely to change substantially over this time period. However, harbour and grey seal populations in the North Sea have been continuously increasing in recent decades (Thomas, et al., 2019; Thompson, Duck, Morris, & Russell, 2019).

4.8 Proposed Project Design and Embedded Mitigation

4.8.1 The Proposed Project has been designed, as far as possible, following the mitigation hierarchy in order to, in the first instance, avoid or minimise environmental impacts and effects, including to marine mammals, through the process of design development, and by embedding measures into the design of the Proposed Project.

4.8.2 As set out in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology**, mitigation measures typically fall into one of the three categories: embedded measures; control and management measures; and mitigation measures.

Embedded Measures

4.8.3 Embedded measures, integral in reducing the environmental effects of the Proposed Project, that have been incorporated and reduce impacts to marine mammals are:

- Sensitive routeing and siting of infrastructure and temporary works; and
- Commitments made within **Application Document 7.5.3.2 Appendix B Register of Environmental Actions and Commitments.**

Control and Management Measures

4.8.4 The following measures have been included within **Application Document 7.5.3.1 Appendix A Outline Code of Construction Practice** relevant to the control and management of impacts that could affect marine mammal receptors:

- MM01 - adherence to JNCC guidelines, where appropriate, regarding the minimisation of injury from underwater sound generated from known project geophysical surveys (JNCC, 2017; JNCC, 2025);
- MM02 – adherence to JNCC guidance for assessing the significance of noise disturbance against conservation objectives of the SNS SAC (JNCC, 2019);
- GM03 - an offshore Construction Environmental Management Plan (CEMP) including an Emergency Spill Response Plan and Waste Management Plan, Marine Pollution Contingency Plan (MPCP), Shipboard Oil Pollution Emergency Plan (SOPEP) and a dropped objects procedure will be produced prior to installation.
- FSF01 - the target depth of lowering (DOL) will be between 1 m to 2.5 m (subject to local geology and obstructions).
- LVS02 - all project vessels must comply with the International Regulations for Preventing Collisions at Sea 1972 (International Maritime Organisation, 1972), regulations relating to International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) (International Maritime Organisation, 1983), with the aim of preventing and minimising pollution from ships and the International Convention for the Safety of Life at Sea (SOLAS 1974) (International Maritime Organisation, 1974);
- LVS05 - Drilling fluids required for trenchless operations will be carefully managed to minimise the risk of breakouts into the marine environment. Specific avoidance measures would include:
  - the use of biodegradable drilling fluids (pose little or no risk (PLONOR) substances) where practicable,
  - drilling fluids will be tested for contamination to determine possible reuse or disposal; and

— If disposal is required drilling fluids would be transported by a licensed courier to a licensed waste disposal site.

4.9 Assessment of Impacts and Likely Significant Effects

4.9.1 The assessment of the effects of the Offshore Scheme on marine mammal receptors described in this section considers the embedded, control and management measures described in Section 4.8. Potential impacts assessed in this section are summarized in Table 4.16 and further information regarding project design can be found in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**.

Table 4.16 Summary of impact pathways and maximum design scenario

Potential Impact	Maximum Design Scenario
Construction	
Underwater sound (excluding UXO) effects	Underwater sound generating activities assessed include pre-installation geophysical survey activities, pre-installation clearance, cable installation via a range of different methods including trenching, placement of cable protection and vessel movements
Potential for indirect effects through impacts to prey species	The maximum possible swathe of disturbance during pre-installation clearance or cable installation is 25.
Vessel collision risk	Vessel transit speeds – 4 knots to 12 knots. Vessel operational speeds – 0 km to 7 km per day.
Airborne sounds and visual disturbance	Activities in the Offshore Scheme that could result in airborne sound and visual disturbance are predominantly due to construction activities at Pegwell Bay. These are vibratory piling for the installation of piles around the HDD exit pit and the movement of a small number of excavators during HDD exit pit digging and the presence of excavators during cable pull and installation in the intertidal zone. Vessel movements may also result in airborne sound and visual disturbance, though of much lower intensity than the intertidal works.
Reduction in water quality due to discharges and unplanned releases, accidental leaks, and spills from vessels	Theoretical maximum dispersion of discharges and releases to a distance of 17 km, the mean tidal excursion for this region of the North Sea. However, discharges are limited in volume as only sources are fuel tanks and materials on deck.

Potential Impact	Maximum Design Scenario
Operation & Maintenance	
Disturbance to marine mammals from electromagnetic field (EMF) emissions	Proposed project has committed to the installation of two bundled HVDC cables.
Maintenance and repair of cable	The Offshore Scheme is designed for a lifespan of approximately 40-60 years. The cable system installation is designed such that a regular maintenance regime is not required to maintain the integrity of the link.
Decommissioning	
Options for decommissioning will be evaluated in both environmental and economic assessments, taking account of the regulations, best practices and available technology at the time of decommissioning. As a worst-case scenario, impacts during decommissioning may be of a similar magnitude to Construction and Operation & Maintenance phase activities.	An initial decommissioning plan will be written once the final route and installation methodology is engineered by the Contractor. This will be in accordance with all applicable legislation and best practice guidance at the time of compilation. Dependent on requirements at end of asset life, the redundant cables could either be recovered for recycling (in its entirety, or in parts) or left in-situ.

Construction Phase

Underwater sound (excluding UXO)

4.9.2 Several activities undertaken during the lifetime of the project will generate underwater sound, including:

- Pre-installation geophysical surveys comprising multi-beam echo sounder (MBES), side-scan sonar (SSS), sub-bottom profiler (SBP) and USBL (acoustic positioning).
- Geotechnical vibrocore sampling.
- Clearance of obstacles and debris.
- Sand wave sweeping.
- Cable trenching – may include various methods depending on seabed conditions (e.g., ploughing, jet trenching, and/or mechanical trenching).
- Cable protection placement (e.g., rocks, concrete mattresses).
- Cable and cable protection removal.
- Vessel movements including vessels operating with dynamic positioning (DP).

4.9.3 For underwater sound impact appraisals, the applied metrics are sound pressure level (SPL) and sound exposure levels (SEL). SPL is a measure of the amplitude or intensity of a sound and is typically described as a peak (SPL_{peak}) or rms (SPL_{rms}) value[3]. In contrast, SEL is a time-integrated measurement of sound energy, which takes account of the level of sound as well as the duration over which the sound is present in the marine environment.

4.9.4 Underwater sound can be either impulsive or continuous (non-impulsive) in nature; both will occur during all phases of the proposed Offshore Scheme. Impulsive sounds include those produced by geophysical survey equipment and continuous sounds come from vessels, cable clearance and installation activities. The sound characteristics of the Project activities have been determined based on equipment specifications and literature values and experience from previous projects (Table 4.17). Where a range of sound source levels was found in literature a reasonable but realistic worst-case level has been assumed.

Table 4.17 Characteristics of underwater sound sources generated during the construction phase

Activity	Sound type	Operating Frequency (kHz)	SPL_{rms} (dB re 1µPa @ 1 m)	Reference
Geophysical and Geotechnical Survey Activities				
Multibeam Echosounding (MBES) in water depths <~200 m.	Impulsive	170 - 450	221-235	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. Document J71656-Final Report-G2 [Online]. Available at: https://www.semanticscholar.org/paper/Review-and-Assessment-of-Underwater-Sound-Produced-IRECTIVE/52b808718275e5203637ed083942fff8502adba9.; and Multiple MBES equipment specification sheets available online.
Multibeam Echosounding (MBES) in water depths <~200 m.	Impulsive	170 - 450	221-235	Genesis (2011). Review and Assessment of Underwater Sound Produced from Oil and Gas Sound Activities

[3] For SPL the peak value is the range in pressure between zero and the greatest pressure of the signal; rms denotes route mean square which is the square root of the average of the square of the pressure of the sound signal over a given duration.

