Cambois Connection – Marine Scheme

Environmental Statement – Volume 2

ES Chapter 11: Marine Mammals

sse Renewables

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11.1. Introduction

1. This chapter presents the assessment of the likely significant effects (as per the 'EIA Regulations'[1]) on the environment arising from the Cambois Connection (hereafter referred to as 'the Project') Marine Scheme on marine mammals. Specifically, this chapter of the Marine Scheme Environmental Statement (ES) considers the potential impacts of the Marine Scheme, seaward of Mean High Water Springs (MHWS), during the construction, operation and maintenance, and decommissioning phases.

2. This assessment is informed by the following technical chapters:

- Volume 2, Chapter 3: EIA Methodology;
- Volume 2, Chapter 4: Stakeholder Consultation and Engagement;
- Volume 2, Chapter 5: Project Description;
- Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology; and
- Volume 2, Chapter 9: Fish and Shellfish Ecology.

11.2. Purpose of this Chapter

3. This chapter:

- Presents the existing environmental baseline established from desk-based assessment (DBA);
- Identifies any assumptions and limitations encountered in compiling the environmental information;
- Presents the environmental impacts on marine mammals arising from the Marine Scheme, and reaches a conclusion on likely significant effects on marine mammals based on the information and the analysis and assessments undertaken; and
- Identifies where impacts are relevant to Scottish waters, English waters, or both. Where there is no separation of assessment of impacts, the assessment for the Marine Scheme (as a whole entity) applies to the Marine Scheme in each of Scottish waters and English waters separately; and
- Highlights any necessary mitigation measure recommended to prevent, minimise, reduce or offset the risk of identified significant adverse environmental effects of the Marine Scheme on marine mammals.

4. Given the large range, cross-border management units and mobile nature of marine mammals as receptors, it is not possible or appropriate to split the assessment according to Scottish or English waters. Therefore, this impact assessment applies to the Marine Scheme in both Scottish and English waters.

[1] For the Marine Scheme these are The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended).

11.3. Study Area

5. The Marine Mammal Study Area has been identified in consideration of the potential impacts of the Marine Scheme on the regional populations of marine mammal species with distributions that overlap with the Marine Scheme. However, the localised and/or short-term and transient nature of the potential impacts associated with the Marine Scheme (through all phases) mean that long-range or North Sea-scale impacts on marine mammals from the Marine Scheme are not likely, and any impacts are most likely to occur within the area overlapping the Marine Scheme and its immediate vicinity. It is recognised that some activities can have impacts beyond the immediate vicinity of an activity or source, e.g. the propagation of underwater sound, and as a result a precautionary approach has been taken in defining the Marine Mammal Study Area.

6. The Marine Mammal Study Area is defined as the Marine Scheme boundary plus a 20 km buffer. This area encompasses much of the outer Firth of Forth. Although the Marine Scheme itself does not overlap with Scottish Territorial Waters (within 12 nm), the Marine Mammal Study Area does overlap with territorial waters (with a total area of 1,959.19 km2 of the Marine Scheme located within territorial waters).

7. Data to support the baseline characterisation of the marine mammal assessment is available for a number of different species at varying spatial scales, based on the identified cetacean Management Units (MU; IAMMWG, 2023) and Seal Management Units (SMU; SCOS, 2021). These data are available for seven of the most common cetacean species2 within UK waters, including an MU abundance estimate for each species (IAMMWG, 2022). The MU size and extent varies for each species (IAMMWG, 2023). Therefore, the marine mammal impact assessment considers the UK portion of each cetacean MU, and the two SMUs which overlap with the Marine Mammal Study Area for the species which have the potential for interaction with the Marine Scheme (IAMMWG, 2022; SCOS, 2021) (Figure 11-1). For the purposes of this assessment these MUs are:

   - The UK portion of the North Sea MU (NS MU) for harbour porpoise;
   - The UK portion of the Celtic & Greater North Sea MU (CGNS MU) for minke whale, common dolphin, Risso's dolphin, Atlantic white sided dolphin and white-beaked dolphin;
   - The UK portion of the Greater North Sea MU (GNS MU) and the Coastal East Scotland MU (CES MU) for bottlenose dolphin; and
   - The East Scotland SMU and Northeast England SMU for grey and harbour seals.

11.4. Policy and Legislative Context

8. National policy and legislation in relation to marine mammals, is set out in detail in Volume 2, Chapter 2: Policy and Legislative Context. A summary of the policy and legislative provisions relevant to marine mammals are provided in Table 11.1 and Table 11.2 below.

[2] Defined as harbour porpoise, common dolphin, bottlenose dolphin, white-beaked dolphin, white-sided dolphin, Risso's dolphin and minke whale.

Table 11.1 Summary of National Legislation Relevant to Marine Mammals

Relevant National Legislation	Summary	How and Where Considered in the ES
Scotland (offshore waters) and England		
Wildlife and Countryside Act 1981	This Act repeals and re-enacts with amendments the Protection of Birds Act 1954 to 1967 and the Conservation of Wild Creatures and Wild Plants Act 1975. Through this Act the intentional or reckless disturbance of a dolphin or whale is an offence.	Although this legislation remains valid, the principal pieces of legislation relating to the conservation of marine mammals are the Habitats Regulations, with particular reference to Annex IV: European Protected Species. An assessment of impacts to marine mammals which could constitute an offence under the Wildlife and Countryside Act 1981 is considered further in section 11.12.1.
Marine and Coastal Access Act 2009	The Marine and Coastal Access Act (MCAA) 2009 makes provisions relating to access to coastal environments and works which have the potential to result in a detrimental impact to navigational features or assets in both Scottish (>12 nm) and English waters. The MCAA provides that a marine licence is required for certain activities carried out within the marine environment. MD-LOT is responsible for marine licencing in Scottish waters and the MMO is responsible for marine licencing within English waters.	An assessment of Marine Scheme activities during the construction, operation and maintenance, and decommissioning phases which have the potential to result in an effect to marine mammal species (and which therefore require consideration as part of the Marine Licence applications) are considered in section 11.12.
The Conservation of Offshore Marine Habitats and Species Regulations 2017 (applies to offshore waters in Scotland and England)	The Conservation of Offshore Marine Habitats and Species Regulations 2017 is the principal piece of secondary legislation that transposes the terrestrial and marine species of the EU Habitats Directive into UK law	All relevant species afforded protection under the nature directives are considered as part of section 11.7. Please refer to the Report to Inform Appropriate Assessment (RIAA) which accompanies this application considers Habitats Regulations Assessment (HRA) in further detail. This follows on from HRA Screening (BBWFL, 2023) assessment carried out by the Applicant which was provided to both MD-LOT and MMO as well as NatureScot and Natural England in March 2023.
The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019	The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 make amendments to the Wildlife and Countryside Act 1981, and the Conservation of Offshore Marine Habitats and Species Regulations 2017 following the UK's exit from the European Union. It is through these regulations that provisions for the UK's National Site Network are outlined.	All designated sites afforded protection as part of the National Site Network which have a marine mammal qualifying feature have been described as part of section 11.7 This legislative framework has been considered in detail as part of the HRA Screening (BBWFL, 2023) and RIAA detailed above and subsequently not been considered further within this chapter of the ES.

Relevant National Legislation	Summary	How and Where Considered in the ES
Scotland (Territorial waters)[3]		
Marine (Scotland) Act 2010	Scottish Ministers and public authorities must act in the best way to further sustainable development, including the protection and, where appropriate, enhancement of habitat health.	All relevant potential impacts on marine habitats important for marine mammals associated with the construction, operation and maintenance and decommissioning of the Marine Scheme have been considered in section 11.12. Any impacts on prey for marine mammals (i.e. fish and shellfish species) are assessed in Volume 2, Chapter 9: Fish and Shellfish Ecology.
	The Act provides improved protection for seals through the designation of haul-out sites where seals are protection from intentional or reckless harassment.	The Marine Scheme will not have an impact on designated seal haul-out sites in Scottish waters given the nature of works proposed and the intervening distance between the Marine Scheme and these sites. There will be no intentional or reckless harassment of seals associated with designated haul-out sites. This legislative framework has not been considered further within the ES.
	The Act seeks to balance seal conservation with other pressures and requirements (such as species conservation). Part 6 prohibits the intentional or reckless killing, injuring or taking of seals except under a specific licence.	No licence is required as there will be no intentional or reckless killing, injuring or taking of seals in relation to the Marine Scheme.
	The Marine (Scotland) Act 2010 provides the development of a marine spatial planning system, creating a framework for marine development and the creation of MPAs.	There are no Nature Conservation MPAs (ncMPAs) designated for the conservation of marine mammals in proximity to the Marine Scheme, and there are no plausible impacts of the Marine Scheme on any ncMPA designated for marine mammals.
The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	Commonly referred to as the Habitats Regulations, these regulations transpose Council Directive 92/43/EEC on the conservation of natural habitats and wild flora and fauna into UK (Scots) law. These regulations cover Scottish Territorial Waters <12 nm. All species of dolphin, porpoise and whale are listed in Schedule 2 of the Habitats Regulations as European Protected Species, and regulation 39 of states that it is an offence to deliberately or recklessly capture, kill, injure, harass or disturb these species. their breeding sites, or their resting places.	All relevant species afforded protection under this legislative framework are considered as part of section 11.7. European Protected Species licensing will be dealt with, where required, through subsequent EPS licence applications, and not within this ES.

[3] Although the Marine Scheme is not located in Scottish inshore (< 12 NM) waters, the Marine Mammal Study Area does overlap with Scottish inshore waters. Legislation relevant to Scottish inshore waters is therefore provided herein.

Relevant National Legislation	Summary	How and Where Considered in the ES
The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019	This amends the Conservation (Natural Habitats, &c.) Regulations 1994 following the UK's exit from the European Union.	All relevant species afforded protection under this legislative framework are considered as part of section 11.7.
Nature Conservation (Scotland) Act 2004	This Act places duties on public bodies in relation to the conservation of biodiversity and strengthens wildlife enforcement. This Act makes it an offence to disturb or harass cetaceans and amends the provisions for enforcement.	All relevant species afforded protection under this legislative framework are considered as part of section 11.7. The potential for disturbance to cetacean species protected under this legislation is considered in section 11.12.1.
England (Territorial waters)		
The Conservation of Habitats and Species Regulations 2017	The Conservation of Habitats and Species Regulations 2017 are the principal pieces of secondary legislation that transpose the terrestrial and marine species of the EU Habitats Directive into UK law. All Under Schedule 2 of the Conservation of Habitats and Species Regulations 2017, all species of dolphin, porpoise and whale are listed as European Protected Species. Under regulation 43, it is an offence to deliberately capture, kill, injure or disturb these species.	All relevant species afforded protection under the nature directives are considered as part of section 11.7. European Protected Species licensing will be dealt with, where required, through subsequent EPS licence applications, and not within this ES.
Conservation of Seals (England) Order 1999	This Order prohibits the killing, injuring, or taking of grey and harbour seals in the counties of England bordering the North Sea and adjacent territorial waters.	There will be no killing, injuring or taking of grey or harbour seals as a result of works associated with the Marine Scheme. This legislative framework has not been considered further within this ES.
The Conservation of Seals Act 1970	This Act provides protection to seals within the territorial waters of England and Wales.	All relevant species afforded protection under this legislative framework are considered as part of section 11.7.
Natural Environment and Rural Communities Act 2006 (NERC Act)	This Act makes provision for the public bodies which are concerned with the natural environment and rural communities. This Act makes provisions regarding the connection with wildlife, sites of special scientific interest, National Parks to provide flexible administrative arrangements for the functions of the environment.	This legislative framework is considered as part of the baseline environment through the identification of designated sites with a marine mammal qualifying feature (section 11.7).

Table 11.2 Summary of National Policy Relevant to Marine Mammals

Relevant National Policy	Summary	How and Where Considered in the ES
Scotland and England (UK)		
UK Marine Policy Statement (MPS)	Ensures a sustainable marine environment which promotes a healthy, functioning marine ecosystem and protects marine habitats, species, and heritage assets.	This policy is considered as part of the baseline environment through the identification of designated sites with a marine mammal qualifying feature (section 11.7).
	The marine environment plays an important role in mitigation of climate change.	
	Marine biodiversity is protected, conserved and where appropriate recovered and habitat loss has been halted.	
	Marine businesses are acting in a way which respects environmental limits and is socially responsible.	
Scotland		
Scottish National Marine Plan (2015)	GEN 9 section of the Plan refers to Natural Heritage and provides that "development and use of the marine environment must: • comply with legal requirements for protected areas and protected species; • not result in significant impacts on the national status of Priority Marine Features; and • protect and, where appropriate, enhance the health of the marine area"	This policy is considered as part of the baseline environment through the identification of designated sites with a marine mammal qualifying feature (section 11.7). All marine mammal species considered within this ES are listed as Priority Marine Features (PMF). Where there is the potential for cumulative effects to arise, this has been considered as part of section 11.14.
	The Plan also references the prohibition of deliberate or reckless disturbance of European Protected Species through the Habitats Regulations, and that Marine Scotland's guidance on Protection of Marine European Protected Species from Injury or Disturbance must be followed.	All cetaceans are listed as European Protected Species. Measures to mitigate the risk of injury to EPS is proposed in section 11.11. European Protected Species licensing will be dealt with, where required, through subsequent EPS licence applications, and not within this ES.
	Paragraph 4.47 of the Plan refers to MPAs and provides that "the Marine Acts place a duty on all regulators to ensure that there is no significant risk of hindering the achievement of the conservation objectives of an MPA before giving consent to an activity. Where an ongoing activity presents a significant risk of hindering the achievement of the conservation objectives of an MPA there will be a management intervention. This	

Relevant National Policy	Summary	How and Where Considered in the ES
	intervention will be practical and proportionate, utilising the most appropriate statutory mechanism to reduce the risk."	
	Paragraphs 4.51 and 4.53 of the Plan refers to protected species and provides that "The presence (or potential presence) of a legally protected species is an important consideration. If there is evidence to suggest that a protected species is present or may be affected by a proposed development, steps must be taken to establish their presence. The level of protection afforded by legislation must be factored into the planning and design of the development and any impacts must be fully considered prior to the determination of the application. (…) for certain species deliberate or reckless disturbance or harassment is prohibited and can only be carried out in accordance with the terms of a licence. "	
	Within the National Marine Plan, Marine Planning Policy 'Renewables 6" provides that "new and future planned grid connections should align with relevant sectoral and other marine spatial planning processes, where appropriate, to ensure a coordinated and strategic approach to grid planning. Cable and network owners and marine users should also take a joined-up approach to development and activity to minimise impacts on the marine historic and natural environment and other users."	The Applicant has engaged and continues to engage with other third-party assets owners and operators, with regards to agreeing crossing and proximity agreements with the aim of minimising disruption and impacts to the marine environment and other users. Please see Volume 2, Chapter 4: Stakeholder Consultation and Engagement and Volume 2, Chapter 15: Other Sea Users for further detail on this engagement and how it has been implemented.
England		
Biodiversity 2020	Priority action: to establish and effectively manage an ecologically coherent network of marine protected areas which covers over 25% of English waters by the end of 2016 (which will contribute towards the UK's achievement of Good Environmental Status under the Marine Strategy Framework Directive)	This policy is considered as part of the baseline environment through the identification of designated sites with a marine mammal qualifying feature (section 11.7).
	Priority action: to develop 10 Marine Plans which integrate economic, social and environmental considerations, and which will guide decision-makers when making any decision that affects, or might affect, a marine area. This action in England	

Relevant National Policy	Summary	How and Where Considered in the ES
	is part of the UK vision for 'clean, healthy, safe, productive and biologically diverse oceans and seas'	
National Policy Statement (NPS)[4],[5]	Section 5.3 of EN-1 sets out the policy in relation to generic biodiversity impacts. Paragraphs 2.6.58 and 2.6.71 outlines the offshore wind-specific biodiversity policy. Additionally, there are specific considerations from piling noise which apply to offshore renewable energy developments in regard to marine mammals, including cetaceans and seals, which are afforded statutory protection.	This policy is considered as part of the cumulative effects assessment (section 11.14) where consideration is given to the likely significant effects of underwater sound emissions from this project in combination with other marine developments (i.e. piling noise from wind farms). It should be noted that piling is not within the scope of the Marine Scheme.
	Section 5.5 of EN-1 outlines specific considerations which apply to biodiversity.	This policy is considered as part of the baseline environment where existing marine mammal biodiversity is defined for each MU (section 11.7).
North East Inshore and North East Offshore Marine Plan	NE-BIO-2 provides that proposals that enhance or facilitate native species or habitat adaptation or connectivity, or native species migration, must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate adverse impacts so they are no longer significant d) compensate for significant adverse impacts that cannot be mitigated.	This policy is considered as part of the baseline environment through the identification of species distribution, migration, and potential connectivity to the Marine Scheme (section 11.7). This policy is considered as part of the assessment of impacts section where the potential for disturbance to marine mammal species as a result of Marine Scheme activities is considered (section 11.12).
	NE-DIST-1 states that proposals that may have significant adverse impacts on highly mobile species through disturbance or displacement must demonstrate that they will, in order of preference: a) avoid b) minimise	This policy is considered as part of the baseline environment through the identification of species distribution, migration, and potential connectivity to the Marine Scheme (section 11.7).