Activity	Sound type	Operating Frequency (kHz)	SPL_{rms} (dB re 1μPa @ 1 m)	Reference
				and Potential Reporting Requirements under the Marine Strategy Framework Directive. Document J71656-Final Report-G2 [Online]. Available at: https://www.semanticscholar.org/paper/Review-and-Assessment-of-Underwater-Sound-Produced-IRECTIVE/52b808718275e5203637ed083942fff8502adba9.; and Multiple MBES equipment specification sheets available online.
Side Scan Sonar (SSS)	Impulsive	300 - 600	210 - 226	Genesis (2011). Multiple online equipment specification sheets
Sub-bottom profiling (SBP)	Impulsive	0.5 – 12	213 - 238 (peak)	There is a significant range of sound source levels from SBP, ranging from 213 dB SPLpeak as referenced in: https://archimer.ifremer.fr/doc/00368/47969/47993.pdf; and https://marine.gov.scot/sites/default/files/eps_risk_assessment_2.pdf. Higher values from equipment specification sheets including: – Innomar SES-2000, – Edgetech Chirp & Applied Acoustics 201 boomer
USBL (Acoustic positioning)	Impulsive	25-35	192 (max)	Specification Sheets including: Easy Track USBL (https://www.aaetechnologiesgroup.com/wp-content/uploads/2023/11/Eastrak-Nexus-2-Lite-2696-%E2%80%93-Technical-Specification-2.pdf)

Activity	Sound type	Operating Frequency (kHz)	SPL_{rms} (dB re 1μPa @ 1 m)	Reference
				Gaps USBL (USBL Solutions - iXblue). Note the HiPAP USBL has the capability to operate to up to 207 dB (SPLpeak) but is expected to only operate to a maximum sound source level of 190 dB with operating frequency of 21-31 kHz.
Geotechnical Survey Activities				
Standard penetration testing (SPT)	Impulsive	Not found	151 - 160	Erbe, C. and McPherson, C. (2017). Underwater noise from geotechnical drilling and standard penetration testing. The Journal of the Acoustical Society of America, 142(3), 281-285.
Vibrocore sediment sampling	Continuous	< 1	<180 – 190 (185 average)	Reiser, C.M, D.W. Funk, R. Rodrigues, and D. Hannay. (eds.) 2011. Marine mammal monitoring and mitigation during marine geophysical surveys by Shell Offshore, Inc. in the Alaskan Chukchi and Beaufort seas, July–October 2010: 90-day report. LGL Rep. P1171E–1. 240 pp, plus appendices (BOEM, 2024).
Cable Installation Activities (including pre-installation preparation)				
HDD (e.g., break-out)	Continuous	n/a	129.5	Nedwell, J.R., Brooker, A.G. and Barham, R.J. (2012). Assessment of underwater noise during the installation of export power cables at the Beatrice Offshore Wind Farm. Subacoustech Environmental Report No. E318R0106. [Online]. Available from: https://marine.gov.scot/datafiles/lot/bowl/ES/ES%20Volume%204%20-

Activity	Sound type	Operating Frequency (kHz)	SPL_{rms} (dB re 1μPa @ 1 m)	Reference
				%20Annexs/7B%20OfTW%20Underwater%20Noise/Annex%207B%20OfTW%20Underwater%20Noise.pdf.
Cable installation (e.g., jet trenching, mechanical trenching)	Continuous	1 - 15	178	Hale, R. (2018). Sounds from Submarine Cable & Pipeline Operations. EGS Survey Group representing the International Cable Protection Committee. Presentation to the United Nations. Available from: https://www.un.org/depts/los/consultative_process/icp19_presentations/2.Richard%20Hale.pdf. Nedwell, J., Langworthy, J., & Howell, D. (2003). Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore windfarms, and comparison with background noise. The Crown Estates. Retrieved from www.subacoustech/information/downloads/reports/544R0424.pdf
Sand wave levelling	Continuous	0.1 – 0.4	< 180*	Kevin, J., Reine, K. J., & Clarke, D. (2014). Kevin J. Reine, K.J and Clarke, D. 2014. Characterization of underwater sounds produced by hydraulic and mechanical dredging operations. Journal of the Acoustical Society of America, 135(6), 3280–3294.
Installation of cable protection including	Continuous	N / A	172	Barham, R., and Mason, T. (2019). Underwater noise modelling at the Teesside A

Activity	Sound type	Operating Frequency (kHz)	SPL_{rms} (dB re 1μPa @ 1 m)	Reference
placement of rock berms and concrete mattressing				offshore wind farm, Dogger Bank. Subacoustech Environmental Report No. P260R0102. Retrieved from: https://doggerbank.com/downloads/DB-Teesside-A_Hammer-Energy-NMC-Environmental-Report-Annex-1-Underwater-Noise-Report.pdf
Cable lay vessel (~140 m in length operating with dynamic positioning)	Continuous	0.005 - 3.2	180 - 197	Ross, D. (1993). "On ocean underwater ambient noise," Inst. Acoust. Bulletin. 18, 5–8. Megan F. McKenna, Donald Ross, Sean M. Wiggins, John A. Hildebrand; Underwater radiated noise from modern commercial ships. J. Acoust. Soc. Am. 1 January 2012; 131 (1): 92–103.
Project support vessels including medium (50 m to 100 m) and small (<50) boats	Continuous	Low to high frequency	160 – 184	Genesis (2011) as above Richardson, W. J., Greene, C. R., Jr., Malme, C. I. and Thomson, D. H. (1995). Marine mammals and noise. New York: Academic Press. 576 pp. OSPAR commission (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. OSPAR B Series. Report available from: https://qsr2010.ospar.org/media/assessments/p00441_Noise_background_document.pdf

Hearing in marine mammals

4.9.5 Marine mammals rely on sound for a range of important ecological functions and sound from anthropogenic activities can affect their ability to echolocate and communicate and in extreme cases can even cause physical harm. Cetaceans in particular, produce and receive sound over a wide range of frequencies for communication, orientation, predator avoidance and foraging. Pinnipeds also produce sounds in social and reproductive interactions, although generally at a lower frequency range and they also rely on airborne sound as well as underwater.

4.9.6 Man-made underwater sound sources have the potential to affect marine mammals where the frequency of the sound generated is within a species auditory range. Thus, for the determination of the impact of underwater sound, marine mammals have been classified into functional hearing groups based on their peak hearing range (Table 4.18) (Southall, et al., 2019)[4]. The most common species expected to occur near the Offshore Scheme are harbour porpoise, which are known to be particularly sensitive to underwater sound, but there is a chance species in the other two hearing groups of cetaceans may occasionally be present.

Table 4.18 Marine mammal hearing groups and auditory thresholds

Hearing Group	Auditory bandwidth	Species potentially present near the Offshore Scheme
Low frequency cetaceans	7 Hz – 35 kHz	Minke whale
High frequency cetaceans	150 Hz – 160 kHz	Bottlenose dolphin
Very high frequency cetaceans	275 Hz – 160 kHz	Harbour porpoise
Pinnipeds in water	50 Hz to 86 kHz*	Grey seal, harbour seal

* Updated NMFS Guidance (2024) which was out for consultation at the time of writing gives a revised hearing range for VHF cetaceans of 200 Hz to 165 kHz and for seals in water of 40 Hz to 90 kHz.

4.9.7 The impact of anthropogenic sound on marine mammals depends on a range of factors including the frequency and intensity of the sound source, the duration of the sound, normal background sound levels, as well as the sensitivity and behaviour of the receiving animal, and possible habituation to background sound sources. Depending on the intensity and frequency of the sound source, exposure to underwater sound can result in the following effects for marine mammals:

- **Auditory injury** – a consequence of damage to the inner ear, that can result in permanent or temporary hearing loss as described below:
  - **Permanent Threshold Shift (PTS)** – a permanent, irreversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level. PTS can occur

[4] The threshold criteria for the assessment of auditory effects to marine mammals from underwater sound sources have been set by the National Marine Fisheries Service (NMFS) 2018 guidance, often referred to as the NOAA criteria (NMFS, 2018). In a subsequent academic paper by Southall et al., these criteria values were also adopted but based on new evidence from some cetacean species, the hearing groupings were amended from low (LF), medium (MF) and high frequency (HF) hearing groups to low, high and very high and these are now commonly used in the academic literature. No species in UK waters have been moved to a different hearing group and so LF, MF and HF is directly equivalent to LF, HF, and VHF thresholds respectively.

from a variety of causes, but it is most often the result of intense and/or long-term repeated noise exposures. PTS is considered to be auditory injury; and

  - **Temporary Threshold Shift (TTS)** – a recoverable reversible increase in the threshold of audibility, most commonly resulting from long-term noise exposure not high enough to cause PTS.

- **Behavioural responses** – these are highly variable and context specific. Can include increased alertness, alteration of movement or diving behaviour, interruption of social interactions, and temporary or permanent habitat abandonment; and
- **Masking** – where anthropogenic underwater sound partially, or entirely, reduce the audibility of signals of interest such as those used for communication and prey detection.

4.9.8 In severe cases, animals may exhibit responses such as panic, rapid flight, or stranding, which can lead to indirect injury or mortality. Such reactions have predominantly been documented in association with high-amplitude impulsive sounds, such as those generated by explosions or certain military sonar systems. For the impulsive sound sources associated with geophysical survey activities required for the Proposed Project, as well as the continuous sounds produced during cable installation and vessel operations, the primary concerns relate to potential auditory impacts and behavioural modifications changes.

4.9.9 The most up-to-date sound exposure criteria for auditory injury in marine mammals have been published by the United States National Marine Fisheries Service (NMFS), (NMFS, 2018; Table 4.19)[5]. The hearing groupings were refined in Southall et al., (2019). For impulsive sounds, thresholds for auditory injury are based on dual metrics of peak Sound Pressure Level (SPL_{peak}) and M-weighted cumulative Sound Exposure Level (SEL_{cum}). For continuous sounds, thresholds are provided for SEL_{cum} only.

4.9.10 The SPL_{peak} criteria for impulsive sources give thresholds for the instantaneous peak sound pressure level above which the auditory effects of PTS or TTS may occur. Impulsive sounds generally have physical characteristics, such as high peak sound pressures and rapid rise times, which make them more injurious than non-impulsive sound sources (NMFS, 2018; Southall B. , et al., 2019)). For example, exposure to impulsive sounds more often lead to mechanical damage of the inner ear, as well as more complex patterns of hearing recovery (e.g. see NMFS, 2018 and references therein). Often the risk of damage from these impulsive sources does not depend on the duration of exposure.