[4] Whilst it is acknowledged that neither BBWF nor the Marine Scheme comprise or form part of an NSIP (please see Volume 2: Chapter 2: Policy and Legislative Context) , NPSs are however a statement of government intention relating, in this case, to renewable energy projects, therefore can be taken into consideration during the preparation of the Marine Scheme ES

[5] A suite of draft revised Energy NPSs were published and consulted on by the UK Government in March 2023, and consultation closed on 23rd June. The consultation responses will be subject to consideration and the draft revised NPSs may now be revised before the NPSs are formally adopted. There is currently no date for the next stage of the review process and therefore this ES presents the current adopted NPSs which have been considered during the preparation of this ES. It is however noted by the Applicant that the new draft NPSs state that they may be material considerations in other applications which are not considered under the Planning Act (2008), this includes the Marine Scheme. Further detail on the consideration of the draft NPSs in this ES is provided in Volume 2 Chapter 2 Policy and Legislation.

Relevant National Policy	Summary	How and Where Considered in the ES
	c) mitigate adverse impacts so they are no longer significant.	
	NE-UWN-1 states that proposals that result in the generation of impulsive sound must contribute data to the UK Marine Noise Registry as per any currently agreed requirements. Public authorities must take account of any currently agreed targets under the Marine Strategy Part One Descriptor 11. NE-UWN-2 provides that proposals that result in the generation of impulsive or non-impulsive noise must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate adverse impacts on highly mobile species so they are no longer significant. If it is not possible to mitigate significant adverse impacts, proposals must state the case for proceeding.	This policy is considered as part of the assessment of impacts (section 11.12) where the potential for underwater noise related impacts is assessed. Measures to mitigate the risk of injury to marine mammals from underwater sound are discussed in section 11.11.
East Inshore and East Offshore Marine Plan	Objective 7 provides that a proposal should seek to protect, conserve and, where appropriate, recover biodiversity that is in or dependent upon the East marine plan areas.	This policy is considered as part of the baseline environment through the identification of species distribution, migration and potential connectivity to the Marine Scheme and through the identification of designated sites with a marine mammal qualifying feature (section 11.7).
	Policy BIO1 provides that appropriate weight should be attached to biodiversity, reflecting the need to protect marine biodiversity as a whole, taking account of the best available evidence (including on habitats and species that are protected or of conservation concern in the East marine plans and adjacent areas (marine and terrestrial).	

11.5. Consultation and Technical Engagement

9. A summary of the key issues raised during consultation and technical engagement activities undertaken to date specific to marine mammals is presented in Table 11.3[6] below, together with how these issues have been considered in this assessment. Further detail is presented within Volume 2, Chapter 4: Stakeholder Consultation and Engagement.

[6] Where scoping comments from stakeholders and consultees has been restated and/or paraphrased by the regulators within Scoping Opinions, this is only referenced with regards to MD-LOT and MMO Scoping Opinions, for brevity and to reduce duplication.

Table 11.3 Summary of key consultation and technical engagement undertaken for the Marine Scheme relevant to marine mammals

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
Relevant consultation and engagement undertaken to date			
18 April 2023	MMO: Consultation meeting	The Applicant would like to confirm that in the absence of MMO specific advice on these topics, the advice from Statutory Nature Conservation Bodies (SNCBs) will be followed. The MMO confirm this approach and have nothing further to add.	Scoping advice from SNCBs has been followed.
18 April 2023	MMO: Consultation meeting	The Applicant sought confirmation that UXO investigation or clearance is not within the scope of the Marine Scheme Marine Licence applications. The MMO confirmed that the preference is for UXO activities to be covered under a separate Marine Licence(s) and agree it will therefore not be covered within the Marine Scheme EIA or Marine Licence applications.	As detailed in Volume 2, Chapter 5 – Project Description; UXO clearance is not anticipated, and this activity is not included in the Marine Scheme. As such UXO clearance has not been considered further as part of this ES. The rationale for this is included in full within Volume 2, Chapter 5: Project Description; in summary: • The exact locations of potential UXO / UXO are not currently known and will not be known until detailed design, as informed by UXO surveys along the route of the Marine Scheme; • The corridor for the Marine Scheme is approximately 1 km wide. A key reason for adopting this corridor is to provide the construction contractor(s) with flexibility to micro-route around potential UXO / UXO; • If at a later stage UXO clearance is required, it will be subject to a robust assessment at the time based on data regarding UXO to enable a meaningful assessment; and • In the event that such an assessment is required, it will be subject to separate marine licensing requirements and European Protected Species licensing requirements.

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
Consultation on the Marine Scheme: Scoping Opinion			
19 December 2022	NatureScot: Scoping comments	Additionally, we advise further evidence is presented in the EIAR to support the conclusion of no impact pathway for underwater noise on fish species (including from machinery noise) before this can be scoped out. Therefore, we disagree that indirect impacts of noise on prey species can be scoped out at this stage for marine mammals.	Impacts on fish and shellfish (prey species) from other sources of underwater noise (e.g. geophysical survey) have been considered in Volume 2, Chapter 9: Fish and Shellfish Ecology. Indirect effects on marine mammals are assessed in Section 11.12.1.6.
19 December 2022	NatureScot: Scoping comments	NatureScot anticipate modelling will be necessary for any UXO clearance. NatureScot advise that an assessment considering the risk of encountering potential UXOs is presented. NatureScot have previously seen desk-based studies using the Ordtek mine map for similar assessments. NatureScot advise modelling is then provided to illustrate impact ranges, and options presented for mitigation.	As detailed in Volume 2, Chapter 5: Project Description; UXO clearance is not anticipated, and this activity is not included in the Marine Scheme. As such UXO clearance has not been considered further as part of this ES (see response below from the MD-LOT Scoping Opinion).
19 December 2022	NatureScot: Scoping comments	Cumulative assessment should focus on the Cambois Connection in combination with the proposed Berwick Bank wind farm and neighbouring (consented) wind farms in the Forth and Tay area, with their associated export cables.	Potential cumulative effects arising from the Marine Scheme and other developments within the marine environment have been considered within section 11.14.
05 January 2023	Cefas: Scoping comments	Cefas notes the scoping report provides high level information that will be expanded upon during the EIA process, as such some technical data about construction is missing. A greater understanding of the methodology intended during installation is needed to review the effects of underwater noise during the EIA. Following on from the previous comment, the timing and duration of works (such as cable laying and vessel operations) will also influence noise exposure levels. Within the EIA this information should be provided, using a worst-case scenario if details are not finalised.	Details relating to the nature and extent of construction activities (including proposed construction timelines) have been outlined in Volume 2, Chapter 5: Project Description. The marine mammal impact assessment in section 11.12 considers the potential for impact-receptor pathways from the full suite of activities that produce underwater sound.
05 January 2023	Cefas: Scoping comments	Cefas does note the MMMP included in the EIA should consider placing timing constraints on activities with associated underwater noise in line	Details relating to the nature and extent of construction activities (including proposed construction timelines) have been outlined in Volume 2, Chapter 5: Project Description.

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		with the calving and nursing periods mentioned in section 11.5 Baseline Environment. The timeline for the installation of the export cables is not fully described in the scoping report. During the EIA, it should confirm this timing of installation does not overlap with fish spawning or marine mammal calving periods, as noise produced during an acoustically sensitive event such as during reproductive activities may have larger effects.	Project specific designed in measures have been considered as part of section 11.11 with the need for secondary mitigation considered on a case-by-case basis as part of the assessment of impacts (section 11.12). The Applicant considers in the absence of significant effects identified for marine mammal and fish populations, there is no requirement for timing constraints with respect to sensitive breeding periods of marine mammals, or spawning periods for fish. The Applicant consulted with Cefas on this point in May 2023 to seek agreement however at the time of writing has not received a response., The proposed timeline for installation works has been outlined in full in Volume 2, Chapter 5: Project Description, and section 11.12 provides a thorough assessment of potential impacts of underwater sound on marine mammal receptors. Consultation on this point is currently ongoing with Cefas.
20 January 2023	Natural England: Scoping comments	Further information on the special interest features, the conservation objectives, and relevant conservation advice packages for designated sites is available on our website	Designated sites with a marine mammal qualifying feature are considered as part of the baseline environment (section 11.7).
23 February 2023	Marine Directorate-Licencing Operations Team (MD-LOT): Scoping Opinion	The Scottish Ministers are broadly content with the study area as defined in section 11.3 of the Scoping Report. The Scottish Ministers agree with the Management Units identified for cetaceans along with the SCANS blocks proposed to be used for regional context. The Scottish Ministers advise however, that for quantitative impact assessment, that the UK portion of the Management Units is used as the reference population, rather than the whole Management Unit population. With regard to seals the Scottish Ministers would highlight	Marine mammal management units are considered as part of the baseline environment (section 11.7). Where relevant, assessment has been carried out with respect to the UK portion of these Management Units. The assessment has considered the East Scotland Seal Management Unit, as well as the Northeast England Seal Management Unit.

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		that the relevant Management Unit is the East of Scotland Management Unit and highlight the NatureScot representation in this regard.	
23 February 2023	MD-LOT: Scoping Opinion	The Scottish Ministers are content with the data sources to inform the marine mammal baseline listed at section 11.4 of the Scoping Report; however, advise that there may be some additional cetacean data from citizen programmes and direct the Applicant further to the NatureScot representation in this regard.	Key data sources used to inform the marine mammals ES are listed in section 11.6: Methodology to Inform Baseline. No relevant ORCA ferry survey data was used to inform the baseline, as the only observations from the Marine Mammal Study Area are >10 years old. Data were sought from Citizen Fins, but no relevant reports are publicly available. However, the Citizen Fins website describes some anecdotal information on observations (with photographic records) of bottlenose dolphins from the east Scotland population off northeast England.
23 February 2023	MD-LOT: Scoping Opinion (*NatureScot*)	In relation to baseline environment detailed at section 11.5.1 of the Scoping Report, the Scottish Ministers advise that in relation bottlenose dolphins there is no SCANS estimate for block O. In relation to seals, the Scottish Ministers are content that the designated seal haul-out sites do not require to be considered further within the ES due to their distance from the Proposed Works. The Scottish Ministers would highlight the NatureScot representation regarding the inconsistences noted within section 11.5.1.7 of the Scoping Report for reference.	The NatureScot comments on inconsistencies have been noted and taken into consideration within the baseline description. Marine mammal management units and relevant/adjacent SCANS survey blocks are considered as part of the baseline environment (section 11.7).
23 February 2023	MD-LOT: Scoping Opinion (*NatureScot*)	Within Table 11-1 of the Scoping Report the Applicant details the potential impacts on marine mammals during the different phases of the Proposed Works which it proposes to scope in and scope out for further assessment within the ES. The Scottish Ministers broadly agree with the potential impacts to be scoped into the EIA for further assessment; however advise that the Applicant must also fully consider within the ES any pre-construction activities that can emit significant underwater noise such as UXO clearance and geophysical activities. Furthermore, the Scottish Ministers disagree that indirect impacts of construction noise	Following further consultation and discussions with MMO, as outlined in the second row of this table., UXO clearance is not anticipated, and this activity is not included in the Marine Scheme. As such UXO clearance has not been considered further as part of this ES. The rationale for this is included in full within Volume 2, Chapter 5: Project Description; in summary:

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		on prey species can be scoped out of the EIA. As per section 5.5.5 of the Scoping Opinion, the Applicant must consider any pre-construction activities on fish species and present further evidence within the ES to support the conclusion of no impact pathway for underwater noise on fish species (including from machinery noise). This is a view supported by the NatureScot representation.	• The exact locations of potential UXO / UXO are not currently known and will not be known until detailed design, as informed by UXO surveys along the route of the Marine Scheme; • The corridor for the Marine Scheme is approximately 1 km wide. A key reason for adopting this corridor is to provide the construction contractor(s) with flexibility to micro-route around potential UXO / UXO; • If at a later stage UXO clearance is required, it will be subject to a robust assessment at the time based on data regarding UXO to enable a meaningful assessment; and • In the event that such an assessment is required, it will be subject to separate marine licensing requirements and European Protected Species licensing requirements. Underwater noise impacts from geophysical activities are assessed in section 11.12.
23 February 2023	MD-LOT: Scoping Opinion (*NatureScot*)	With regard to UXO clearance, the Scottish Ministers advise that an assessment considering the risk of encountering potential UXOs is presented within the ES and modelling is then provided to illustrate the impact ranges and options presented for mitigation. The Scottish Ministers highlight the NatureScot representation in this regard relating to similar assessments previously undertaken.	Following further consultation and discussions with MMO, as outlined in the second row of this table., UXO clearance have not been considered further as part of this ES (see response above).
23 February 2023	MD-LOT: Scoping Opinion	With regard to the cumulative impacts on marine mammals and other megafauna considered by the Applicant at section 11.8, the Scottish Ministers advise that the cumulative assessment should focus on impacts in combination with the proposed Berwick Bank wind farm and neighbouring (consented) wind farms in the Forth and Tay area, with their associated export cables. The upcoming Cumulative Effects Framework should be used if available at the time of assessment The	The CEF was not available when this assessment was undertaken. Because of the negligible significance of impacts from the Marine Scheme on marine mammal species, no population modelling (e.g. interim Population Consequences of Disturbance modelling) was carried out as part of this assessment. The assessment (section 11.12) concluded that any disturbance impacts to marine mammal species would be short-term, transient and at a small spatial scale, while risk of injury could be mitigated.

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		Scottish Ministers further agree that transboundary impacts must be considered further within the ES.	The potential for effects arising from the Marine Scheme cumulative/in combination with Berwick Bank wind farm, the neighbouring (in planning and consented) wind farms in the Forth and Tay area and their associated export cables, and the Blyth demonstration offshore wind project have been considered as part of section 11.14. Transboundary impacts have been considered in section 11.17.
23 February 2023	MD-LOT: Scoping Opinion	With regards to mitigation and monitoring, the Scottish Ministers would advise that where impact pathways have been identified, the Applicant must fully consider and detail a full range of mitigation techniques and published guidance within the ES. The Scottish Ministers refer the Applicant to the guidance provided in section 3.3 of this Scoping Opinion regarding the necessary detail required.	Project specific designed in measures have been considered as part of section 11.11 with the need for secondary mitigation and monitoring considered on a case-by-case basis as part of the assessment of impacts (section 11.12).
23 February 2023	MMO: Scoping Opinion	The MMO provided no specific comments on marine mammals. It was therefore agreed in a consultation meeting 18 April 2023 that in the absence of specific advice on this topic, the advice from SNCBs will be followed.	

11.6. Methodology to Inform Baseline

11.6.1. Desktop Study

10. Information on marine mammals within the Marine Mammal Study Area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 11.4 below.

Table 11.4 Summary of key desktop studies & datasets

Title	Source	Year	Author
Scotland and England (UK)			
Atlas of Cetacean Distribution in north-west European Waters	https://cieem.net/resource/atlas-of-cetacean-distribution-in-north-west-european-waters/ Although old, this reference covers all 28 cetacean species known to have occurred in the waters off northwest Europe and illustrates the general distribution of rarer species.	2003	Reid & Northridge
Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters	https://data.marine.gov.scot/dataset/regional-baselines-marine-mammal-knowledge-across-north-sea-and-atlantic-areas-scottish	2020	Hague, Sinclair & Sparling
Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management	https://www.frontiersin.org/articles/10.3389/fmars.2022.875869/full	2022	Carter *et al*.
Distribution models for harbour porpoise within the UK Exclusive Economic Zone based on 18 years of survey data collected as part of the Joint Cetacean Protocol	https://hub.jncc.gov.uk/assets/f7450390-9a89-4986-8389-9bff5ea1978a This data set reanalysed survey data to model the density of harbour porpoise around the UK. Although some of these data are old, the modelling was used to identify the Southern North Sea SAC, by identifying an area of persistent high occurrence of harbour porpoise. It has not been updated.	2015	Heinänen & Skov
Sea Watch Foundation Recent Sightings	https://www.seawatchfoundation.org.uk/	2023	Sea Watch Foundation
Small Cetaceans in European Atlantic waters and the North Sea (SCANS) Project	https://scans3.wp.st-andrews.ac.uk/	2021	Hammond *et al*.
SCANS III modelled densities	https://scans3.wp.st-andrews.ac.uk/files/2022/08/SCANS-III_density_surface_modelling_report_final_20220815.pdf	2022	Lacey *et al*.
Special Committee on Seals (SCOS) advice to Governments	http://www.smru.st-andrews.ac.uk/scos/scos-reports/	2021	SCOS
Distribution maps of cetacean and seabird populations in the North-East Atlantic	https://abdn.pure.elsevier.com/en/publications/distribution-maps-of-cetacean-and-seabird-populations-in-the-nort	2019	Waggitt *et al*.

Title	Source	Year	Author
Citizen Fins	https://citizenfins.wp.st-andrews.ac.uk/	2023	SMRU; University of Aberdeen
ORCA Ferry Survey marine mammal sightings	https://orca.org.uk/species-sightings	2023	ORCA
Inter-Agency Marine Mammal Working Group (IAMMWG)	https://hub.jncc.gov.uk/assets/3a401204-aa46-43c8-85b8-5ae42cdd7ff3	2022	IAMMWG
Scotland			
National Marine Plan interactive map of designated seal haul-out sites in Scotland	https://marine.gov.scot/maps/446	2022	Marine Scotland

11.6.2. Site-Specific Surveys

11. No site-specific marine mammal surveys have been undertaken or are planned for the Marine Scheme, nor have they been requested by MD-LOT or the MMO as part of pre-application engagement and consultation activity. This has been considered appropriate due to there being sufficient available data sources to assess impacts to marine mammals from the generally transient and short-duration impact pathways associated with cable installation activities (e.g. from underwater sound emissions), and the absence of likely significant long-term impacts from the Marine Scheme.

12. Third party impact assessments and surveys for surrounding projects and developments have also been utilised to help inform the marine mammal baseline and to provide a more rounded understanding for the surrounding area. These projects include the environmental appraisals for the Neart na Gaoithe Offshore Wind Farm, Inch Cape Offshore Wind Farm, Seagreen Alpha and Bravo Offshore Wind Farms, Eastern Green Link 2, and Berwick Bank Wind Farm (BBWF) EIA Report (BBWFL, 2022a), specifically information from the offshore technical reports survey data.

13. The assessment also considers the post-construction marine mammal monitoring surveys for the Blyth Offshore Demonstrator (BOD) Project (EDF renewables, 2019). This report reviewed the presence and distribution of marine mammals during transect surveys in 2018, approximately one year after the BOD became operational.

14. It is acknowledged that some of the data sources presented in Table 11.5 are greater than 5 years old, however it is considered that the information provided by these sources provide relevant context to the marine mammal assessment.

Table 11.5 Summary of survey data used to inform the assessment

Title	Extent of Survey	Overview of Survey	Survey Contractor	Date	Reference to Further Information
Neart na Gaoithe Offshore Wind Farm	Survey area directly overlaps with the portion of the Marine Scheme in Scottish waters.	Ship based surveys were conducted over two or three days each month between November 2009 and December 2011. Acoustic surveys were undertaken between December 2010 to December 2011. These surveys are old but provide relevant regional context for the marine mammal baseline.	Marine Ecological Research	2012	https://nngoffshorewind.com/files/offshore-environmental-statement/Appendix-13.5---Visual-and-Acoustic-Surveys.pdf
Inch Cape Offshore Wind Farm	Survey area directly overlaps with the portion of the Marine Scheme in Scottish waters.	Underwater noise modelling Underwater noise modelling using a 1% conversion factor These surveys are old but provide relevant regional context for the marine mammal baseline.		2018	https://marine.gov.scot/sites/default/files/appendix_9b_underwater_noise_modelling_rev_b.pdf https://marine.gov.scot/sites/default/files/appendix_10b_under_water_noise_modelling_using_a_1._reva.pdf
Seagreen Alpha and Bravo Offshore Wind Farm	Survey area directly overlaps with the portion of the Marine Scheme in Scottish waters.	Modelling undertaken for the effects of underwater noise generating activities between 2012-2018 These surveys are old but provide relevant regional context for the marine mammal baseline.	SMRU Ltd	2012-2018	https://marine.gov.scot/sites/default/files/appendix_h7.pdf https://marine.gov.scot/sites/default/files/appendix_h8.pdf https://marine.gov.scot/sites/default/files/appendix_h9.pdf https://marine.gov.scot/sites/default/files/appendix_h10.pdf
BBWF offshore technical report survey data	Surveys directly overlap with the portion of the Marine Scheme in Scottish waters (BBWF plus a 16 km buffer)	Subsea Noise Technical Report Marine Mammal Technical Report Marine Mammal IPCOD Modelling Report	RPS SMRU Ltd	2022 2022 2022	https://marine.gov.scot/sites/default/files/berwic1_4.pdf https://marine.gov.scot/sites/default/files/be05e01.pdf https://marine.gov.scot/sites/default/files/be32db1.pdf
Blyth Offshore Demonstrator Project	Survey area directly overlaps with the portion of the Marine	Post construction marine mammal monitoring undertaken 1 year after completion of constructions.	EDF Renewables	2018	https://www.marinedataexchange.co.uk/details/68/2018-edf-renewables-blyth-offshore-demonstrator-project-post-construction-bird-and-marine-mammal-monitoring-array-2-year-1/packages/253?directory=%2F

Title	Extent of Survey	Overview of Survey	Survey Contractor	Date	Reference to Further Information
	Scheme in English waters.	A comparison of visual sightings of marine mammals from pre- and post-construction. These surveys are old but provide relevant regional context for the marine mammal baseline.			

11.7. Baseline Environment

15. This section provides an overview of the baseline for marine mammals within the defined Marine Mammal Study Area. It provides a baseline characterisation for the impact assessment, provides a description of the spatial extent and distribution of receptors within the Marine Mammal Study Area which could be influenced by the Marine Scheme. This description helps to establish the reference conditions for receptors against which the potential impacts of the Marine Scheme will be assessed.

11.7.1. Overview of Baseline Environment

11.7.1.1 CETACEANS

16. Throughout the North Sea, the most commonly occurring cetacean species (or resident cetacean species) (ICES, 2019) are:

- Harbour porpoise (Phocoena phocoena);
- Bottlenose dolphin (Tursiops truncatus);
- White-beaked dolphin (Lagenorhynchus albirostris); and
- Minke whale (Balaenoptera acutorostrata).

17. These species have been identified as the cetacean species likely to occur in the Marine Mammal Study Area.

11.7.1.1.1. Harbour Porpoise

18. Harbour porpoise has a widespread distribution throughout the North Sea (Sea Watch Foundation, 2012a; Hague, Sinclair, & Sparling, 2020), with individuals most common in waters less than 100 m in depth (and rarely exceeding 200 m in depth). Harbour porpoises are present in UK waters throughout the year, with observed numbers peaking between July and September (Hague, Sinclair, & Sparling, 2020), and observations decreasing during the winter months. However, it is suggested that this decrease could be attributed to a decrease in detectability rather than a decrease in population numbers. Within the North Sea Management Unit, there is a persistently high density of harbour porpoise during winter off the Lincolnshire and Norfolk coasts and the outer Thames estuary, within the southern part of the Southern North Sea SAC (Heinänen & Skov, 2015), which could indicate a southward shift in the population in winter months.

19. Harbour porpoise have been recorded in all SCANS-III blocks within Scottish and English Waters. The Marine Scheme lies wholly within Block R (which is located across both Scottish and English waters). The estimated harbour porpoise abundance in Block R is 38,646 individuals (95% confidence interval (CI) = 20,584 – 66,524), with a recorded density of 0.599 animals per km2 (Hammond et al., 2021; Lacey et al., 2022).

20. Recent model predictions from Waggitt et al., (2019) identify seasonal shifts in harbour porpoise distribution, with a northward shift in harbour porpoise density between April and September to the waters off northeast Scotland and the northern North Sea. Densities appear to increase in the southern North Sea during October to March where significant numbers are recorded along the east coast of England (Heinänen & Skov, 2015).

21. Harbour porpoise population abundance estimates for the North Sea MU (as derived from the IAMMWG (2022) updated data of the SCANS-III survey (Hammond *et al*., 2021)) recorded 346,601 individuals (95% CI = 289,498 – 419,967). Of these, 159,632 individuals (95% CI = 127,442 – 199,954) were recorded within the UK portion of the North Sea MU (abundance estimates within

the UK Exclusive Economic Zone (EEZ) (IAMMWG, 2022)). The Southern North Sea SAC is the largest SAC in UK and European waters and is an important area for harbour porpoise (covering an area of 36,951 km^2 (Figure 11.2).

22. The Southern North Sea SAC includes key winter and summer habitat for the species (such as sandbanks and gravel beds). The northern boundary of the Southern North Sea SAC is located approximately 111 km to the east of the Marine Scheme.

23. The OSPAR commission (2008) consider harbour porpoise to be 'threatened and declining' throughout the Greater North Sea, however in the UK harbour porpoise is considered to be of 'favourable' conservation status, although the overall trend of the population is unknown (JNCC, 2023). The International Union for Conservation of Nature (IUCN) considers harbour porpoise to be of 'least concern' (despite having previously being considered 'vulnerable') (IUCN, 2021)).

24. Post-construction survey works undertaken for the BOD project in 2018 concluded that harbour porpoise were the most frequently observed species during survey works, with a maximum of 5 animals observed during a one-day survey. This was a lower rate of observation than during a 2016 survey where a maximum of 13 animals were observed during a one-day survey (EDF Renewables, 2019).

11.7.1.1.2. Bottlenose Dolphin

25. The bottlenose dolphin is the larger of the two most frequently observed dolphin species in the North Sea and is often sighted close to shore either alone or in small groups. Bottlenose dolphins occur throughout UK waters, with sightings common in the Moray Firth, off eastern Scotland, in Cardigan Bay and off Cornwall (The Wildlife Trust (TWT), 2023(a)). Two distinct ecotypes of bottlenose dolphin are recognised in UK waters: a wide-ranging offshore type, and a more philopatric inshore type, with resident populations off coastal eastern Scotland, in Cardigan Bay and in the Inner and Outer Hebrides (IAMMWG, 2022). Relatively little is known about the offshore bottlenose dolphin ecotype in the North Sea compared to the coastal ecotype (Waggitt et al., 2019).

26. The Marine Scheme lies wholly within the Greater North Sea MU and adjacent to (although not overlapping with) the Coastal East Scotland MU. For the UK portion of the Greater North Sea MU (abundance estimates within the UK EEZ) the most recent abundance estimate was 1,885 individuals (95% CI = 476 – 7,461) (IAMMWG, 2022). However very few bottlenose dolphins have been observed within the Greater North Sea MU (Thompson *et al*., 2011; Hammond *et al*., 2021). The current population of the Coastal East Scotland MU is an estimated 224 individuals (CV 0.071) (Arso Civil *et al*., 2021).

27. Bottlenose dolphin abundance in SCANS-III Block R is estimated to be 1,924 individuals (95% CI = 0 – 5,048) with a density of 0.0298 animals per km^2.

28. Population models from Waggitt *et al*. (2019) predicted bottlenose dolphin population distributions throughout the northeast Atlantic. These models suggest that there is very little variation in the population density of bottlenose dolphins throughout the year. While population numbers generally peak between July and October, densities remain low. Despite this, bottlenose dolphin populations have been increasing in size along the east coast of Scotland and England, with future population estimates suggesting population expansion and distribution shifts are likely to occur (Arso-Civil *et al*., 2019). The Moray Firth SAC on the north-east coast of Scotland is home to the only known resident population of bottlenose dolphin in the North Sea, with a historical population estimate at this site of approximately 130 individuals (Wilson *et al.,* 1999) and the most recent report finding that 103 individuals are using the SAC during the summer of 2016 (Cheney *et al.*, 2018). The five-year population estimates for bottlenose dolphins in Scotland suggest that individuals move along the east coast between the Moray Firth and the Tay Estuary (with total abundance estimated as

224 individuals (between 2015-2019) ((95% = 214 – 234) (Arso-Civil *et al*., 2021). Animals are known to move from the Tay estuary to the Moray Firth in the early summer months, with individuals travelling in the opposite direction in the late summer months.

29. Bottlenose dolphin is considered to be of 'favourable' conservation status within UK waters (JNCC, 2019), with the IUCN considering this species of 'least concern' globally (IUCN, 2021).