4.9.11 The characteristics of the sound received by an animal, rather than at the point of sound generation, are relevant to the determination of potential impacts. Understanding the physical characteristics in the marine realm, with most animals moving in space and time is difficult. However, the NMFS guidance recognises that as sound spreads out from the source the characteristics of impulsive sounds that make them more injurious start to dissipate due to effects of propagation. Thus, the adoption of JNCC mitigation measures (JNCC, 2017; JNCC, 2025), particularly the presence of an observation zone and period of observation to exclude animals from an area 500 m around the sound source when it begins, is an effective tool used to minimise injury to marine mammals from underwater sound sources.

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[5] An update of the 2018 guidance is currently in draft form and has been published for consultation. The 2024 draft guidance is available at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance. The updated guidance has not been adopted as it has not yet been finalised.

4.9.12 The SEL_{cum} metric accounts for both the received level and the duration of exposure (NMFS, 2018; Southall B. , et al., 2019). This enables a comparison of the total energy attributed to different pulsed sound sources with different time intervals. For example, exposure to a low sound source over a long time period can present an equal risk of auditory effects as exposure to a louder source over a shorter period. However, it is recognised that weighted SEL_{cum} is not an appropriate metric to capture all the effects of impulsive sounds, as it can contradict the equal energy hypothesis, and why an instantaneous peak level is included in the NMFS' dual metric thresholds for impulsive sounds. Thus, whilst dual criteria are considered for impulsive sound sources the key metric for auditory injury (PTS), particularly when considering the animal exclusion measures in place, is the SPL_{peak} metric.

4.9.13 For behavioural disturbance, there are no widely agreed quantitative thresholds and there are none in the latest guidance (NMFS, 2018; Southall B. , et al., 2019). This reflects both a lack of empirical evidence and a high level of variability in behavioural responses, which are often unrelated to the sound level received (Gomez, et al., 2016).

Table 4.19 PTS and TTS thresholds for marine mammals exposed to underwater sound sources

Hearing Group	Impulsive sound				Continuous sound	
	SPL_{peak}		SEL_{cum}		SEL_{cum}	
	PTS	TTS	PTS	TTS	PTS	TTS
Low frequency cetaceans	219	213	183	168	199	179
High frequency cetaceans	230	224	185	170	198	178
Very high frequency cetaceans	202	196	155	140	173	153
Pinnipeds in water	218	212	185	170	201	181

Note units: SPL: dB re 1 μPa; and SEL: (M-weighted) dB re. 1 $\mu Pa^2.s$

Sound Propagation

4.9.14 Of the activities summarized in Table 4.17 (excluding MBES and SSS) all occur within the hearing ranges of all marine mammal functional hearing groups. These two activities are therefore screened out and not considered further in the assessment.

4.9.15 Of the activities which do occur within the hearing range of marine mammals, the highest peak pressure is expected to come from any SBP works during pre-installation geophysical surveys. This sound source is impulsive in nature and is known to represent a higher risk of injury (NMFS, 2018; Southall B. , et al., 2019)). However, sound source levels for this acoustic method differ considerably and so an upper and lower range have been considered.

4.9.16 Other activities, such as cable lay and associated tasks, have a much lower sound intensity and are non-impulsive in nature. Whilst these activities do occur for longer the sound source is not stationary and so the overall sound exposure duration for mobile species is expected to be limited.

4.9.17 However, marine mammals present within the vicinity of the Offshore Scheme could be at risk of auditory and/or behavioural effects. To determine the distances at which these have the potential to occur, the propagation of sound associated with these activities has been calculated.

4.9.18 Sound propagation calculations have been undertaken using the latest version of the NMFS spreadsheet, together with the NOAA guidance manual (available from Marine Mammal Acoustic Technical Guidance & Other Acoustic Tools | NOAA Fisheries[6]).

4.9.19 The dual-metric modelling approach has been used to identify impacts based on the peak sound pressure level (SPL_{peak}) and the cumulative sound exposure level (SEL_{cum}) assuming a 24-hour cumulative exposure, despite such a lengthy duration being unlikely. The SEL_{cum} impact zones have been determined using the M-weightings, from the NOAA guidance, that account for the specific hearing range of each of the functional hearing groups of marine mammals. The estimation of distances at which thresholds are met have used the standard NOAA Acoustic Tool that assumes a mobile sound source, such as a cable lay vessel, or a geophysical survey. However, the threshold calculations do not allow for the mobile nature of the receptor. Marine mammals in particular, are highly mobile, except where there is very strong habitat fidelity such as for feeding or breeding. For in-water animals, cetaceans and seals, there are no areas where there is very strong site fidelity. Grey seals congregate at Goodwin Sands, but only at low tide when they haul-out on the temporarily exposed sand banks. At other times seals are expected to be foraging across a wide area, as evidenced by tracking data that show ranges of 273 km and 448 km for harbour and grey seals respectively (Carter, et al., 2022).

Table 4.20 Maximum estimated distance (m) from project underwater sound sources at which the sound level will exceed the SPL_{peak} and SEL_{cum} PTS injury threshold

Acoustic source	LF Cetaceans		HF Cetaceans		VHF Cetaceans		Phocids in Water	
	SPL_{peak}	SEL_{cum}	SPL_{peak}	SEL_{cum}	SPL_{peak}	SEL_{cum}	SPL_{peak}	SEL_{cum}
SBP (213 dB_{peak})	0	23.7	0	9.7	3.5	5,782	0	14.9
SBP (238 dB_{peak})	8.9	7,489	2.5	3,056	63.1	>10,000	10.0	4,725
USBL	0	0.7	0	0.5	0	468.5	0	0.5
HDD break-out	-	0	-	0	-	0	-	0

[6] https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance-other-acoustic-tools.

Acoustic source	LF Cetaceans		HF Cetaceans		VHF Cetaceans		Phocids in Water	
	SPL_{peak}	SEL_{cum}	SPL_{peak}	SEL_{cum}	SPL_{peak}	SEL_{cum}	SPL_{peak}	SEL_{cum}
Cable installation	-	0	-	0	-	0	-	0
Sand wave levelling	-	0	-	0	-	0	-	0
Placement of cable protection	-	0	-	0	-	0	-	0
Vibrocore sediment sampling	-	27.1	-	0.4	-	4.7	-	8.1
Cable lay vessel	-	0.5	-	0	-	2.0	-	0.3
Support vessels	-	0	-	0	-	0	-	0

Note: SPL_{peak} units are dB re 1 µPa and SEL_{cum} are dB re 1 µPa^2.s

Auditory Injury Impacts

4.9.20 For impulsive sounds, such as SBP and USBL, marine mammals are expected to move away from a sudden intense underwater sound source. In addition, the determination of threshold distances does not allow for the presence of marine mammal observation and the adoption of a soft-start for such impulsive sound sources. These behavioural responses and embedded mitigation measures, minimise accumulated exposure (as measured by SEL_{cum}), and so the potential for injury from such sources is best described by the SPL metric (NMFS, 2018; Southall B. , et al., 2019). Modelling indicates that PTS, for the SBP, even at the most intensive impulsive sound source, has the potential to occur only in marine mammals that are in very close proximity, i.e. within 63.1 m of the source for harbour porpoise. For the USBL source the SPL_{peak} threshold is not reached at any distance because the sound level is below the threshold.

4.9.21 Distances estimated by SEL_{cum} are significantly higher, based on exposure over a 24-hour period within the spreadsheet. The range at which the threshold is met from SBP activities is predicted to be from < 10 m to over 10,000 m depending on the sound source level and the marine mammal hearing group (Table 4.20). However, as described above, these distances assume a mobile source and a stationary receptor and since all sound generating activities take place from a moving vessel the cumulative exposure calculated is a significant over-estimation. In addition, the soft-start and exclusion zone mitigation measures (JNCC, 2017; JNCC, 2025) that are implemented for SBP operations, are not considered in the calculations, but do act to significantly reduce the degree of exposure energy as the sound energy it rapidly falls away with distance. Considering the highly mobile nature of marine mammals, the low density of all species identified in the vicinity of the Marine Installation Corridor, and the constant movement of the survey and installation vessels, the likelihood of animals exposed to 24 hour of any type of underwater sound is unlikely.

4.9.22 The greatest distances relate to harbour porpoise, the most sound sensitive species known to occur in UK waters. It is also the most abundant marine mammal species in the North Sea though available survey data indicates the density around most of the Marine Installation Corridor is relatively low. The most important region of the North Sea for this species is the southern North Sea, as defined by the area protected by the Southern North Sea SAC, which overlaps with a section of the northern region of the Marine Installation Corridor. Calculations also indicate the auditory injury is also possible in minke whale, though only within immediate proximity of the sound source which is unlikely to occur since the project has adopted the standard JNCC measures (MM01, as described in Section 5.8).