30. Post-construction survey works undertaken for the BOD project in 2018 identified three bottlenose dolphins over two separate survey counts (EDF Renewables, 2019).

31. In 2022, the Citizen Fins project undertook a monitoring programme of bottlenose dolphin at dedicated survey areas around the Tay Estuary, St Andrews Bay and the Firth of Forth. Through this project, it was noted that a number of animals associated with the St Andrews Bay and Firth of Forth range further south into the waters of northeast England and the Tayside area, with animals recorded as far south as Scarborough and Flamborough Head (Citizen Fins, 2022).

11.7.1.1.3. White-beaked Dolphin

32. The white-beaked dolphin is a subpolar species and is commonly sighted in the cooler waters of the North Atlantic. White beaked dolphins are observed along the shores of Northumberland during the summer months (TWT, 2023(b)).

33. SCANS-III survey data and modelling for white-beaked dolphin suggests that densities close to the coast are very limited, with higher density estimates recorded in the northern North Sea (Hammond et al., 2021). Block R estimated abundance was 15,694 individuals (95% CI = 3,022 – 33,340) with a density of 0.243 individuals per km2.

34. Population models from Waggitt et al. (2019) indicate reasonably high population densities of white-beaked dolphin throughout the north-western North Sea, with population hotspots identified along the coasts of northern Scotland and northeast England (with a number of sightings recorded at Flamborough Head) (Waggitt et al., 2019; WWT Consulting, 2009). Modelling also demonstrates a southwards trend in the distribution of this species during the summer months into the North Sea from more northern waters (Waggitt et al., (2019).

35. The IAMMWG MU for white-beaked dolphin is the Celtic and Greater North Seas MU. The most recent abundance estimate is 43,951 individuals (95% CI=28,439 – 67,924), of which 34,025 individuals (95% CI=20,026 – 57,807) are considered to be present within the UK EEZ (estimates are derived from the updated SCANS-III abundance estimates for the continental shelf waters, representing the core range of the species) (IAMMWG, 2022; Hammond et al., 2021).

36. White-beaked dolphin is considered to be of 'favourable' conservation status within UK waters (JNCC, 2019), with the IUCN considering this species to be of 'least concern' globally (IUCN, 2021).

37. While two white-beaked dolphins had been observed during the 2016 survey works, during the post-construction survey works undertaken for the BOD project in 2018 no white-beaked dolphins were observed (EDF Renewables, 2019).

11.7.1.1.3. Minke Whale

38. The minke whale is found in oceans throughout the Northern Hemisphere and can generally be observed in the nearshore waters around the UK between June and August (although sightings in the southern North Sea and English Channel are rare) (TWT, 2023(c); Hammond et al., 2021).

39. SCANS-III survey data and modelling for minke whale in Block R was 2,498 individuals (95% CI = 604 – 6,791) with recorded density of 0.0387 individuals per km^2. Predicted SCANS-III data presented in Hague *et al*. (2020) identifies a hotspot of minke whale located within Block R which

extends from the coastal waters of Berwick-upon-Tweed and Northumberland east into offshore waters and the Marine Scheme. Population models from Waggitt *et al*. (2019) indicate a slight southwards trend in minke whale distribution during the summer months, with sightings extending from the northern North Sea to the central North Sea.

40. The IAMMWG MU for minke whale is the Celtic and Greater North Sea MU. The most recent abundance estimate is 20,118 individuals, of which 10,288 individuals (95% CI=6,210-17,042) are considered to be present within the UK EEZ (IAMMWG, 2022; Hammond et al., 2021).

41. Minke whale is considered to be of 'favourable' conservation status within UK waters (JNCC, 2019), with the IUCN considering this species be of 'least concern' globally (IUCN, 2021).

42. Similar to survey works undertaken in 2016, post-construction survey works undertaken for the BOD project in 2018 identified a single minke whale (EDF Renewables, 2019).

11.7.1.2 OTHER CETACEAN SPECIES

43. In additional to the four species assessed above, a further five cetacean species occur throughout the North Sea regularly but are less common. Given the infrequency of their occurrence in the Marine Mammal Study Area, and the lack of data with which to undertake a meaningful assessment, for these species no further quantitative assessment has been carried out, although the principles of the impact assessment and proposed mitigation of impacts still apply. These species include:

- Atlantic white-sided dolphin (Lagenorhynchus acutus);
- Short-beaked common dolphin (Delphinus delphis);
- Long-finned pilot whale (Globicephala melas);
- Killer whale (or orca) (Orcinus orca); and
- Risso's dolphin (*Grampus griseus*).

44. These species are summarised below.

11.7.1.2.1. Atlantic White-sided dolphin

45. The Atlantic white-sided dolphin has a limited distribution but can be found in both the temperate and cold waters of the north Atlantic Ocean, with a preference for the deeper waters of the continental shelves (at depths of 100-500 m), with sightings in the shallower coastal waters rare (WDC, 2023; Reid, Evans & Northridge, 2003). Within UK waters, the distribution of Atlantic white-sided dolphin is broadly from the west of Ireland to the north/northwest of the UK, with occasional sightings recorded off the north coast of Scotland and in the northern North Sea (Reid, Evans & Northridge, 2003; Waggitt *et al*., 2019). SCANS-III survey data and modelling for Atlantic white-sided dolphin in Block R estimated an abundance of 644 individuals (95% CI=0-2,069) and a density of 0.01 individuals per km^2 within this survey block (Hammond, *et al*., 2021). The IAMMWG MU for Atlantic white-sided dolphin is the Celtic and Greater North Seas MU, where the most recent abundance estimate is 18,128 individuals (95% CI=6,049-54,323), of which 12,293 (95% CI=3,891-38,841) of these individuals are considered to be present within the UK EEZ (IAMMWG, 2022).

46. Atlantic white-sided dolphin is considered to be a species of 'least concern' globally (IUCN, 2021). The latest assessment of the UK conservation status is Unknown (JNCC, 2019).

11.7.1.2.2. Short-beaked common dolphin

47. The short-beaked common dolphin is found in most tropical and temperate waters of both the Pacific and Atlantic Oceans. Sightings are recorded in both the coastal and offshore waters, particularly in the Celtic Sea and western approaches to the English Channel, and in the waters off

the southern and western coasts of Ireland (Waggitt *et al*., 2019). Individuals have been sighted in the North Sea primarily in the summer months (from June to September) (Reid, Evans, & Northridge, 2003). The IAMMWG MU for short-beaked common dolphin is the Celtic and Greater North Sea MU, where the most recent abundance estimate is 102,656 individuals (95% CI=58,932-178,822) (IAMMWG, 2022) of which 57,417 (95% CI=30,850-106,863) of these individuals are considered to be present within the UK EEZ (IAMMWG, 2022). There is no SCANS-III survey or modelling data available for Block R for this species, nor were there any common dolphin observations within the North Sea during the SCANS I or SCANS II surveys (Murphy *et al.*, 2013). The relative paucity of observations of this species in the Marine Mammal Study Area (or wider region) is likely representative of the rare and infrequent occurrence of this species in the region.

48. Short-beaked common dolphin is considered to be a species of 'least concern' globally (IUCN, 2021). The latest assessment of the UK conservation status is Unknown (JNCC, 2019).

11.7.1.2.3. Long-finned pilot whale

49. The long-finned pilot whale is a deep-water species, with a preference for waters greater than 200 m. This species is rarely sighted in shallower waters around the northern coast of Scotland, the northern North Sea and the English Channel (Reid, Evans, & Northridge., 2003; Waggitt et al., 2019; Hague, Sinclair, & Sparling., 2020). Sightings of this species within UK waters are generally low (Hague, Sinclair, & Sparling., 2020; Waggitt et al., 2019) and for this reason there is no SCANS-III survey of modelling data available for Block R.

50. Long-finned pilot whale is considered to be a species of 'least concern' globally (IUCN, 2018). The latest assessment of the conservation status is Unknown (JNCC, 2019).

11.7.1.2.4. Killer whale

51. The killer whale (or orca) is a resident species with groups ranging widely around the west coasts of the UK and Ireland and the Northern Isles. A seasonal population of orca has been recorded in the waters off northern Scotland, particularly around Shetland the Orkney Isles (TWT, 2023). Orcas are occasionally sighted in the central North Sea (Reid, Evans, & Northridge, S.P., 2003) with modelling by Waggitt et al., (2019) suggesting that there are low densities in the northern North Sea and waters off the east coast of Scotland, with very little seasonal variation (Waggitt, et al., 2019; Hague, Sinclair, & Sparling, 2020). SCANS-III surveys observed no orca in Blocks R or T, and for this reason there are no regional density estimates available.

52. Killer whale is considered to be a data deficient species globally (IUCN, 2017). The latest assessment of the UK conservation status is Unknown (JNCC, 2019).

11.7.1.2.5. Risso's dolphin

53. Risso's dolphin favours deep offshore waters, with sightings in the UK most common around northern and western Scotland, the Outer Hebrides and the Isle of Man. Sightings have also been recorded in the waters off Cornwall, southwest and northwest Wales and Ireland (TWT, 2023(e)). A coastal ecotype is present in UK waters throughout the year, with densities increasing during the summer months (Hague, Sinclair, & Sparling, 2020). There are few recorded sightings of this species in the central and southern North Sea (Reid, Evans, & Northridge, 2003), however, there are some recorded sightings during the winter months off the northeast coast of Scotland. There are no abundance estimates from SCANS-III data for Block R for this species. The IAMMWG MU for Risso's dolphin is the Celtic and Greater North Sea MU, where the most recent abundance estimate is 12,262 individuals (95% CI=5,227 - 28,764), of which 8,687 (95% CI=2,810 – 26,852) of these individuals are considered to be present within the UK EEZ (IAMMWG, 2022).

54. Risso's dolphin is considered to be a species of 'least concern' globally (IUCN, 2018). The latest assessment of UK conservation status is Unknown (JNCC, 2019).

11.7.1.3 Pinnipeds

55. Two seal species live and breed within UK waters: harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*). These species are summarised below.

11.7.1.3.1. Harbour seal

56. Approximately 32% of the European harbour seal population are found in UK waters (SCOS, 2021). The most recent population counts for harbour seal in the UK during the 2020 moulting season is 43,750 (95% CI: 35,800-58,300), as derived by scaling the most recent composite count of 31,500 (based on surveys conducted between 2016 and 2021) (SCOS, 2021). Due to Covid-19 restrictions during the summer of 2020 no population counts were conducted during this season. Approximately 85% of the total harbour seal population is located in Scottish waters (SCOS, 2021), with colonies along the east coast of Scotland; their distribution is concentrated to the major estuaries of Firth of Tay and the Moray Firth (Carter *et al*., 2020). Harbour seal are an Annex II species, with a total of 16 SACs designated for the conservation of this species in UK waters (Figure 11.3) (SCOS, 2021), three of these occur in the North Sea. These include the Firth of Tay and Eden Estuary SAC in the east of Scotland, and the Wash and North Norfolk Coast SAC in East Anglia.

57. These SACs support nationally important breeding colonies of harbour seals (approximately 7% of the total UK population). Harbour seal at-sea distribution is concentrated within the vicinity of these SACs, with this species rarely occurring more than 50 km from the coast, and harbour seal habitat preference modelling predicts an average at-sea density of 0.04 harbour seals km-2- across the Marine Mammal Study Area (Figure 11.3) (Carter, et al., 2022).

58. Harbour seal haul-out sites are used as pupping and moulting sites, with individuals leaving to forage in deeper water (SCOS, 2021). Harbour seals also demonstrate variation between the sexes, with females spending more time hauled-out between June and September compared to males, and less time hauled-out between October and May (Cunningham et al., 2009). There is some evidence to suggest that this variation is subject to prey availability, with harbour seals spending more time hauled-out during periods of high prey availability (Härkönen, 1987).

59. The overall population trends of harbour seals have shown a general increase in the UK, based on August haul-out counts, from 25,566 individuals counted in 2007-2009 to 31,486 individuals counted in 2016-2021(SCOS, 2021). However, much of this population increase has been around western Scotland. In the North Sea, some populations of harbour seals have undergone substantial declines in recent years. These most recent UK counts included harbour seal counts for the East Scotland seal management unit (356 harbour seals in 2016) and the Northeast England seal management unit (79 harbour seals in 2019.

60. Harbour seal is considered to be of 'favourable' conservation status within UK waters (JNCC, 2019), with the IUCN considering this species be of 'least concern' globally (IUCN, 2021).

11.7.1.3.2. Grey seal

61. Approximately 36% of the world's grey seal population breeds in UK waters, with hotspots of species distribution located in the Inner and Outer Hebrides and Orkney (Duck, 2010). The waters of Scotland are home to approximately 86% of the UK grey seal population (SCOS, 2021) with the majority of these seals occurring around the Western and Northern Isles. The total UK grey seal population at the start of the 2020 breeding season (before pups were born) was estimated at 157,300 (95% CI=144,600-169,400) (this estimate is based on the most recent pup production

estimates for 2019 on surveyed colonies in Orkney, the Inner and Outer Hebrides and the Firth of Forth).

62. The most recent UK counts included grey seal counts for the East Scotland SMU (ES SMU) (15,038 grey seals in 2016) and the Northeast England SMU (NEE SMU) (18,529 grey seals in 2016) (SCOS, 2021), with an average at-sea density across the Marine Mammal Study Area of 3 animals per km2. There is one large grey seal breeding colony within the NEE SMU located at the Farne Islands, which lies within the Berwickshire and North Northumberland Coast SAC. The 2020 population counts for the NEE SMU recorded 4,660 individuals, with pup production in 2019 recorded as 2,823 pups (SCOS, 2021). The breeding grey seal population associated with the Farne Islands accounts for >90% of the total NEE SMU population, with pup production at this site increasing by an estimated 53% between 2014 and 2019 (Figure 11.3) (SCOS, 2021).

63. Grey seals are a designated feature of 13 SACs around the UK. Two of these sites (the Isle of May SAC and the Berwickshire and North Northumberland Coast SAC) support important breeding colonies of grey seal in the vicinity of the Marine Scheme (Figure 11.4). This species uses haul-out sites for breeding, resting and moulting (SCOS, 2021) and the designated haul-out site for grey seal in closest proximity to the Marine Scheme is Fast Castle, a site within the Berwickshire and North Northumberland Coast SAC where pup production has shown a 16.9% increase per annum in recent years.

64. Grey seals can forage over distances of up to 135 km from a haul-out site over a period of 1 - 30 days (SCOS, 2021). This foraging activity typically occurs along the seabed (reaching maximum depths of 100 m) (SCOS, 2021). Tagging research from McConnell et al., (2001) for seals in the North Sea established that 43% of their time is spent within 10 km of a haul-out site. Given the foraging distances of grey seal of up to 135 km from a haul-out site, it is possible that individuals associated with the Isle of May SAC, the Berwickshire and North Northumberland Coast SAC and the Humber Estuary SAC could directly interact with the Marine Scheme. Research suggests that grey seals repeat the same trip from a haul-out site and return to this site 88% of the time (McConnell et al., 2001). As a result of the potential for interactions between the Marine Scheme and grey seals from these designated sites, regular usage of the Marine Scheme by some individuals could be important in the context of their preferred foraging grounds.