4.9.23 This embedded mitigation (JNCC, 2017; JNCC, 2025) requires that there will be a 500 m observation zone around the vessel, which should be observed by a marine mammal observer for 30 minutes. If an animal is sighted within the observation zone, there must be a minimum of a 20-minute delay from the time of the last detection within the observation zone and the commencement of the soft-start. Prior to equipment operating at full power, there will be a soft-start or gradual increase in sound intensity so avoidance behaviour can result in animals moving away before any injury is likely to occur. No other geophysical survey activities are considered to be likely to result in injury. Therefore, any injury to marine mammals from any geophysical survey activities is considered unlikely.

4.9.24 Underwater sound can also be emitted during cable construction works, including from cable lay and support vessels, and during the placement of cable protection. The thresholds for continuous sound are based on sound exposure level and calculations indicate there is no potential PTS beyond 4.1 m for VHF harbour porpoise, and 27 m for low frequency cetaceans, for a standard 24-hour exposure period for any continuous sound production. Thus, any auditory injury from cable installation activity derived sound sources is highly unlikely.

4.9.25 This concurs with an assessment of the environmental impact of underwater sound by OSPAR which concluded that underwater sound associated with cable installation works does not pose a high risk to marine fauna (OSPAR, 2023). Cable laying and associated activities (including the operation of vessel engines) is considered unlikely to generate sufficient sound source levels for PTS, and that the potential for TTS is only likely in very close proximity to the source (Todd, et al., 2014).

4.9.26 Therefore, for auditory injury to occur in relation to the Proposed Project, exceptional circumstances would need to occur to reach the thresholds capable of causing these effects, such as an animal remaining stationary within close proximity of the installation activities for a prolonged period of time (Nedwell, Brooker, & Barham, 2012). Thus, when considering the mobile nature of marine mammals, the timing and transient nature of the cable installation activities and the relatively low level non-impulsive sound sources (compared to activities such as impact piling and seismic surveys) associated with installation, PTS or TTS are considered highly unlikely to occur.

Disturbance effects

4.9.27 Behavioural disturbances are the most likely effect resulting from underwater sound in the marine environment. The latest thresholds for underwater sound effects do not include quantitative thresholds for behavioural disturbance (NMFS, 2018; Southall B. , et al., 2019), reflecting both a lack of empirical evidence and a high level of variability in behavioural responses which have been shown to be often unrelated to the sound level received (Gomez, et al., 2016).

4.9.28 However, an SPL_{rms} threshold of 160 dB re 1µPa @ 1 m for impulsive sound, and 120 dB re 1µPa @ 1 m for continuous sound, is adopted in the US, for assessment of 'Level B' harassment in marine mammals (NOAA, 2024) though it is widely accepted that behavioural thresholds require further research and so should be treated as indicative only. It has previously been assumed that significant behavioural disturbance might occur if sound exposure is sufficient to have a measurable transient effect on hearing (i.e., TTS-onset) but there is insufficient data to indicate if this is correct.

4.9.29 Regarding disturbance, the activity with the highest sound source is the operation of the SBP. The distance from this particular sound source at which disturbance is reported to occur in harbour porpoise, referred to as the Effective Deterrent Range (EDR), is 5 km (JNCC, 2020). Within the Southern North Sea SAC, harbour porpoise are present year-round, but exhibit some seasonal movements between the north and south of the SAC. The highest densities close to the Offshore Scheme are expected in the winter months, during the seasonal restriction in place for red throated divers.

4.9.30 Effective deterrent ranges are not available for any other marine mammal species. Whilst the harbour porpoise is often regarded as the species with the highest sensitivity to underwater sound, all marine mammals are sensitive. Low frequency cetaceans, such as the minke whale, are highly sensitive to lower frequency sounds and modelling indicates potentially large effect zones for this species as well. However, for the nature of the underwater sound sources that will be produced during the project the m-weighted sound propagation modelling shows the greatest zones of influence are for the harbour porpoise. On this basis, that PTS and TTS distances for all other species are lower, it is considered reasonable to assume, for the project sound sources, that the EDR (disturbance zone) for all other species will also be lower, so that the EDR for harbour porpoise will encompass other marine mammal species. An EDR of 5 km, equating to a total width of 10 km (5 km either side of the cable) is therefore adopted for all marine mammals and is more precautionary for non harbour porpoise species. Thus, the area of disturbance from the project activities identified above is small in relation to the distribution range of the populations of concern. The cable passes through the Southern North Sea SAC, an area known to have a high density of harbour porpoise, for approximately 70 km. With an EDR of 5 km, either side of the activities (i.e. a total of 10 km), the total EDR area is 700 km^2. Using the winter density of harbour porpoise (0.83 individuals/km^2), which is the highest value, this equates to 581 individuals that may be disturbed within an area that is less than 2% of the area of the Southern North Sea SAC. For the entire Sea Link route a highly conservative estimate of harbour porpoise with the EDR, also using the 0.83 individuals/km^2, is 1,146. This is less than 1% of the total number of harbour porpoise in the UK portion of North Sea Management Unit (159,632) (IAMMWG, 2022). Using a similar approach for the other cetacean species conservative estimates of the number of animals that could be disturbed are 55 bottlenose dolphin (1,380 km^2 x density of 0.04), 14 minke whale (1,380 km^2 x density of 0.01) and 14 white beaked dolphin (1,380 km^2 x density of 0.01). These account for 2.9%, 0.13% <0.1% of the UK portion of the species IAMMWG Management Unit, respectively. In addition, as project vessels are continuously moving, any disturbance impacts will be transient, intermittent, and short-term. The magnitude of the effect is therefore considered to be small.

4.9.31 Harbour porpoise, grey seal, and harbour seal are the species most likely to be present within the vicinity of the Offshore Scheme. Considering the importance of underwater sound to marine mammals, and the high level of protection afforded to this receptor group, the sensitivity of this receptor group is assessed as very high.

4.9.32 However, despite the high sensitivity of the receptor, adherence to appropriate JNCC guidelines for geophysical sound sources (JNCC, 2017; JNCC, 2025)) will minimise injurious impacts to marine mammals. Although behavioural responses may occur, they will be temporary and localised and in the case of harbour porpoise no installation activities will be taking place in the winter months when the density of animals around the Suffolk region of the Offshore Scheme are lower. When considering this in conjunction with the likely short-term and transient nature of impact, the magnitude of effects from underwater sound are likely to be small and thus the significance of the impact of underwater sound to all marine mammals is assessed as **minor** and therefore not significant.

Potential for indirect effects through impacts to prey species

4.9.33 Construction activities which disturb the seabed or produce underwater sound could impact demersal fish and shellfish species which are prey items for many marine mammals. Marine mammal species that commonly occur near the Offshore Scheme include harbour porpoise, harbour seal, and grey seal. Harbour porpoise forage mainly for sandeel, whilst both harbour and grey seals in the southern North Sea forage principally for benthic fish (e.g., flatfish and sandeel) and gadoids (e.g., cod and hake) (Wilson & Hammond, 2016).

4.9.34 Marine mammals can be very wide-ranging in their foraging trips. Important spawning and nursery grounds were identified within the Offshore Scheme for sandeel, plaice, Dover sole, and lemon sole (**Application Document 6.2.4.4 Part 4 Marine Chapter Chapter 4 Fish and Shellfish Ecology**). Areas within the Offshore Scheme have been identified as low intensity spawning and nursery grounds for sandeel, with 15 grab-sampling sites identified as supporting marginal or preferred sandeel spawning habitat (**Application Document 6.2.4.4 Part 4 Marine Chapter Chapter 4 Fish and Shellfish Ecology**). As such, cable construction activities such as route preparation (e.g. sand wave leveling, route clearance), cable lay, and cable protection may result in disturbance to these important habitats.

4.9.35 However, habitat loss and disturbance impact from construction phase activities to the seabed are likely to be localised, and will be small in extent, confined largely to a small area around the cable installation, and in many cases temporary.

4.9.36 Despite the high sensitivity of the receptor, the magnitude of impact is anticipated to be **negligible**. Therefore, effects from this impact are not significant.

Vessel collision risk

4.9.37 Construction, maintenance and decommissioning activities will involve the deployment of a number of vessels including survey, cable lay, guard and rock placement vessels, and additional specialised support vessels such as a jack up barge for the works at the HDD breakout point in the nearshore (for the Suffolk landfall only as the HDD exit is in the intertidal zone at Pegwell Bay).

4.9.38 Vessel strikes with marine mammals can result in physical injury, which may reduce foraging abilities and fitness at an individual level, or even mortality (Moore, et al., 2013; Southall, et al., 2019). Marine mammals, particularly cetaceans, are considered to be fast swimming, agile species, with rapid reflexes and good sensory capabilities. Moreover, marine mammals possess a thick subdermal layer of blubber or fat deposits which provides a level of protection to their vital organs, meaning they are reasonably resilient to minor strikes and collisions (Wilson, Batty, Daunt, & Carter, 2007). The most lethal and serious injuries to cetaceans, primarily whales, are believed to be caused by large ships, typically 80 m and longer with large drafts, as well as vessels travelling faster than 14 knots (Laist, Knowlton, Mead, Collet, & Podesta, 2001). Higher vessel speeds produce a greater impact force and larger drafts have been associated with increased mortality (Dahne, et al., 2013; Rockwood, Calambokidis, & Jahncke, 2017; Southall, et al., 2019).