65. The UK grey seal population is considered stable, with population trends in the eastern colonies generally increasing (SCOS, 2021). Pup production in the Isle of May SAC stabilised in the 1990s, with pup production in the Berwickshire and North Northumberland Coast SAC still increasing (SCOS, 2021). Grey seal is considered to be of 'favourable' conservation status within UK waters (JNCC, 2019), with the IUCN considering this species be of 'least concern' globally (IUCN, 2021).

11.7.1.4 Summary of Baseline and Key receptors for Assessment

66. Given the large range, cross-border management units and mobile nature of marine mammals as receptors, it is not possible or appropriate to split the assessment according to Scottish or English waters. Therefore, the impact assessment presented here applies to the Marine Scheme as a whole entity in each of Scottish and English waters.

Table 11.6 Summary and key receptors for marine mammals

Receptor		Location / Jurisdiction		Estimated size of Management Unit population	At-sea density used in assessment
		Scotland	England		(individuals/km^2)
Cetaceans (commonly occurring)	Harbour porpoise	✓	✓	159,632 *	0.599 [a]
	Bottlenose dolphin	✓	✓	1,885 *	0.0298 [a]
	White-beaked dolphin	✓	✓	34,025 *	0.243 [a]
	Minke whale	✓	✓	10,288 *	0.0387 [a]
Cetaceans (other species)	Atlantic white-sided dolphin	✓	✓	12,293 *	0.01 [a]
	Short-beaked common dolphin	✓	✓	57,417 *	Unknown
	Long finned pilot whale	✓	✓	Unknown	Unknown
	Killer whale	✓	✓	Unknown	Unknown
	Risso's dolphin	✓	✓	8,687 *	Unknown
Pinniped	Harbour seal	✓	✓	435 **	0.04 [c]
	Grey seal	✓	✓	33,567 **	3 [c]

* UK portion of relevant Management Unit (IAMMWG, 2022)

** Combined population of East Scotland SMU and Northeast England SMU (SCOS, 2021)

[a] from SCANS-III block R (Hammond *et al.*, 2021)

[c] from Carter et al., (2022)

11.7.2. Future Baseline Scenario

67. The abundance and distribution of marine mammals continue to change in response to evolving environmental and anthropogenic pressures within the marine environment. These pressures include resource competition (including inter- and intraspecific competition or with commercial fisheries activities); broad-scale habitat change; coastal development; and climate change. Environmental and anthropogenic pressures have the potential to alter future marine mammal distributions throughout the Marine Mammal Study Area and wider North Sea environment.

68. Continued competition with humans for resources, such as commercially valuable fish species or access to coastal habitats which may be impacted by local developments, is also likely to impact the distribution and abundance of marine mammal species around the UK. The future baseline for commercial fishing activities is described in Volume 2, Chapter 12: Commercial Fisheries and the

future baseline for coastal habitats is described in Volume 2, Chapter 7: Physical Environment and Seabed Conditions.

69. Similarly, change in the distribution of prey species has the potential to mediate changes in marine mammal distribution throughout the life cycle of the Marine Scheme. Increases in the number of warmer-water fish species have been documented in the waters of the North Sea, which compounded by shifts in the timing of fish spawning may have important implications on the seasonality and occurrence of marine predators within the Marine Mammal Study Area (Mitchell *et al*., 2020).

70. The complex nature of the marine environment, compounded by both environmental and human pressures, will continue to lead to changes in both the distribution of marine mammals and the nature of the relationship between these species and the natural environment. Accordingly it is not possible to make accurate predictions on changes to the current baseline environment description (as outlined in section 11.7.1) over the life cycle of the Marine Scheme.

71. Any changes that may occur during the design life span of the Marine Scheme should be considered in the context of both greater variability and sustained trends occurring on national and international scales in the marine environment.

11.7.3. Data Assumptions and Limitations

72. As part of the development of the marine mammal baseline environment description, an extensive literature review was undertaken. This review considered the presence of marine mammals within the Marine Mammal Study Area and the surrounding marine environment.

73. It should be noted that the availability of data for marine mammals within the North Sea region is considered sufficient to characterise the baseline environment for this assessment and, as such, provide a sufficient understanding of the existing environment. There are, however, some limitations to the extent of the marine mammal surveys which cover the North Sea, which form the basis of this assessment. This is primarily a result of the highly mobile and transient nature of marine mammal species and the potential variability of habitat usage throughout the Marine Mammal Study Area. It is further compounded by the typically cryptic behaviour and dispersed distribution of marine mammals at sea, which makes obtaining accurate distribution and density estimates from marine surveys challenging. As a result, the surveys which have been used to characterise the marine mammal baseline environment often only provide a snapshot of the distribution of these species in the marine environment and do not characterise spatial distribution or usage for all marine mammal species at all times. Due to this uncertainty, and in ensuring a precautionary approach, this assessment has used several conservative assumptions and made reference to these where appropriate throughout the assessment.

11.8. Scope of the Assessment

11.8.1. Impacts Scoped into the Assessment

74. The following impact pathways have been scoped into the assessment, as agreed through the Scoping process and follow up consultation with stakeholders and consultees[7], further details are provided in Section 11.5 and within the Scoping Report (BBWFL, 2022b):

- Noise-related impacts from pre-construction and construction activities (C & D);
- Indirect effects on marine mammals through effects on prey species (C & D);
- Permanent habitat change, including the potential for change in foraging opportunities (O); and
- Indirect effects on marine mammals through effects on prey species (O&M).

75. Noise related impacts from construction activities and pre-construction surveys are considered together as one impact pathway, 'noise related impacts from pre-construction and construction activities'. An assessment of indirect impacts to prey species is provided in section 11.12 below, drawing on the conclusions from Volume 2: Chapter 8: Benthic Subtidal and Intertidal Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology.

11.8.2. Impacts Scoped Out of the Assessment

76. Impacts scoped out of the assessment were agreed with key stakeholders through consultation following receipt of the Scoping Opinion from MD-LOT and MMO in February and March 2023 respectively. These are summarised below for completeness:

- Impacts associated with clearance of UXO (C);
- Disturbance due to the physical presence of vessels (C & D);
- Risk of injury resulting from collision of marine mammals and other megafauna with construction and decommissioning vessels (C &D);
- Direct impacts on marine mammals associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity (C & D);
- Accidental release of pollutants (C & D);
- Displacement or barrier effects resulting from the physical presence of devices and infrastructure (O&M);
- Risk associated with electromagnetic fields (EMFs) associated with subsea cabling (O&M); and
- Risk of injury resulting from collision of marine mammals and other megafauna with operations and maintenance vessels (O&M).

11.9. Key Parameters for Assessment

11.9.1. Maximum Design Scenario

77. The maximum design scenario(s) summarised here have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in the Volume 2, Chapter 5: Project Description. Effects of greater adverse significance are not predicted to arise should any other development

[7] C = Construction, O&M= Operation and maintenance, D = Decommissioning

scenario, based on details within the PDE (e.g. different infrastructure layout), to that assessed here, be taken forward in the final design scheme.

78. Given that the maximum design scenario is based on the design option (or combination of options) that represents the greatest potential for change, confidence can be held that development of any alternative options within the design parameters will give rise to no worse effects than assessed in this impact assessment. Table 11.7 presents the maximum design scenario for potential impacts on marine mammals during construction, operation and maintenance and decommissioning.

79. Site preparation works, in advance of construction, are predicted to commence in Q4 of 2026 and will continue until all installation activities have ceased. Landfall construction is expected to occur between Q4 of 2027 until Q4 of 2028. Export cable installation is expected to begin in Q3 2028 and is expected to last until Q4 of 2029. All activities associated with the Marine Scheme are predicted to conclude by the end of 2029. Until detailed design of the Marine Scheme is progressed and further refined pre-construction, this programme for the Marine Scheme as a whole is indicative and is subject to further refinement, but is used to inform assessment of construction phase impacts for the Marine Scheme.

Table 11.7 Maximum design scenario specific to marine mammal impact assessment

Potential Impact	Maximum Design Scenario (Marine Scheme as a whole)	Maximum Design Scenario – Scottish and/or English Waters	Justification
Construction and Decommissioning			
Noise related impacts from pre-construction and construction activities	Route preparation works such as seabed levelling, boulder clearance and pre-lay grapnel run (PLGR) will be undertaken by the support vessel. These works are expected to take place over the construction period of up to 39 months. Construction of the Offshore Export Cable Corridor is expected to take up to 18 months. Pre-construction surveys may include geophysical, geotechnical and benthic surveys. Construction of a maximum of four cables, up to 720 km total length.	Maximum design scenario applicable to both Scottish and English waters. Sources of underwater noise include: • Geophysical surveys; • Cable laying activities; • Installation of cable protection; • Drilling at the breakout point of trenchless techniques and Landfall locations (if required); • Vessel movements during construction activities (including cable lay vessels with dynamic positioning (DP); and • Operational cable surveys using acoustic methods	Maximum duration and nature of construction activities, including pre-construction.
Indirect effects on marine mammals through effects on prey species	Please see Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology, and Volume 2, Chapter 9: Fish and Shellfish for the MDS parameters associated with those assessments, upon which this impact pathway draws on.		
Operation and Maintenance			
Permanent habitat change, including the potential for change in foraging opportunities	Up to 1.46 km^2 of permanent habitat loss due to: • Up to 1.41 km^2 of cable protection associated with up to 37.1 km of per cable (154.8 km in total) at a width of up to 9.5 m; • Up to 0.05 km^2 of cable protection for five cable crossings and up to 200 m	**Scotland:** Up to 0.23 km^2 of cable protection associated with 6 km per cable (24 km in total) **England:** Up to 1.24 km^2 of cable protection: Up to 1.18 km2 of cable protection associated with 31.1 km of per cable	Maximum footprint which would be affected during the operation and maintenance phase. The total cable protection area and length for the Marine Scheme exceeds the sum of English and Scottish Waters. This is due to the worst-case for the Marine Scheme as a whole being

Potential Impact	Maximum Design Scenario (Marine Scheme as a whole)	Maximum Design Scenario – Scottish and/or English Waters	Justification
	of cable requiring protection per crossing at a width of up to 12.5 m; and Operation and maintenance phase of up 35 years.	(124.4 km in total) at a width of up to 9.5 m; Up to 0.05 km2 of cable protection for five cable crossings at a width of up to 12.5 m;	associated with the eastern option for the Marine Scheme Offshore Export Cable Corridor to avoid double counting of both routes for total length. The impacts occurring to lower trophic levels from long term habitat changes may result in significant changes to marine mammals. See Fish and Shellfish Ecology and Benthic and Intertidal Ecology for further details (Volume 2, Chapter 9 and Volume 2, Chapter 8 respectively).
Indirect effects on marine mammals through effects on prey species	The assessment of indirect effects on marine mammals through effects on prey species considers EMF effects and thermal emissions. Please see Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology, and Volume 2, Chapter 9: Fish and Shellfish for the MDS parameters associated with those assessments, upon which this impact pathway draws on.		

11.10. Methodology for Assessment of Effects

11.10.1. Overview

80. The marine mammal assessment of effects has followed the methodology set out in Volume 2, Chapter 3: EIA Methodology. Specific to the assessment of marine mammals, the following guidance documents have also been considered:

- Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in Britain and Ireland – Terrestrial, Freshwater, Coastal and marine (CIEEM, updated April 2022);
- Nature Conservation Considerations and Environmental Best Practice for subsea cable for English Inshore and UK Offshore Water (JNCC and Natural England, 2022);
- Natural England and JNCC advice on key sensitivities of habitats and Marine Protected Areas in English Waters to offshore wind farm cabling within Proposed Round 4 leasing areas (JNCC and Natural England, 2019);
- Review of Cabling Techniques and Environmental Effects applicable to the Offshore Windfarm Industry (BERR, 2008); and
- Guidelines for data acquisition to support marine environmental assessment of offshore renewable energy projects (Judd, 2012).

11.10.2. Receptor Sensitivity

81. The sensitivity of a marine mammal species can be viewed as the ability of the species to tolerate change. The consideration of marine mammal sensitivity to works associated with the Marine Scheme has been assessed using the available data outlined in section 11.7.

82. The approach taken in this assessment is that a marine mammal considered to be of high sensitivity to works associated with the Marine Scheme is one which has no ability to adapt, tolerate or recover from any potential environmental changes arising due to impacts from the Marine Scheme. Consequently, if a marine mammal is of low sensitivity, works associated with the Marine Scheme are not anticipated to result in any important effect on individuals of that species.

83. The approach taken within this assessment aims to determine the sensitivity of individual marine mammals (and their supporting habitats) to any possible impacts arising as a result of the Marine Schemers. It is not the aim of this assessment to define the overall conservation value of each of the marine mammal species considered. However, the biodiversity conservation importance of each marine mammal species considered remains an important factor in the evaluation process of impact significance (as defined in section 11.10.5).

84. Table 11.8 summarises the criteria used to define receptor sensitivity for the marine mammal assessment.

Table 11.8 Definition of terms relating to the sensitivity of the receptor

Value (Sensitivity of the Receptor)	Description
Very High	No ability to adapt behaviour so that the individual vital rates (survival and reproduction) are highly likely to be significantly affected. No tolerance: the effect will result in a significant change in individual vital rates. No ability for the animal to recover from any impact on vital rates.
High	Very limited ability to adapt behaviour so that the individual vital rates (survival and reproduction) are likely to be significantly affected. Very limited tolerance: the effect is likely to result in a significant change in individual vital rates. Very limited ability for the animal to recover from any impact on vital rates.
Medium	Limited ability to adapt behaviour so that the individual vital rates (survival and reproduction) may be significantly affected. Limited tolerance: the effect may result in significant change in individual vital rates. Limited ability for the animal to recover from any impact on vital rates.
Low	Ability to adapt behaviour so that the individual vital rates (survival and reproduction) may be affected, but not on a significant level. Some tolerance: no significant change in individual vital rates. Ability for the animal to recover from any impact on vital rates.
Negligible	Receptor is able to adapt behaviour so that the individual vital rates (survival and reproduction) are not affected. Receptor is able to tolerate the effect without any impact on individual vital rates. Receptor is able to return to previous behavioural state/activities once the impact has ceased.

11.10.3. Receptor Value

85. The value or importance of a marine mammal receptor is based on a pre-defined judgement based on legislative requirements, guidance or policy (as outlined in section 11.4).

86. All marine mammal receptors are of 'high' conservation value as a result of their inclusion in Annex IV of the EU Habitats Directive as an EPS and/or as a qualifying species of UK and European designated sites (i.e., SACs). All marine mammal species considered in this assessment are listed as Priority Marine Features in Scotland, and all except for grey seal are listed as Species of Principal Importance in England (Defra, 2022). For this reason, receptor value has not been used to differentiate impact outcomes to the marine mammal populations considered as part of this assessment. Rather, the assessment considered individual species' sensitivities to the impact pathways being assessed.

11.10.4. Defining Impact Magnitude

87. Defining impact magnitude for the marine mammal assessment requires that consideration of how the following factors will impact on baseline conditions (as outlined in section 11.7):

- **Spatial Extent**: the area of which the potential will occur;
- **Duration**: the period of time over which the impact will occur;
- **Frequency**: the number of times the impact will occur during the life cycle of the Marine Scheme;
- **Intensity**: the severity of the impact;
- **Likelihood**: the probability that the impact will occur and the probability that the marine mammal receptor will be present; and

- **Reversibility**: the ability of the receiving environment / exposed marine mammal receptor to return to defined baseline conditions.