4.9.39 Avoidance behaviour exhibited by cetaceans is often associated with fast, unpredictable vessels such as speedboats and jet-skis (Bristow & Reeves, 2001; Gregory & Rowden, 2001), while neutral or positive reactions, particularly in dolphins have been observed with larger, slower moving vessels such as cargo ships (Ng & Leung, 2003; Sini, Canning, Stockin, & Pierce, 2005). Although there have been reports of vessel strikes with cetaceans, evidence of risk is limited. Mortality and injury of cetaceans resulting from vessel strikes have been mostly reported in large baleen whales which are slow swimming (IAMMWG, 2015). There are few reports of vessel strikes with harbour porpoise and other small cetaceans, likely due to the avoidance behaviour of these species, particularly porpoises (Wisniewska, et al., 2018; Roberts, Collier, Law, & Gaion, 2019).

4.9.40 The risk to pinnipeds is generally lower than that for cetaceans (Jones, et al., 2017). Although there have been reports of vessel strikes to pinnipeds, including several cases of ‘corkscrew’ type injuries ascribed to vessel propellers and thrusters, evidence of risk is limited (Bexton, Thompson, Brownlow, Milne, & Bidewell, 2012). Indeed, later research has shown that very similar injuries were the result of predation from grey seals which are now thought to be responsible for a high proportion of the assumed propellor duct injuries (Brownlow, Onoufriou, Bishop, Davison, & Thompson, 2016). For slow-moving dredging operations (Todd, et al., 2014) individual seals have been seen to easily avoid vessel movements.

4.9.41 Whilst large cetaceans, such as whales, are considered primarily at risk of collision with vessels, many other species, including smaller cetaceans and seals, have also been reported as involved in vessel strikes in the North Sea and wider Atlantic (Winkler, Panigada, Murphy, & Ritter, 2020). As this area experiences high levels of vessel traffic (EMODnet, 2023), it poses a high-risk for collisions with marine mammals.

4.9.42 Construction works are anticipated between April and October (inclusive) (see **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**). Works will avoid the majority of the winter period when it is understood that there are elevated numbers of harbour porpoise utilising the area of the Southern North Sea SAC that the cable corridor passes through (JNCC, 2019). In addition, the project will adhere to the International Regulations for Preventing Collisions at Sea 1972 (International Maritime Organisation, 1972), (Commitment LVS02 in **Application Document 7.5.3.1 Register of Environmental Actions and Commitments (REAC)**). Whilst these regulations are intended to minimise collisions between vessels, the speed restrictions will also help minimise collision risk with marine mammals.

4.9.43 In light of this, the likelihood of Proposed Project vessels colliding with marine mammals is low given the relatively low density of marine mammals within the Study Area and the low number of vessels. Minimisation of the risk of collisions is further supported by slow speed of the Proposed Project vessels moving through the area surrounding the cable corridor for the majority of the Construction Phase duration.

4.9.44 Simultaneous vessel activities (i.e. cable lay vessels and guard vessels) are expected to be involved in Construction Phase activities. This increase in vessel numbers is expected to be representative of background shipping levels in an already heavily trafficked area of the North Sea. Additionally, these vessels are primarily slow moving, with operational speeds ranging from 0 to 7 km per day and transit speeds remaining ≤12 knots (see **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**). When considering these slow operational speeds, individual animals will likely be able to easily avoid vessels, greatly reducing the risk of collision. Vessels transiting between the cable corridor and port, which travel at greater speeds, pose an increased likelihood of collision and potential for injury. However, these journeys will be relatively infrequent and likely for a short period which, compared to the background levels of shipping traffic in the Greater Thames Estuary (**Application Document 6.2.4.7 Part 4 Marine Chapter 7 Shipping and Navigation**), are considered to contribute to a negligible increase in vessel movements.

4.9.45 Although the occurrence of any collisions could cause injury or death, the likelihood of vessel collision with marine mammals is appraised as unlikely when considering the agility of marine mammals and the slow vessel operation speeds. Therefore, the magnitude of impact is considered negligible due to the short-term and temporary nature of the works, limited spatial extent of the risk of collisions, and the high level of traffic already present. Thus, the impact significance is considered **minor** and thus not significant.

Airborne sound and visual disturbance

4.9.46 A number of construction operations during the Construction Phase could result in changes in visual stimuli (including artificial light) and an increase in airborne sound, both of which could impact marine mammals. Activities comprise cable lay operations from a vessel and HDD, or other trenchless installation techniques, in the nearshore region where the cable will transition from the onshore to the offshore scheme.

4.9.47 Cetaceans are not considered to be particularly sensitive to changes in visual stimuli or airborne sound as their primary sense relates to underwater sound and so this group of marine mammals are not considered further for this impact pathway.

4.9.48 Seals, however, spend time hauled-out on land and at the sea-surface, making them more susceptible to airborne sound and visual stimuli. These can lead to avoidance behaviour or disturbance responses, which could cause individuals to stop resting, feeding, travelling and/or socialising. Repeated disturbance could therefore result in permanent displacement and/or a decline in fitness and productivity.

4.9.49 There will be seals hauled-out at Goodwin Sands, which is adjacent to the Offshore Scheme. However, installation operations will only be able to take place during high tide, when the sea covers Goodwin Sands and they become completely submerged underwater. Thus, during installation activities around Goodwin Sands seals will be in the water and no longer hauled-out. Thus, possible visual disturbance could occur to individuals remaining around Goodwin Sands at high tide.

4.9.50 However, disturbance to seals at sea is expected to be minimal as the cable installation vessel and any support vessels will be constantly moving, and at low speeds. In addition, there is already a significant amount of vessel traffic in this region, including the presence of offshore industry vessels coming to and from local ports, including Ramsgate, to offshore installations within the study area and wider region (**Application Document 6.2.4.7 Part 4 Marine Scheme Chapter 7 Shipping and Navigation**). There is therefore, expected to be habituation to vessel traffic and therefore, disturbance during cable lay, from the cable lay and support vessels. However, vessel movements will be very short-lived and of low magnitude and so is not likely to result in significant disturbance.

4.9.51 However, airborne sound and visual disturbance from the Offshore Scheme could also result from any construction activities in the intertidal environment, i.e. between MLWS and MHWS. The Offshore Scheme will enter the marine environment via HDD or other trenchless techniques, with installation starting onshore. At the Suffolk landfall the HDD exit point is in the subtidal environment and so there are no activities taking place in the intertidal. At Pegwell Bay however, the HDD exit pit is within the intertidal environment, in the muddy/sandy sediment approximately 150 m seaward of the saltmarsh (**Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project)**, in order to avoid any impact on this protected habitat. Thus, additional construction activities, over and above cable lay, have the potential to cause airborne and sound and visual disturbance at Pegwell Bay.

4.9.52 Pegwell Bay hosts an important haul-out site for harbour seal and includes low numbers of pups born here. As the southern landfall HDD exit point occurs within the intertidal zone of Pegwell Bay, there is the potential for construction activities associated with the HDD, as well as changes in visual stimuli, such as lighting from cable lay vessels operating at night, to disturb hauled-out seals. To reflect the different disturbance pathways for hauled-out and at-sea seals (including those at Goodwin Sands) the assessment considers them separately.

Pegwell Bay

4.9.53 This assessment of potential airborne sound effects on seals in Pegwell Bay should be read in conjunction with **Application Document 9.49 Seals and Airborne Sound Disturbance in Pegwell Bay [REP1-122]**.

4.9.54 A number of construction activities associated with the landfall have the potential to produce airborne sound, as described in detail in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project** and **Application Document 9.13 Pegwell Bay Construction Method Technical Note [REP2-011]**. The worst-case activities for sound production have been assessed based on sound production and proximity to seals. These activities are the excavation of four pits for break-out of 4-ducts which involves vibratory piling and the presence of up to four tracked excavators to create a cofferdam at each of the four pits, the break-out point for the HDD, cable pull in the intertidal including the placement of anchors within the Order Limits, trenching activities via excavators working on installation of the cable from the HDD exit pit to the subtidal where the cable lay vessel will take over, and the associated movements of excavators and other plant across the intertidal during construction. The construction activities, their sound level and duration, that need to be considered in the impact assessment are summarised in Table 4.21 below.

Table 4.21 Estimated air-borne sound levels for project activities at Pegwell Bay

Activity	Equipment and/or method	Sound power level L_{WA} / L_{WM} (dB)	Indicative Duration of activity
HDD pit setup (occurs in construction year 1)	HDD breakout for 4 ducts	98 (L_{WA})	Each breakout is instantaneous and

			therefore of very short duration
	Tracked excavator (226 40 t) – estimated to require No. 4 vehicles	107 / 104 (based on BS5228 Sound Emission Table Reference C.2.14)	HDD pit excavation at 4 breakout points, undertaken sequentially. Up to 4 excavators on site for approximately 80 days of variable movements. Works are 24 hours.
	Vibratory sheet piling rig (52 t / 14 m length / soft clay) creating cofferdam around each individual duct	116 / 114 (based on BS5228 Sound Emission Table Reference C.3.8)	16 days based on 4 days x 4 per HDD cofferdam
Cable pull-in and intertidal installation (occurs in construction year 2)	Cable pull	Minor sound generated for a few hours so scoped out	1-day
	Cable burial via jetting at low/high tide or trenching at high tide Anchor installation using tracker excavator	107 / 104 (based on BS5228 Sound Emission Table Reference C.2.14)	Estimated maximum of 4 days of work in the intertidal zone. Works only occurring 12 hours per day.

4.9.55 All other activities are considered to be below the sound levels identified above and thus the assessment considers the highest sound levels to occur throughout the duration of the construction activities, for 100% of the time, and auditory effects to seals are assessed as such.

4.9.56 There are thresholds for auditory effects to seals in air because of anthropogenic sound (NMFS, 2018; Southall B. , et al., 2019). To determine the impacts of construction activities on seals hauled-out, indicative predictions of construction sound levels have been made. The free-field (A-weighted) sound level for each construction activity has been predicted or determined based on readily available literature values. A-weighting is an adjustment that is typically applied to measurements of sound to reflect how a human ear responds to an environmental noise (Parmanen, 2007). However, to consider the difference in seal hearing, M-weightings based on the audiogram for phocid seals, presented in Southall et al. (2019), were also reviewed. Whilst there are some differences in the overall hearing frequency range for humans and seals, for most common noises including from the construction activities considered here, there is very little difference in the weightings between the two groups (estimated to be in the region of 0.1 dB only). Thus, the A-weighted sound levels for construction activities when assessing disturbance are applicable[7]. However, for comparison with seal M-weighted auditory injury thresholds provided by Southall et al. (2019), M-weighted parameters

[7] Only where a noise source has significant energy in the 16 kHz and 32 kHz bands would there be a noticeable difference in the sound propagation distances.

have also been used in the modelling to assess the distances from the construction activities at which a permanent threshold shift (PTS) and a temporary threshold shift (TTS) could be reached (see **Application Document 9.49 Seals and Airborne Sound Disturbance Technical Note [REP1-122]**). These auditory injury thresholds indicate that TTS in seal hearing could occur at 24 hour sound exposure level (SEL) of 134 dB re 20 $\mu Pa^2 s$ and above. For PTS in seal hearing to occur, the SEL would be required to reach 154 dB re 20 $\mu Pa^2 s$.

4.9.57 The noise modelling has considered the worst-case scenarios for noise production relating to seals. The detailed modelling methodology and results are provided in **Application Document 9.49 Seals and Airborne Sound Disturbance Technical Note [REP1-122]**. Three construction scenarios have been assessed, based on the activities provided in Table 4.21:

- drilling by vibratory piling rig continuously for 12-hour shifts, using one piling rig and four excavators located at the 'worst-case' point on the HDD exit boundary.
- installation of anchor points during the cable pull-in operation – four anchors, each anchor requiring one excavator to operate for one hour, and each requiring four excavator trips between the anchor and the barge; and
- movement of construction plant and vehicles across the intertidal area of Pegwell Bay, assuming 36 two-way movements of vehicles moving at 5 miles per hour per each 12-hour day.

4.9.58 The simultaneous operation of vibratory piling and four excavators (which covers all other possible sound levels) at the HDD location is expected to produce the highest and therefore worst-case sound levels and finds the following (M-weighted):

- PTS threshold met at a maximum distance of less than 1 m from the source; and
- TTS threshold met at a maximum distance of 13 m from the source.

4.9.59 For all other construction scenarios assessed, the distances for PTS and TTS are negligible or the thresholds are not met (see **Application Document 9.49 Seals and Airborne Sound Disturbance Technical Note [REP1-122]**).

4.9.60 At the seal haul-out site on mudflats in the River Stour, the worst-case sound level is predicted to be 49 dB $L_{Aeq,12hours}$, resulting from the simultaneous piling and excavator operations at the HDD exit pit (see **Application Document 9.13 Pegwell Bay Construction Method Technical Note [REP2-011]**). Whilst sound levels at the seal haul-out site are predicted to be significantly lower than thresholds for PTS and TTS there may be potential for disturbance behaviour at the seal haul-out site in the River Stour due to the presence of people and construction activities in the intertidal area of Pegwell Bay.

4.9.61 Disturbed seals can exhibit a range of behaviours, from increased alertness to 'flushing', in which disturbed seals flee their haul-out site and return to the water (Marine Scotland, 2014; Wilson S. , 2014). Such avoidance behaviour could cause individuals to stop resting, feeding, travelling and/or socialising, with repeated disturbance potentially resulting in permanent displacement and abandonment of pups, which could lead to a decline in fitness and/or productivity. However, studies of disturbance in seals show that behaviour is highly variable and not always related to the degree of disturbance.

4.9.62 In general, it is reported that shipping traffic more than 1,500 m away from a haul-out site is not thought to evoke any reaction. However, other studies of harbour seals have shown a flight response to boats at a distance of around 500 m (Anderson, Teilmann, Dietz, Schmidt, & Miller, 2012) or flushing from the presence of a cruise ship at a distance of 400 m away. The range of disturbance distances have been associated with vastly different vessel types, species, and localities (Wilson S. , 2014), and as such, it is likely that vessel type and habituation of local populations play a factor in seal response.

4.9.63 Modelling of harbour seal disturbance in Puget Sound, USA found that flushing behaviour was best explained by a combination of the number of boats per hour, vessel type, and distance from the haul-out site, as well as the interaction between these factors (Cates & Acevedo-Gutierrez, 2017). The percentage of harbour seals observed flushing and the distance at which this occurred was greater at sites with lower vessel activity, suggesting that habituation to the local environment, and background levels of potentially disturbing activity, is an important factor in seal disturbance (Cates & Acevedo-Gutierrez, 2017). Furthermore, spatial analysis has indicated a high co-occurrence of seals at sea, within 50 km of their haul-put sites and shipping vessels, with no evidence of related population declines (Jones, et al., 2017).

4.9.64 There are no thresholds for measuring disturbance for seals but considering TTS and PTS is only possible within the immediate vicinity of the sound producing equipment (or not considered to be reached at all for some construction scenarios (see **Application Document 9.49 Seals and Airborne Sound Disturbance Technical Note [REP1-122]**) and the hauled-out seals are a minimum of 670 m away from the closest activity occurring in the intertidal zone, the potential for disturbance is considered to be very low. Further detail to support this judgement is provided below.

4.9.65 Whilst there are no commonly accepted thresholds relating to disturbance in seals, the hearing range and hearing sensitivity of humans and seals is very similar (as seen in the A-weighted and M-weighted curves in **Application Document 9.49 Seals and Airborne Sound Disturbance Technical Note [REP1-122]**) such that thresholds for sound disturbing effects in humans are also likely to be indicative of disturbance in seals. Thus, the typical noise design criteria used in relation to humans, to minimise sound impacts from developments (Association of Noise Consultants, Institute of Acoustics, & Chartered Institute of Environmental Health, 2017) can give an indication of the likelihood of disturbance to seals.

4.9.66 Considering the maximum sound intensity at the seal haul-out site on mudflats in the River Stour, the worst-case noise from the piling operations at the HDD exit, is predicted to be 49 dB $L_{\text{Aeq,12hours}}$. Using the human noise design criteria, an ‘average’ daytime noise level of 50 dB $L_{\text{Aeq,16hours}}$ in outdoor environments is considered a suitable and comfortable noise limit with no adverse effects and negligible disturbance. Thus, it is also considered to be unlikely to result in disturbance of the seals during construction activity, particularly considering the context at the haul-out location. In addition, the highest sound levels produced during the construction of the HDD exit pits and cofferdam are very short term and will not take place at the MDS modelling location for the entire duration. As such, sound levels predicted for the mudflats will be lower than modelled for much of this construction activity.

4.9.67 Seals are known to be sensitive to visual and noise disturbance, but in practice, much will depend on the situation and location of the individual haul-out site and the degree to which the seals using the site are used to the presence of humans. In time, seals can become accustomed to human presence and learn to recognise particular people or boats or aircraft (Marine Scotland, 2014). Thus, habituation can be an important factor when considering disturbance effects in seals.

4.9.68 As widely reported in the literature, and as detailed in Gomez et al. (2016), ecological context is an important determinant of disturbance. Seals hauled-out in the River Stour have demonstrated significant habituation to airborne noise due to the regular, year-round use of the River Stour by seal spotting tour boats and other vessels which often come within 20-30 m of the seals. The site-specific seal observation surveys conducted for the Proposed project in September to November 2024 and August 2025 observed no reaction, including from the few pups observed, to the presence of the survey vessel, as reported in **Appendix 6.3.4.4.A (B) Pegwell Bay Seal Survey Report[REP1-003]**.