88. Based on these parameters and expert judgement, a summarised description of impact magnitude is provided in Table 11.9.

89. The benchmark conservation status for the assessment of impacts to marine mammal sensitivity is 'Favourable Conservation Status', as defined within the 'Favourable Conservation Status: UK Statutory Nature Conservation Bodies Common Statement' (JNCC, 2018). The impact magnitude is defined by the extent of the impact outcomes and the duration of the impacts on marine mammal populations, and whether activities will consequentially impact the conservation status of those populations. A high impact magnitude relates to an irreversible change to a marine mammal population or its habitat area. A low impact magnitude is defined as a minor shift from established baseline conditions for a marine mammal species, including short-term changes, which will not result in an overall change to the character, nature or conservation status of the marine mammal receptor.

Table 11.9 Magnitude of impact criteria

Magnitude of Impact	Definition
High	Total loss of, or major alteration to conservation status or integrity of a marine mammal receptor with likely long-term of irreversible results. Fundamental alteration to the character and composition of any proposed or designated protected sites.
Medium	Observed effect on the conservation status or integrity of a marine mammal receptor over the short to medium term. For this assessment the duration of a medium magnitude of impact is considered to be no more than two breeding cycles of an individual of a species. This impact is likely to be reversible in the longer term through replacement.
Low	A minor shift away from baseline conditions. The effect may be detectable, but any impacts are unlikely to be on a scale or for a duration that would result in a significant effect on the conservation status or integrity of the marine mammal receptor, and would be reversible in the short term i.e. within one breeding cycle of an individual of a species.
Negligible	A very slight change from baseline conditions. Any effects are likely to be reversible either immediately following (or soon after) the cessation of the impact and will not affect the conservation status or integrity of the marine mammal receptor.
No Change	No material change from baseline conditions.

11.10.5. Evaluation to Determine Significance of Effect

90. The significance of an effect is determined by the magnitude of the impact and the sensitivity of the receptor. The evaluation to determine significance of effect will be informed by professional judgement and using standard industry practice.

91. To ensure a transparent and consistent approach throughout this ES, a matrix approach has been adopted to guide the assessment of significance of effect. Table 11.10 outlines the significance of effect matrix used as part of the marine mammal assessment.

Table 11.10 Matrix used for the assessment of the significance of the effect

		Magnitude of Impact			
		Negligible	**Low**	**Medium**	**High**
Sensitivity of Receptor	**Negligible**	Negligible	Negligible to Minor	Negligible to Minor	Minor
	Low	Negligible to Minor	Negligible to Minor	Minor	Minor to Moderate
	Medium	Negligible to Minor	Minor	Moderate	Moderate to Major
	High	Minor	Minor to Moderate	Moderate to Major	Major
	Very High	Minor	Moderate to Major	Major	Major

92. Definitions for the significance of effect are provided in Table 11.11. For the purposes of the Marine Scheme ES, any effect which is deemed to result in a significance or moderate or greater, is generally considered to be 'significant' in EIA terms and will require additional mitigation. Effects considered to be 'minor' or 'negligible' are generally considered to be 'not significant' in EIA terms.

Table 11.11 Assessment of consequence

Assessment Consequence	Description	Significance of Effect
Major Effects	Effects (beneficial or adverse) are likely to result in highly noticeable and long-term, or permanent impacts to the character of the baseline and which are likely to disrupt the function and/or status/value of a marine mammal receptor. These effects are a priority for mitigation in order to avoid or reduce the significance of the effect.	Significant
Moderate Effects	Effects (beneficial or adverse) are likely to result in noticeable and lasting impacts to the character of the baseline and which may cause degradation of the marine mammal receptor. These effects are a priority for mitigation in order to avoid or reduce the significance of the effect.	Significant
Minor Effects	Effects (beneficial or adverse) are likely to result in noticeable changes to baseline conditions, beyond the natural variation, but which are not anticipated to result in long-term degradation to the function or value of the marine mammal receptor. Such effects will not generally require additional mitigation but may be of interest to relevant stakeholders.	Not Significant
Negligible	Effects are anticipated to be likely indistinguishable from baseline conditions or within the natural level of variation. These effects do not require additional mitigation and are not anticipated to be a stakeholder concern. Effect not considered an issue in the decision-making process.	Not Significant

93. In line with the Scottish Ministers' Scoping Opinion, the Assessment of Impacts identifies where impacts are relevant only to Scottish waters, only to English waters, or are relevant to both jurisdictions. Where there is no separation of assessment of impacts, the assessment for the Marine Scheme (as a whole entity) applies to the Marine Scheme in both Scottish waters and English waters concurrently. As noted in section 11.7.1, given the large range, cross-border management units and mobile nature of marine mammals as receptors, it is not possible or appropriate to split the assessment according to Scottish or English waters Therefore, the impact assessment presented here applies to the Marine Scheme as a whole entity in each of Scottish and English waters.

11.11. Designed-in Mitigation

94. As part of the project design process, a number of measures have been proposed to reduce the potential for impacts on marine mammals (see Table 11.12). These include measures which have been incorporated as part of the Marine Scheme's design (referred to as 'designed-in measures') and measures which will be implemented regardless of the impact assessment (referred to as 'tertiary mitigation'). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Marine Scheme and have therefore been considered in the assessment presented in section 11.12 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry practice for this type of development.

Table 11.12 Measures adopted as part of the Marine Scheme (designed-in measures & tertiary mitigation)

Mitigation Measure and Management Plans	Justification	Applicable Jurisdiction
Management Plans		
Marine Mammal Mitigation Plan (MMMP)	A MMMP will be developed for the marine mammal species of particular relevance to the Marine Scheme, if and when required. Given the potential for injury arising from the installation of the Offshore Export Cable, including the use of pre-installation survey techniques which have the potential to generate underwater noise, the JNCC guidelines for minimising the risk of injury to marine mammals will be employed.	Scotland and England (UK)
Designed in Measures		
Geophysical survey mitigation	The potential for injury to marine mammals as a result of sub-bottom profiling (SBP) operations, will be mitigated by the Marine Scheme will be mitigation by adoption of measures recommended by in the JNCC 2017 guidelines (JNCC, 2017) for minimising the potential impacts to marine mammals from geophysical survey activities.`````````````````````````````````` These measures will be detailed within the MMMP and will include the use of Marine Mammal Observers and/or Passive Acoustic Monitoring (depending on daylight and meteorological conditions) to monitor a marine mammal mitigation zone around the survey vessel.	Scotland and England (UK)
Shipboard Oil Pollution Emergency Plan (SOPEP)	All vessels to be used as part of any phase of the Project will adopt a waste management plan in line with the requirements set out as part of the International Convention for the Prevention of Pollution from Ships (MARPOL) and the SOPEP.	Scotland and England (UK)
Vessel best-practice / MARPOL	Compliance with MARPOL regulations and best-practice protocols to prevent and manage incidents of accidental release of marine contaminants.	Scotland and England (UK)
Code of Conduct.	To reduce potential for collision risk or injury to marine mammals, the Code of Conduct will be issued to all Marine Scheme vessels to be adhered to at all times. This will include requirements to: • Not deliberately approach marine mammals; • Maintain a minimum vessel speed; and • Avoid abrupt changes to vessel speed or direction should a marine mammal approach the vessel.	Scottish and English waters
Adherence to Scottish Marine Wildlife watching code	Project vessels (in both Scottish and English waters) will adhere to the protocols supplied in the Scottish Marine Wildlife Watching Code and will protect and reduce the risk of direct interactions and disturbance to marine wildlife, including marine mammals, seabirds and waterfowl.	Scotland and England (UK)
Route Selection and Avoidance	The Marine Scheme has been specifically refined to avoid interactions with key designations, environmental sensitivities, and notable inshore fishing grounds as far as reasonably practicable. On the approach to the Landfall at Cambois, the route has been selected to minimise the footprint within European Sites. Nearshore routes with greater levels of	Scotland and England (UK)

Mitigation Measure and Management Plans	Justification	Applicable Jurisdiction
	interactivity with European Sites along the English and Scottish coast have been de-selected. Further detail on this is provided in Volume 2, Chapter 6: Route Appraisal and Consideration of Alternatives	
PLONOR substances	During trenchless installation activities at Landfall, there will be an interface between the sea and the drilling fluids used to create the exit pits at the breakouts. Small quantities of drilling fluids may be discharged to the marine environment, however best practice mitigation will be implemented to reduce the amount of drill mud / cuttings released in the event of a release. To limit environmental damage, only biologically inert PLONOR listed drilling fluid will be used	England
Landfall construction	Trenchless techniques, such as Horizontal Directional Drilling (HDD) will be used at the Landfall for the construction of the Marine Scheme. Works associated with Landfall construction activities will avoid any works in the intertidal environment and will reduce the potential for sediment disturbance.	England

11.12. Assessment of Impacts

95. The potential impacts arising from the construction, operation and maintenance and decommissioning phases of the Marine Scheme are listed in Table 11.7 along with the maximum design scenario against which each impact has been assessed.

96. An assessment of the likely significance of the effects of the Marine Scheme on marine mammal receptors caused by each identified impact pathway is given below.

11.12.1. Effects During Construction

11.12.1.1 NOISE RELATED IMPACTS FROM PRE-CONSTRUCTION AND CONSTRUCTION ACTIVITIES

97. During the pre-construction and construction phases of the Marine Scheme, underwater sound emissions from acoustic (e.g. geophysical) surveys, site preparation and construction activities have the potential to result in acoustic impacts (including injury and disturbance) to marine mammal receptors on an individual or population level. Underwater sound can result from a number of activities, including:

- Geophysical surveys;
- Cable laying activities;
- Installation of cable protection on the seabed;
- Drilling at the breakout point of trenchless techniques and Landfall locations (if required);
- Vessel movements during construction activities (including cable lay vessels with dynamic positioning (DP); and
- Operational cable surveys using acoustic methods.

98. Underwater sounds can either be impulsive (for example, geophysical survey equipment); or non-impulsive (or continuous) in nature (such are those generated by trenching and from vessel movements). The potential impacts of anthropogenic underwater sound on marine mammals are influenced by the nature of the sound source (i.e., the frequency and intensity of the sound), the

duration of the sound against baseline background levels and the sensitivity of the marine mammal receptor.

99. For the assessment of acoustic impacts on marine mammal species, the principal metrics for describing the intensity of underwater sound are the sound pressure level (SPL) and sound exposure level (SEL). The SPL is a measure of the amplitude or intensity of a sound and, for impulsive sounds, is measured as a peak value. The SEL is a time-integrated measurement of sound energy which considers the intensity as well as the duration of the sound. Cumulative SEL (SELcum) is a measure of sound exposure over a longer time period, typically 24 h, to assess the risk of longer periods of sound emission. Estimations of SELcum often taken into account the behaviour of animals (i.e. fleeing from a loud sound source) in estimating impact ranges. For impulsive sources considered in this assessment, underwater sound propagation modelling has been used to estimate impact ranges based on the peak SPL and SELcum metrics.

100. The sound characteristics of activities associated with the Marine Scheme have been determined by a significant body of knowledge from common sound generating activities from existing literature (as summarised in Table 11.13). Where a range of sound source levels were identified for an activity, a reasonable, realistic worst-case level has been assumed for the assessment.

Table 11.13 Characteristics of underwater sound sources generated by Marine Scheme construction activities

Underwater Sound Generating Activity	Frequency Range (kHz)	Indicative SPL (SPL_{PEAK} dB re 1µPA)	Scoped In for Assessment
Survey vessels and construction vessels	Acoustic energy from vessel is strongest at frequencies <1 kHz	160-175	X
Sub Bottom Profiler (SBP)	8-12	240	✓
Multi-Beam Echo Sounder (MBES)	400-700	180-240	X
Side Scan Sonar (SSS)	300-900	213-225	X
Ultrashort Baseline (USBL)	19.5-33.5	207	✓

101. A number of the underwater sound sources associated with pre-construction survey and construction phases can be removed at this stage of marine mammal assessment based on the nature of the sound and the likelihood that they will be masked by ambient sound levels within the marine environment. A justification for screening out those underwater sound sources have been provided below:

- **MBES**: in shallow waters (< 200 m) MBES is typically used at high frequencies (>200 kHz) that will fall outside the known hearing range of the marine mammal species considered within this assessment. Due to the high source frequency, sounds produced from MBES will also attenuate quickly with distance. Therefore, there will be no significant impacts from MBES activities on marine mammal species and this underwater sound source has not been considered further in this assessment;
- **SSS**: similar to MBES, SSS operates at high frequencies outside the known hearing range of the marine mammal species considered within this assessment (typically > 300 kHz). Therefore, there will be no significant impacts from SSS activities on marine mammal species and this underwater sound source has not been considered further in this assessment;

- **Installation of cable protection**: where this involves the use of rock placement it is likely that marine mammals have the ability to faintly hear rocks falling through a fall tube to the seabed. However, studies suggest that it was the underwater sound associated with rock placement vessels that dominated sound pressure associated with this activity (Nedwell, Brooker, & Barham, 2012). Therefore, no significant impacts from the installation of cable protection placement on marine mammal species are anticipated and this underwater sound source has not been considered further in this assessment;
- **Trenchless techniques (e.g., Horizontal Directional Drilling (HDD))**: existing studies into the sound profile of HDD operations within shallow, riverine waters concluded that, in the absence of vessel noise, HDD produced a maximum unweighted SPL of 129.5 dB re. 1µPa (Nedwell, Brooker, & Barham, 2012), when drilling below the riverbed (although it was not reported whether this number was peak or root-mean-square pressure). While this level exceeds the 120 dBrms re 1 µPa threshold for disturbance (i.e. Level B harassment; NOAA, 2005) from continuous sound sources, underwater sound propagation loss means that the HDD sound would fall below this threshold within 10 m of the seabed, meaning that significant disturbance of marine mammals is unlikely. Therefore, no significant impacts from HDD operations on marine mammal species are anticipated and this underwater sound source has not been considered further in assessment;
- **Ploughing, jetting and trenching cable during construction**: Although the sound associated with ploughing reported by Nedwell et al. (2003) is of a level which could cause disturbance to marine mammals, the SPL is broadly comparable to other shipping noise (Simard et al. 2016; in Jiminez-Arranz et al. 2020). It is therefore probable that vessel noise, rather than the mechanical action of the plough itself, likely dominates the acoustic signal during ploughing and jetting operations. As ploughing and jetting will be transient and of a short duration, it is unlikely to have any significant impacts on acoustically sensitive animals such as marine mammals. Therefore, no significant impacts from ploughing, jetting and trenching cable construction activities on marine mammal species are anticipated and this underwater sound source has not been considered further in this assessment; and
- **Survey vessels and construction vessels**: the underwater sound pressure levels associated with survey and construction vessel activities are likely to be too low to result in injury or significant disturbance to marine mammal species. There will be a limited number of vessels associated with the survey and construction phase of the Marine Scheme, and although sound emissions from vessels associated with the Marine Scheme will exceed the threshold for behavioural effects from continuous sound (120 dBrms re 1 µPa), the associated underwater sound profile is not considered to represent a material change from baseline conditions in the context of existing shipping and navigation activities throughout the North Sea (see Volume 2, Chapter 13: Shipping and Navigation for further information on existing vessel baseline conditions associated with the Marine Scheme). As a result of the minor contribution of vessel noise associated with the Marine Scheme to the soundscape, and the short-duration, transience of vessel operations, no significant impacts from vessel movements on marine mammal species are anticipated and this underwater sound source has not been considered further in this assessment.