4.9.69 There are limited data on baseline sound levels at Pegwell Bay and in the River Stour.

4.9.70 There is however, regular passage of vessel traffic in the river, with the highest number of vessels observed in the months July and August, at least in 2022 (Plate 4.5), when seals are considered to be at a sensitive life stage. A breakdown by vessel type shows the majority of traffic in the river is recreational, and the busiest months, which also coincide with the pupping and moulting season, reflective of the UK summer period and main holiday season.

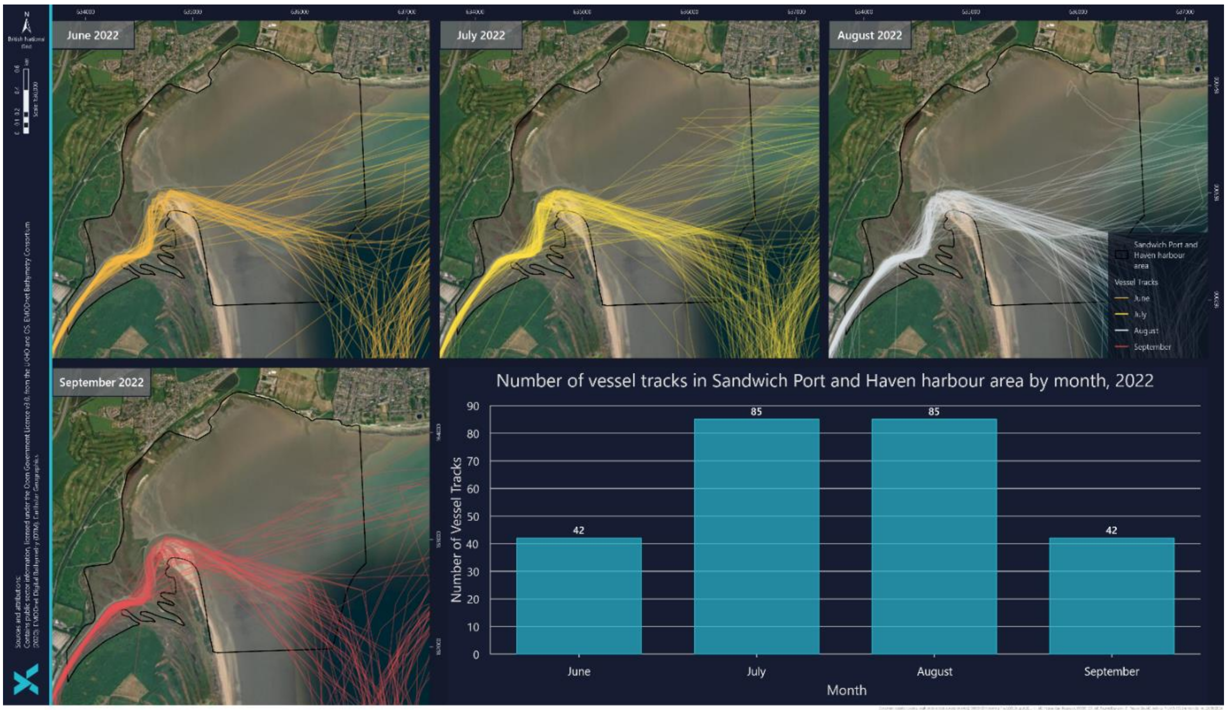

Plate 4.5 AIS data for Pegwell Bay and the River Stour for the period June – September 2022

4.9.71 At Pegwell Bay regular seal watching tours occur all year round (River Runner) with seals highly habituated to the presence of the boat as evidenced by no flight response observed in any seal, including of juveniles, at a distance of around 30-50 m away from large congregations of seals on the sandbanks at low tide and saltmarsh at high tide during project surveys (**Application Document 6.3.4.4.A (B) Pegwell Bay Seal Survey Report [REP1-003]**).

4.9.72 Seals at Pegwell Bay are known to preferentially haul-out on the sandbanks and mudflats in the channel of the River Stour at low tide. They are, therefore, relatively sheltered from any noise or activities occurring in Pegwell Bay for long periods of time. Even at high tide, when there may be seals hauled-out on the saltmarsh, the potential for disturbance from Pegwell Bay is limited due to distance and background sounds from waves and wind. At such a distance away, (a minimum of 670 m from any Proposed Project activities), this region of the river is somewhat sheltered from and so project activities occurring in Pegwell Bay are not likely to cause seals to move away.

4.9.73 Additionally, there may be the potential for visual disturbance during construction activities to seals in the River Stour due to presence of humans and construction vehicles (such as excavators and other plant) operating both on the intertidal area and moving to and from the hoverport area. However, the seals are considered to be largely sheltered from visual effects resulting from construction activities occurring on the intertidal area of Pegwell Bay, particularly during and around low tide. This is due to the location of the hauled-out seals on the sandbanks and mudflats in the River Stour and therefore the distance between project activities and the haul-out site. Personnel and construction vehicles will be operating at a minimum distance of 670 m from the seal haul-out site in the River Stour (determined based on seal surveys undertaken in the River Stour in September to November 2024 and August 2025 (**Application Document 6.3.4.4.A (B) Pegwell Bay Seal Survey Report [REP1-003]**)) and will only remain in one location on the intertidal mudflats of Pegwell Bay for a short period of time due to the different construction activities occurring. Therefore, for a large proportion of the construction activities, personnel and construction vehicles will be much further away from the seal haul-out site than the minimum distance of 670 m. Furthermore, due to the regular seal watching tours which occur in the River Stour and Pegwell Bay year round, the seals are considered to be habituated to the presence of humans in close proximity, even during more sensitive time periods such as when they are breeding and when small numbers of young pups are present (**Application Document 6.3.4.4.A (B) Pegwell Bay Seal Survey Report [REP1-003]**). Seals entering or leaving the River Stour may have more exposure to visual effects resulting from works on the intertidal mudflats of Pegwell Bay, compared to those hauled-out on the mudflats. However, any seals entering or leaving the River Stour will be underwater for prolonged periods of time for foraging, only raising their heads above the water temporarily, significantly limiting exposure to visual effects. Furthermore, for a large proportion of the Construction Phase, activities resulting in visual effects will be a considerable distance away from the entrance to the River Stour channel.

4.9.74 Thus, sound propagation modelling, the location of the haul-out sites, and the habituation of the seals to very close presence of regular vessel activity in the river and the short duration of activities in Pegwell Bay indicate any airborne sound and visual disturbance from construction activities is expected to be **minor adverse** and therefore **not significant**.

Goodwin Sands

4.9.75 At Goodwin Sands, approximately **over 100 harbour seals** and **over 400 grey seals** are known to haul-out on the banks during low tide (Cox et al., 2020). However, these banks become completely submerged at low tide. During construction activities, which require a cable-laying vessel and sufficient water depth, the sandbanks will be tidally inundated and thus seals are expected to be in the water, thereby minimizing disturbance to haul-out sites.

4.9.76 Seals are known to respond to vessel traffic, but this is largely when hauled-out rather than in the water. Some disturbances, such as avoidance behaviour may result from the presence of vessels but animals in the water are naturally mobile. The Greater Thames Estuary is a highly trafficked area and as hauling out still occurs regularly around the estuary, and hence animals foraging in this region, it indicates a degree of habituation to airborne vessel noise and visual disturbance. Spatial analysis has also indicated a high co-occurrence of seals and shipping vessels within 50 km of the coastline near haul-out sites, with no evidence of related population declines (Jones, et al., 2017). Furthermore, the nature of cable lay is transitory and localised to the Offshore Scheme extent. As such, any effects will be short lived in any one location and any changes in visual stimuli, including at night, will be localised and limited to extent.

4.9.77 Therefore, the number of animals likely to be at risk of disturbance at any one time is extremely small. Any disturbance effects would also be expected to be limited to minor avoidance behaviour and as highly mobile animals that forage over extensive ranges, such movements are not considered likely to have any meaningful effect on the availability of prey or the energetic expenditure required for foraging.

4.9.78 Although seals are of high conservation value, when considering that any disturbance would be short-term, temporary, and very limited in extent, the magnitude is considered negligible. Furthermore, as individuals within the Greater Thames Estuary are likely to have high tolerance, and recoverability from disturbance and thus considered to have a low sensitivity to airborne sound and visual disturbance. As such, any effects to seals in the water in the vicinity of Goodwin Sand from airborne sound and/or visual disturbance during Construction Phase activities are considered **minor adverse** and therefore not significant.

Reduction in water quality due to discharges and unplanned releases, accidental leaks, and spills from vessels

4.9.79 The accidental release of pollutants (e.g., oil, fuels, lubricants, chemicals) and planned release of wastewater could occur from any of the vessels associated with the Proposed Project. Such releases have the potential to reduce water quality, leading to consequences to marine fauna, including benthic invertebrates, fish and shellfish, and marine mammals.

4.9.80 To ensure the risk of accidental spills is as low as reasonably practicable (ALARP), the Proposed Project will adhere to relevant guidance (e.g. Pollution Prevention Guidance) and best practice and will comply with all relevant health, safety, and environmental legislation (**Application Document 7.5.3.1 CEMP Appendix A Outline Code of Construction Practice**). This includes compliance with regulations relating to International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) with the aim of preventing and minimising pollution from ships (control and management measure LVS02). Preparedness and swift responses are essential for effective spill management and as such, response plans will be in place should an incident occur. Control measures and shipboard oil pollution emergency plans (SOPEP; control and management measure GM03) will be in place and adhered to under MARPOL Annex I requirements for all vessels. Any planned effluent dischargers will also be compliant with MARPOL Annex IV ‘Prevention of Pollution from Ships’ standards.

4.9.81 Moreover, an Emergency Spill Response Plan and Waste Management Plan will be implemented during the Construction phase of the Project to minimise releases, secured within the Offshore Construction Management Plan (**Application Document 7.5.2 Outline Offshore Construction Environmental Management Plan**).

4.9.82 Appropriate Health, Safety, and Environment (HS&E) procedures will also be implemented, with strict weather and personnel limits to reduce any risk of accidental spillage, as outlined in **Application Document 7.5.2 Outline Offshore Construction Environmental Management Plan**.

4.9.83 With consideration of this good practice mitigation, the likelihood of an accidental spillage occurring from any of the vessels is considered to be very low. Should a spill occur, the impact would be of very small magnitude, short-term and localised to the Offshore Scheme. Any releases are expected to be relatively small in volume and will be rapidly dispersed and diluted by wave and tidal movements.

4.9.84 When considering the low likelihood of accidental releases from vessels and rapid dilution of any mobilised sediment-bound contaminants, the magnitude of impact is assessed as negligible. Irrespective of the value and sensitivity of marine fauna, it can therefore be concluded that the effect on marine ecological receptors from adverse water quality is **negligible** and therefore not significant.

Operation and Maintenance Phase

Disturbance to marine mammals from electromagnetic field (EMF) emissions

4.9.85 Power cables do not emit electric fields directly, as the metal sheath physically protecting the cable ensures the electric field is entirely confined within the cable. However, they do emit magnetic fields, that can indirectly induce electric fields in the surrounding sea water and marine fauna.

4.9.86 Cetaceans are capable of sensing electromagnetic fields, an ability that enables them use differences in field direction, intensity, and inclination of the earth's geomagnetic field for orientation and navigation purposes. The migratory behaviour of many species indicates that they likely rely on the earth's magnetic field for navigation (Walker, Diebel, & Kirschvink, 2003). This includes species such as the harbour porpoise, which is commonly found in UK waters (e.g. see (Gill, Gloyne-Phillips, Neal, & Kimber, 2005)). At the time of writing, there is no evidence to suggest that seals are magnoreceptive and therefore sensitive to EMF.

4.9.87 Cetaceans can be highly migratory, indicating however, this ability for the use of the geomagnetic field is poorly understood, and evidence is lacking. Whilst controlled experimentation in this regard is not feasible, studies have correlated cetacean behaviour with geomagnetic field differences (Normandeau, Tricas, & Gill, 2011). Behavioural studies observed both behavioural and physiological responses in dolphins (Delphinidae) exposed to magnetic fields, suggesting sensitivity to these fields (Normandeau, Tricas, & Gill, 2011). Depending on the magnitude of the field, this could result in temporary change in swimming direction or a longer detour in migration (Normandeau, Tricas, & Gill, 2011). There is also some evidence that spatial and temporal variation or anomalies in geomagnetic field correlate with cetacean strandings (Klimley, Putman, Keller, & Noakes, 2021; Levitt, Lai, & Manvill II, 2021). However, strandings have also been correlated with solar storms, parasitic disease, and low frequency active sonar on ships (Klimley, Putman, Keller, & Noakes, 2021; Levitt, Lai, & Manvill II, 2021).

4.9.88 Project specific modelling has been conducted for bundled cables, where the magnetic fields from each cable cancel each other to a degree, buried to a depth of 1 m. For the bundled cable designs, the geomagnetic field and induced electric fields return to the background level at about 8 m from the seabed (**Application Document 6.5 Electric and Magnetic Field Compliance Report**). In the unlikely occurrence of the worst-case scenario of two unbundled cables, this distance is about 20 m. Thus, there is very limited potential for marine mammals, which will spend most of their time in the water column, to come into close contact with any EMF emissions. Indirect effects, through impacts on prey items are more likely, since evidence suggests that fish, elasmobranchs in particular, have a higher sensitivity to EMF.

4.9.89 The species most likely to occur near the Offshore Scheme are harbour porpoise, harbour seal, and grey seal. All three forage for sandeel, whilst harbour and grey seal in the area typically also forage for flatfish, gadoids, and other sandy benthic species (Stone & Tasker, 2006). Modelling of sandeel distribution in the North Sea has indicated that important sandeel areas overlap with the Offshore Scheme (Gilles, et al., 2016). However, the impact of EMF on fish was considered not significant (**Application Document 6.2.4.3 Part 4 Marine Chapter 3 Fish and Shellfish Ecology** as there is likely to only be a very small footprint around the cable where an increase in EMF would be detectable. Furthermore, given the wide-ranging nature of each of these marine mammal species, it is likely that they will be capable of avoiding any EMF effects directly or indirectly, and can easily forage in other areas. Therefore, there is unlikely to be a noticeable effect on marine mammal foraging directly or indirectly. Finally, as the target DOB for the cable is 1 m - 2.5 m, the emissions cited above are likely the worst scenario.

4.9.90 Given that any emissions will be localised to the water column immediately surrounding the cable, and the high mobile nature of marine mammals, or fish prey items, which are thus capable of avoiding the area, the magnitude of impact from EMF has been assessed as **negligible** and therefore not significant.

Decommissioning Phase

4.9.91 The Offshore Scheme is designed for a lifespan of approximately 40-60 years. Following the completion of the Operational phase, the Decommissioning phase will take place. As this work is planned decades into the future, it is unknown what the exact methodology will be for decommissioning, though it will be based on the Best Available Technology (BAT) available at the time.

4.9.92 In the years leading up to the end of the Project’s operational life, options for decommissioning will be evaluated through integrated environmental, technical, and economic assessments. The objective in undertaking these assessments will be to minimise the short- and long-term effects on the environment, whilst ensuring that the sea is safe for other users to navigate. The level of decommissioning will be based upon the regulations, best practices, and available technology at the time of decommissioning. The principal options for decommissioning include:

- Full removal of the cable; and
- Leaving the cable buried in-situ.

4.9.93 In the event of the full removal of the cable, this would have the potential to cause similar impacts to the Construction Phase of the Proposed Project. Should the cable be left in-situ, there would likely be no impact pathways to marine mammals. Thus, as a worst-case scenario, impacts during decommissioning may be of a similar magnitude to Construction Phase activities, depending upon the decommissioning option selected. Therefore, considering the worst-case method for decommissioning, the effects to marine mammals are predicted to be **small** and therefore not significant.

4.10 Additional Mitigation and Enhancement Measures

4.10.1 Mitigation measures refer to additional topic- and site-specific actions implemented to reduce or offset any likely significant effects. Aside from the embedded mitigation measures outlined in Section 4.8, no further mitigation measures or monitoring requirements for marine mammals have been identified as necessary following the appraisal. Residual Effects and Conclusions

4.10.2 As no additional mitigation was required as no likely significant effects on marine mammals have been identified; the residual effects of the Project remain as reported in Section 4.9.

4.11 Transboundary Effects

4.11.1 A transboundary effect is any significant adverse effect on the environment resulting from human activity, the physical origin of which is situated wholly or in part within an area under the jurisdiction of another State.

4.11.2 All works associated with the Proposed Project fall within the UK jurisdiction (12 NM). Given the distance of the Proposed Project from French waters (approximately 25 km), no significant transboundary effects have been identified. Predicted disturbance from the Proposed Project is short term and local and therefore not anticipated to be sufficient to influence marine mammal receptors outside UK waters, and subsequently cause transboundary effects.

Table 4.22 Summary of marine mammal effects

Phase	Receptor	Sensitivity	Impact	Effect		Additional Mitigation Measures	Residual Effect	
				Magnitude	Significance		Magnitude	Significance
Construction	Marine Mammals	High	Underwater Sound (excluding UXO)	Negligible	Minor (Not Significant)	No	Negligible	Minor (Not Significant)
			Indirect effects through impacts to prey items	Negligible	Negligible (Not Significant)	No	Negligible	Negligible (Not Significant)
			Vessel collision risk	Negligible	Minor (Not Significant)	No	Negligible	Minor (Not Significant)
			Airborne sound and visual disturbance	Negligible	Minor (Not Significant)	No	Negligible	Minor (Not Significant)
			Reduction in water quality	Negligible	Negligible (Not Significant)	No	Negligible	Negligible (Not Significant)
Operation			EMF emissions	Negligible	Negligible (Not Significant)	No	Negligible	Negligible (Not Significant)
Decommissioning			As a worst-case scenario, impacts during decommissioning may be of a similar magnitude to Construction and Operation & Maintenance phase activities					

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