102. The only activities associated with the Marine Scheme that are considered to generate an underwater sound profile within the thresholds of impacts to marine mammals (and therefore result in a potentially significant effect) are those associated with USBL and SBP activities.

11.12.1.1.2. Magnitude of impact

103. Acoustic impacts arising from Marine Scheme survey and construction activities are highly influenced by both the nature of the works and the receiving environment. Sound attenuates as it propagates throughout the water column and the magnitude of impact will be influenced by local

oceanographic conditions (influencing both the path of the sound into the water column and how much sound is transmitted).

SBP (risk of injury):

104. The use of SBP equipment has the potential to cause injury to marine mammals, without appropriate mitigation. Predicted ranges at which injury impacts are likely to result from the use of SBP, as presented in Table 11.14. The Innomar SES 2000 has been modelled at two frequencies to exemplify the worst-case scenarios for a SBP, using both the peak SPL and cumulative SEL metrics.

105. Across modelling scenarios and metrics, the injury ranges were generally highest for the VHF hearing group, (i.e. harbour porpoise). Conversely, HF cetaceans seemed to constitute the hearing group with the lowest potential impact ranges for the peak SPL metric, while LF cetaceans had the lowest impact ranges for the cumulative SEL metric, when comparing between activity types.

106. The greatest injury range is predicted from the modelled low frequency (i.e. 4 kHz) operation of the Innomar SES 2000 SBP during shallow water operations (i.e. 10 m). In shallow waters, refraction off the seabed causes nearly immediate cylindrical spreading of sound emissions, causing the sound to travel farther along the horizontal plane of the water column more quickly. Deployment of a low frequency SBP in nearshore waters constitutes a worst-case prediction of the potential injury range attributable to this survey technique. These impact ranges are considered precautionary, due to the fact the beam of sound generated by SBP equipment is directed downward towards the seabed (Pace et al., 2021). The majority of power is contained within a roughly 45° angle from the source (the slant height of the conical sound source) to maximise penetration and the resultant imagery. Animals would need to be directly below the sound source to experience the full sound levels behind the modelled impact ranges.

107. The majority of injury ranges were at least slightly reduced when considering animal movement (swimming away) during cumulative SEL estimation. A suite of standard values for mean swimming speeds of various marine mammal species likely to occur in the study area have been identified (NatureScot (formerly Scottish Natural Heritage (SNH), 2016), including harbour porpoise (1.4 m/s; Westgate et al., 1995); harbour seal / grey seal (1.8 m/s; Thompson, 2015); and minke whale (2.1 m/s; Williams, 2009). There is additional evidence that some of these swim speeds could be conservative, e.g., cruising minke whale swim speed is 3.25 m/s (Blix and Folkow, 1995) and harbour porpoise may swim up to 4.3 m/s (Otani et al., 2000). To offer a representative estimation of the predicted sound exposure ranges of marine mammals moving away from the sound source, the model used a generalised swim speed of 1.5 m/s for all species, together with sound source characteristics for the representative SBP device. Given that many species, harbour porpoise in particular, are likely to flee at speeds >1.5 m/s (Otani et al., 2000; Kastelein et al., 2018), this approach is considered to be appropriately precautionary. Considering that the surveys themselves will take place while the vessel is moving, the cumulative SELs of all equipment types are expected to be even lower based on the premise that animals are likely to move away from the mobile sound source at some angle opposite (i.e. greater than 180°) the direction of travel of the vessel.

108. It should also be noted that the modelling scenarios for the Innomar SES 2000 SBP aim to define the worst-case injury ranges associated with the deployment of survey equipment to be used in the Marine Scheme. The *in-situ* deployment of the acoustic survey equipment will most frequently occur in waters of intermediate depths (i.e. between 10-100 m). Moreover, the frequency ranges depicted constitute the lowest and highest reasonably practicable settings for the survey activities modelled, meaning that the propagation of sound in the marine environment is also likely to fall somewhere between the modelled extremes. The injury ranges that are predicted to result from

the use of SBP are thus likely to fall within the range of those defined by the model outputs (i.e. as predicted for water depths of 10 and 100 metres), thus the zone of potential injury will in most cases be smaller than those radii presented in Table 11.14.

109. Mitigation measures specifically designed for geophysical surveys (JNCC, 2017) will be implemented to mitigate the risk of injury during SBP operations, as part of a Marine Mammal Mitigation Plan (MMMP) to be prepared post-consent. These measures include deployment of a Marine Mammal Observer (MMObs) to monitor for the presence of cetaceans within a 500 m mitigation zone prior to the commencement of, and during, any SBP surveys (JNCC, 2017).

110. In consideration of the relevant mitigation measures, none of the modelled scenarios indicate that risk of auditory injury is likely to exceed the 500 m mitigation zone. As cetaceans and other marine mammal species would need to come within 500 m of, and likely follow, the moving vessel or vehicular platforms from which the survey equipment will be deployed, the risk of injury to marine mammals from survey activities can be mitigated through application of the JNCC protocol. For these reasons, the survey activities are not anticipated to result in any risk of injury to marine mammals.

Table 11.14 Sound modelling results for injury impacts from an exemplar SBP and USBL

Activity	Example equipment modelled	Depth (m)	Frequency (kHz)	SPL_{peak} dB re 1 µPA)	Injury range (m)											
					Cumulative SEL (static mammal)				Cumulative SEL (moving mammal)				Peak SPL			
					VHF	HF	LF	PW	VHF	HF	LF	PW	VHF	HF	LF	PW
SBP	Innomar SES 2000 sub-bottom profiler, 4 kHz	100	4	235	9	5	9	9	9	5	6	5	255	28	68	73
		10	4	235	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E	445	98	178	188
	Innomar SES 2000 sub-bottom profiler, 100 kHz	100	100	235	28	17	17	17	19	17	16	17	30	12	17	18
		10	100	235	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E	29	11	16	17
USBL	Kongsberg HiPAP	100	19.5 – 33.5	207	43	8	4	5	38	2	1	1	3	N/E	N/E	N/E
		10	19.5 – 33.5	207	4	4	2	3	4	2	N/E	N/E	3	N/E	N/E	N/E

N/E = no exceedance of threshold

SBP (risk of disturbance):

111. In addition to the potential physiological impacts of underwater sound (i.e., auditory injury), sound emissions have the potential to result in behavioural disturbance of marine mammals. Acoustic impacts associated with SBP operations are likely to be highly localised due to the highly directional nature of the sound source. The effective deterrence range (EDR) for SBP operations on harbour porpoise are considered to be precautionary due to the directional sound source and the influence of this directionality on underwater sound propagation. JNCC (2020) recommend a 5 km (likely conservative) EDR to account for differences in acoustic propagation between types of SBP in the absence of field data on harbour porpoise responses to this sound source. This 5 km EDR has been defined with respect to harbour porpoise but has been used in this assessment to represent all marine mammal hearing groups. This is because there are no agreed quantitative thresholds for disturbance as there are for auditory injury. As harbour porpoise are notoriously 'shy', they are considered to be highly sensitive to disturbance, and there is evidence of harbour porpoise responding to impulsive construction sounds as well as vessel activity (Brandt *et al.*, 2011, Graham *et al.*, 2019). Using a disturbance range appropriate for this highly sensitive species has been considered to represent a worst-case scenario for other marine mammal species.

Table 11.15 EDR and total MU population disturbance in relation to pre-construction SBP operations, based on a 5 km EDR for SBP

Species	Number of animals in UK portion of MU/SMU	Population density estimates per km^2	Number of individuals disturbed	Percentage of MU disturbed (%)
Harbour porpoise	159,632	0.599*	47.05	0.03
Bottlenose dolphin	1,885	0.0298*	2.34	0.12
White-beaked dolphin	34,025	0.243*	19.09	0.06
Minke whale	10,288	0.0387*	3.04	0.03
Grey seals***	33,567	3**	235.62	0.70
Harbour seals***	585	0.04**	3.14	0.54

*SCANS III population estimate for Block R (per km^2; Hammond *et al*., 2021)
**Maximum number of animals estimated (per km^2; Carter *et al*., 2022)
*** Combined population estimate of East Scotland / Northeast England Seal Management Units (2016-2021; SCOS 2021)

112. The number of animals disturbed by Marine Scheme pre-construction SBP operations has been calculated using a 5 km EDR radius (JNCC, 2020) around a survey vessel (giving a total area of disturbance of 78.54 km^2) and based on relevant species-specific densities. For cetacean species the densities were derived from SCANS III estimates for SCANS block R, which overlaps the Marine Scheme. For pinnipeds (i.e., harbour and grey seal) the densities were derived from the

Carter *et al* (2022) at sea distribution maps and using the maximum value across all grid cells that overlapped the Marine Scheme (Figure 11-3).

113. It is anticipated that the percentage of each respective marine mammal MU population that will exhibit behavioural disturbance will be <1% (Table 11.15). As the number of individuals that could be disturbed are a small proportion of each MU, and impacts from the SBP surveys will be of a short duration and are transient (i.e., a moving source) this disturbance is not likely to have any long-term, lasting impacts on any marine mammal species, particularly given the conservative use of a 5 km disturbance radius in these estimates.

USBL (risk of injury):

114. Sound emissions from USBL operations will attenuate below the instantaneous PTS (i.e., auditory injury) threshold for VHF cetaceans within 3 meters from the source, based on sound propagation modelling (Table 11.14). It is highly unlikely that harbour porpoise will be present within 3 m of the USBL (given they are known to exhibit strong vessel avoidance; Graham *et al.*, 2019), therefore the risk of auditory injury from USBL operations is very low and is not considered likely. Although the SEL_{cum} metric does result in a larger predicted injury zone (up to 43 metres for a static VHF cetacean), because the acoustic source will be moving and SEL_{cum} is calculated over a 24-hour period, there is no plausible risk of auditory injury to harbour porpoise. For dolphin, whale and seal species representing other hearing groups (i.e. LF, HF, PCW) injury ranges for USBL are in every case < 10 metres for both SPL and SEL_{cum} metrics, so although modelling predicts that some PTS thresholds could be exceeded, there is no realistic risk of injury to any marine mammal from this activity.

USBL (risk of disturbance):

115. Behavioural disturbance as a result of USBL is considered to be limited in magnitude, and the use of a 5 km EDR (as with SBP operations) is not considered to be appropriate. No EDR for USBL are proposed or recommended by JNCC (2020). Underwater sound propagation modelling has been carried out for an exemplar USBL to obtain range of disturbance to marine mammals, in line with the Level B harassment threshold of 160 dB re 1 µPa (Southall *et* al., 2007). The resulting radius of disturbance is 63 – 64 m, dependent on water depth (Table 11.16).

Table 11.16 Potential for behavioural change (disturbance) from USBL operations

Activity	Frequency (kHz)	SPL_{rms} (dB re 1 µPA)	Depth (m)	Range of disturbance (m)
USBL (Kongsberg HiPAP)	19.5 – 33.5	190	10	64
			100	63

Table 11.17 Predicted disturbance of marine mammal species in relation to USBL operations

Species	Equipment	SPL_{rms} for USBL operations (dB re 1 µPa at 1 metre)	Max. range of behavioural change (disturbance) (metres)	Predicted area of disturbance (km^2)	Density estimates (per km^2)	Number of individuals disturbed
Harbour porpoise	USBL (e.g., Kongsberg HiPAP)	190	64	0.013	0.434*	< 0.01
Bottlenose dolphin					0.0057*	< 0.01
White-beaked dolphin					0.066*	< 0.01
Minke whale					0.0328*	< 0.01
Grey seal					3**	0.038
Harbour seal					0.04**	< 0.01

* SCANS III block R predicted density
** Carter *et al.*, 2022 maximum predicted density

116. Impacts from underwater noise will represent only a minor shift away from baseline conditions, for the short duration of the activities that would generate significant levels of underwater sound. While any effects could be detectable, they are unlikely to result in any significant impacts on the conservation status of any marine mammal species beyond short term (behavioural disturbance) impacts.

117. While any impact will affect the receptor directly, the impact is predicted to be of regional special extent, short term duration, and will be intermittent and highly reversible (i.e. impacts will cease when the activity ceases). The magnitude is therefore considered to be low.

11.12.1.1.3. Sensitivity of the Receptor

118. Underwater sound could result in a direct impact to marine mammal species, with animals in the immediate vicinity of the source likely to experience greater exposure to survey and construction sounds than those outside the Marine Scheme cable corridor.

119. The impact of underwater sound on marine mammals is generally split into the following categories:

- **Auditory injury**: which results from damage to the inner ear of marine mammals, the organ system most directly sensitive to sound exposure. Auditory injury can result in hearing loss (known as Permanent Threshold Shift (PTS); Southall et al., 2007); and
- **Behavioural responses**: which are highly viable and context specific. Responses can include increased alertness, altered vocal behaviour, alteration of movements or diving behaviour or temporary or permanent habitat abandonment. In some circumstances, sound exposure from military sonar has resulted in behavioural responses in marine mammals (Tyack *et al*., 2011).

Underwater sound from anthropogenic sources has the potential to partially, or entirely, reduce the audibility of signals from other animals or prey species.

120. Each marine mammal species has a unique hearing range within which it has the ability to adapt to perceived sounds, however not all marine mammal species have been studied in sufficient detail to define these hearing ranges. Species were grouped by Southall et al., (2019) based on taxonomy, hearing morphology, the frequencies characteristics of the sound source and other relevant similarities in order to define 'functional hearing groups'. The delphinid species likely to occur in the Marine Mammal Study Area (i.e., bottlenose dolphin, white-beaked dolphin, common and Risso's dolphin) are considered to be High Frequency cetaceans; harbour porpoise is considered to be a Very High Frequency species; minke whale is considered a Low Frequency species; and grey and harbour seal fall into the Phocid Carnivores in Water hearing group (Southall et al., 2019).

121. Table 11.18 provides and overview of the functional marine mammal hearing groups for species identified within the Marine Scheme study area.

Table 11.18 Functional marine mammal hearing groups, auditory bandwidth and species identified within the study area

Functional Hearing Group	Auditory Band Width	Species	Species Potentially Present in the Study Area
Low frequency cetaceans (LF)	7 Hz to 35 kHz	Baleen whales	Minke whale
High frequency cetaceans (HF)	150 Hz to 160 kHz	Dolphins	Bottlenose dolphin White-beaked dolphin Atlantic white-sided dolphin Short-beaked common dolphin Risso's dolphin Long-finned pilot whale Killer whale
Very high frequency cetaceans (VHF)	275 Hz to 160 kHz	True porpoise and some small whales	Harbour porpoise
Phocid seals in water (PW)	75 Hz to 100 kHz	Seals	Grey seal Harbour seal

122. The most up to date sound exposure criteria for auditory injury in marine mammals have been published by the US National Marine Fisheries Service (NMFS), often referred to as the NOAA criteria (NMFS, 2018) and updated in a peer-reviewed academic paper (Southall *et al*., 2019). The thresholds for PTS are defined on a dual criterion of unweighted, instantaneous peak sound pressure levels (SPL_{peak}; dB re 1µPa) and M-weighted cumulative Sound Exposure Levels (SEL_{cum}; dB 1 μPa^2s) (Table 11.19).

Table 11.19 Quantitative thresholds for auditory effects (PTS) in marine mammal species

Marine Mammals Hearing Group	Impulsive Sound Sources	
	PTS SEL_{cum}	PTS SPL_{peak}
LF cetaceans	183	219
HF cetaceans	185	230
VHF cetaceans	155	202
PW	185	218

SBP:

123. SBP systems transmit a series of sound pulses to generate an echo from the seabed and sediment/rock layers up to 50 metres below the seabed. The highly directional nature of these sources means that horizontal sound propagation is generally limited, but the sound source pressure level associated with many SBP systems does have the potential to induce auditory injury in marine mammals (ca. 235 dB re 1 µPa @ 1 m). The frequency of SBP sound emissions is typically of a higher frequency than seismic airguns, but lower than most multi-beam echosounders, meaning that it generally lies within the hearing ranges of LF, HF and VHF cetaceans, as well as seals. Although sound pressure levels modelled in this assessment fall below instantaneous injury ranges within 500 metres of the source for all hearing groups, the possibility of behavioural disturbance is believed to occur to a range of 5 km from the source (JNCC, 2020).

124. Although there is a growing body of evidence on impacts to marine mammals from geophysical sound sources (Bröker, 2019) there is no evidence of the impacts of SBP operations on marine mammals. Two recent studies examined the impacts on Cuvier's beaked whale *Ziphius cavirostris* (HF cetaceans) responses to 12 kHz multi-beam echosounder surveys at an acoustic monitoring range off California. These studies found no clear effect on the distribution (Kates Varghese *et al.*, 2021) nor a consistent change in the foraging behaviour of this species (Kates Varghese *et al.*, 2020). Likewise, a study that analysed harbour porpoise responses to a seismic survey in the North Sea found that, in spite of evidence of short-term displacement, porpoises were detected again at affected sites within a few hours of the survey ceasing with no evidence of long-term impacts (Thompson *et al.*, 2013). Together, these studies suggest that any behavioural effects of acoustic disturbance as a result of geophysical surveys are not likely to have major impacts on the ecology of cetacean species.

USBL:

125. USBL systems introduce sound into the marine environment through the emissions of an underwater sound from a hull-mounted transducer to a subsea transponder. The potential for impacts arising from USBL operations on marine mammal species is influenced by the abundance, distribution and sensitivity of the species to acoustic impacts, and the duration of the USBL operations. The exemplar SPL_{peak} for USBL operations is max. 207 dB re 1 µPa @ 1 m, at a frequency of between 19.5-33.5 kHz. The USBL equipment that will be used for Marine Scheme pre-construction survey activities will fall within this envelope, therefore using a source level of 207 dB re 1 µPa at 1 metre has been considered a realistic worst case. These metrics mean that USBL sound sources lie within the hearing range of low-frequency (LF), high-frequency (HF), very high frequency (VHF) cetaceans and seals (phocid carnivores in water (PW)).

126. There is deemed to be low likelihood of acoustic injury associated with the Marine Scheme, and rates of disturbance from acoustic emissions associated with the Marine Scheme are unlikely to significantly affect individual vital rates. Individuals are likely to be able to adapt their behaviour so that any effects on vital rates are not on a significant level. Individuals are likely to recover from any impacts, and populations are unlikely to experience significant impacts. As a result, these species are deemed to be of low vulnerability to acoustic impacts. As any impacts are likely to be highly recoverable, the sensitivity of marine mammal receptors is therefore considered to be low.

11.12.1.1.4. Significance of the effect

127. Based on the nature and extent of Marine Scheme pre-construction surveys, construction, and decommissioning activities and the auditory sensitivity of marine mammals in relation to potential impacts of these activities, acoustic injury and behavioural responses are only considered likely to occur to animals that are in very close proximity to sound sources (i.e., SBP, USBL) and only for the short duration. In effect, acoustic injury to marine mammals is only likely to occur to animals that are within a few meters of sound emitting operations, and only for a short time. The risk of injury can be mitigated through the use of MMObs during periods of SBP operation.

128. Injury impact ranges for SBP are anticipated to be larger than any other sound source, and injury thresholds will be exceeded for LF and VHF cetaceans. The predicted impact ranges in relation to HF cetaceans and seals suggest that injury is unlikely for dolphin/seal species expected to be present within the vicinity of the Marine Scheme (i.e., bottlenose dolphin and white beaked dolphin, grey seal and harbour seal).

129. The greatest injury range resulting from SBP operations across all marine mammal species relates to harbour porpoise at up to 445 m from the sound source. Harbour porpoise are the most abundant marine mammal species within the North Sea, however existing research suggests that their presence within the Marine Scheme cable corridor is relatively low as a proportion of the total number of animals within the North Sea MU (<1% of the MU population). The Southern North Sea SAC (located approximately 111 km to the east of the Marine Scheme) has been designated to protect an important area for harbour porpoise. Activities undertaken within the North Sea that emit a sound source within the functional hearing group have the potential to result in injury to harbour porpoise.

130. Given the potential for auditory injury to arise from SBP operations on marine mammals, designed in measures will be adopted to minimise the risk of injury considering the largest predicted injury range of 445 m (as outlined in section11.11). JNCC guidance to minimise the potential for injury to marine mammals require that, before the SBP is activated, there will be a period of observation over a pre-defined mitigation zone (i.e. a minimum of 445 m) by a qualified Marine Mammal Observer (or passive acoustic monitoring, in the case of construction activities during hours of darkness or poor weather). Through implementation of this mitigation measure, the likelihood that any animals within 445 m of the sound source at the point of SBP initiation will be greatly reduced, therefore, the risk of injury to marine mammals can be considered to be mitigated.

131. A conservative range of disturbance from SBP operations (5 km EDR) has been considered for all species. The 5 km EDR should not be considered as a zone of species exclusion, but rather an impact zone within which an animal may not exhibit normal behaviour. Therefore, whilst animals may move away from the sound source, they are likely to return to the area once SBP operations have passed or ceased (Thompson *et al.*, 2013, Kates Verghese *et al.*, 2021). Owing to the low density of animals that are anticipated within the Marine Scheme cable corridor and the transient nature of survey vessels and activities, the number of animals likely to be disturbed by these activities is small, relative to management population size.

132. For USBL operations, sound will attenuate to below the threshold for behavioural disturbance (160 dB re 1 µPa; Southall *et al*., 2007) within 64 m of the source. It is concluded that <0.1 cetaceans (all species) will be disturbed by USBL operations and <0.1 grey seals and harbour seals will be disturbed and there will be no potential for significant impacts to marine mammal species as a result of USBL operations (Table 11.17), and this equipment has not been considered further in this assessment.

133. SBP and USBL operations have been aggregated in an overall assessment of underwater sound impacts on marine mammals. This approach has been taken as SBP operations generate greater levels of underwater sound (and associated risk) than USBL operations, so disturbance impacts associated with the use of SBP represent the greatest risk to marine mammal species associated with the Construction phase. As previously discussed, disturbance impacts associated with USBL are considered to be of low magnitude, and marine mammals are assessed as being of low sensitivity to USBL. The combined risk of SBP and USBL operations is contingent predominantly on the higher-amplitude sound source (SBP). As a result of acoustic impacts from SBP and USBL operations, the magnitude of the impact of both acoustic sources is deemed to be **low,** and the sensitivity of marine mammal receptors is considered to be **low**. The effect will, therefore, be of **low adverse** significance, which is **not significant** in EIA terms.

11.12.1.1.5. Secondary mitigation and residual effect

134. Given that there are no likely significant effects in EIA terms, secondary mitigation is not required.

11.12.1.2 INDIRECT EFFECTS ON MARINE MAMMALS THROUGH EFFECTS ON PREY SPECIES

11.12.1.2.1 Introduction of impact

135. Construction and decommissioning activities have the potential to result in impacts to fish and shellfish species which are prey for marine mammals. For example, an increase in sediment loading in the water column, and the resulting increase in turbidity can result in the smothering of sessile prey species and associated habitats.

136. The following potential impacts to fish and shellfish receptors are assessed in Volume 2, Chapter 9: Fish and Shellfish Ecology:

- Temporary habitat and species loss or disturbance (C & D);
- Temporary increases in suspended sediment concentrations (SSC) and associated sediment deposition and potential release of contaminants (C & D); and
- Underwater sound (C & D).

11.12.1.2.2 Magnitude of impact

137. The conclusions drawn in Volume 2, Chapter 9: Fish and Shellfish Ecology concluded that construction activities associated with the Marine Scheme would not result in a significant effect on fish, shellfish or benthic species which are considered to be key prey species for marine mammals.

138. For potential impacts during the pre-construction/construction and decommissioning phases i.e. underwater sound from SBP operations, temporary habitat/species loss and disturbance and temporary increases in suspended sediment, impacts would only occur during a temporally constrained period, and would be highly localised and transient. For example, the potential for injury to the most acoustically-sensitive species – herring *Clupea harengus* – was predicted to result in a small zone of impact and would not lead to significant impacts on this species. Similarly, for temporary habitat loss and SSC there would be high recoverability for fish and shellfish species, including sandeels which are known to be important prey for a range of marine mammal species

including harbour porpoise and seal species (Santos et al. 2004; Wilson & Hammond, 2019). The magnitude of these impacts to marine mammal prey species is assessed as low/negligible.

139. While impacts on fish and shellfish could affect marine mammals indirectly (through disruption to prey availability), any impacts to species that are prey to marine mammals are predicted to be of local spatial extent and will be reversible (i.e., impacts will cease when the activity ceases). Individually, these impacts have been assessed as of low magnitude. Overall, the magnitude is therefore considered to be low.

11.12.1.2.3 Sensitivity of the receptor

140. Increased sediment loading in the water column as a result of construction and decommissioning activities associated with the Marine Scheme, and the associated increased turbidity, has the potential to affect fish and shellfish communities which in turn could lead to indirect effects on marine mammals (e.g. reduced prey availability and foraging success of marine mammals). For example, elevated SSC and smothering could lead to mortality in some individuals (particularly low mobility species) leading to localised reductions in abundance or shifts in community structure. However, these impacts are likely to be very localised and temporary in nature and are considered unlikely to have any short- or long-term consequences for marine mammals, given the widespread distribution of their prey and the recoverability of most prey species to these short-term impacts.

141. While marine mammals are considered to be of high conservation value, they are deemed to be of low vulnerability and high recoverability. The sensitivity of the receptor is therefore considered to be low.

11.12.1.2.4 Significance of the effect

142. As outlined above and identified in Chapter 9: Fish and Shellfish Ecology and Chapter 8: Benthic and Subtidal Ecology no significant effects on marine mammal prey species have been identified from construction impacts resulting from the Marine Scheme. Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of marine mammal receptors is considered to be **low**. The effect will, therefore, be of **negligible adverse** significance, which is **not significant** in EIA terms.

11.12.1.2.5 Secondary mitigation and residual effect

143. Given that there are no likely significant effects in EIA terms, secondary mitigation is not required.

11.12.2. Effects During Operation and Maintenance

11.12.2.1 PERMANENT HABITAT CHANGE, INCLUDING THE POTENTIAL FOR CHANGE IN FORAGING OPPORTUNITIES

144. Long-term habitat changes during the operation and maintenance phase of the Marine Scheme may arise as a result of the placement of cable protection (such as rock) on the seabed, which can bring about reef effects (i.e., the concentrating of biomass where it would not otherwise normally occur). This results from the accumulation of lower trophic organisms on cable infrastructure and associated protection. Higher tropic species such as fish and crustaceans may be attracted to the site, with Marine Scheme infrastructure acting as a fish aggregation device, due to the presence of novel foraging opportunities and ecological enrichment. Reef effects have the potential to attract predatory species, including marine mammals. It is therefore important to consider how this effect may result in impacts to the distribution and abundance of marine mammals throughout the lifetime of the Marine Scheme. These effects may be either positive or negative in nature.

145. There are records of marine mammals utilising offshore infrastructure (such as offshore export cables) and exploiting fish aggregations at these locations. The introduction of artificial hard substrates to the marine environment will potentially alter the structure of existing benthic and demersal communities within the Marine Scheme cable corridor.

146. This section considers the impact of the permanent habitat modifications due to the presence of the cable protection within the marine environment on marine mammals.

11.12.2.1.2 Magnitude of impact

147. The Marine Scheme base case is to achieve cable burial along the entire cable route. Additional external cable protection measures will only be required where the target burial depth cannot be achieved due to seabed type and features, e.g. rock outcrops and buried boulders. The presence of external cable protection across the Marine Scheme is anticipated to include approx. 0.37 km^2 of hard substrate within the Marine Scheme. Details on the nature of cable protection methods to be utilised as part of the Marine Scheme and the maximum volume of cable protection to be used can be found in Volume 2, Chapter 5: Project Description.

148. The nature and extent of fish aggregations associated with reef effects will be influenced by the nature of biofouling organisms colonising hard substrates across the Marine Scheme.

149. Three types of higher-trophic-level species with mobility appear to benefit from the increased availability of food at biofouling sites (Degraer *et al*., 2020):

- Species that predate the biofouling community for a prolonged period;
- Species that occasionally predate the biofouling community; and
- Species that are attracted for non-trophic reasons (e.g., to find shelter or to encounter other individuals of their species which may lead to their creating larger colonies and thus increasing their safety and changes of finding food and mates).

150. There is evidence of marine mammals exploiting these aggregations of prey species, with work by Fernandez-Betelu *et al*. (2022) providing evidence to suggest that the occurrence of harbour porpoise and foraging activity increased around offshore infrastructures (with a significant increase in foraging activity occurring within 200 m of the structure) and existing research from Russell *et al*., (2014) concluding that in response to the introduction of structures associated with offshore developments that provide artificial reefs, grey and harbour seal individuals exploit the increased foraging opportunities associated with fish aggregations around these artificial reefs. The permanent presence of cable protection associated with the Marine Scheme and the associated reef effects that may result have the potential to result in beneficial impacts to marine mammal receptors. Furthermore, the introduction of hard substrate to the marine environment may affect the presence and availability of spawning and nursery habitats for fish species which are prey for marine mammals (including herring and sandeel). The introduction of cable protection into a largely soft-sediment environment may have localised adverse impacts on the spawning habitat of some species which are dependent on particular sediment characteristics.

151. Overall, the potential area of impact associated with the presence of cable protection across the Marine Scheme is very small in the context of the nature and extent of habitat types throughout the North Sea and is therefore considered not likely to have an extensive spatial influence on habitats which support marine mammals and fish and shellfish species which are prey for marine mammals.

152. The conclusions drawn in Volume 2, Chapter 9: Fish and Shellfish Ecology concluded that permanent habitat changes associated with the Marine Scheme would not result in a significant effect on fish, shellfish or benthic species which are considered to be key prey species for marine mammals.

153. While any effect has the potential to affect the marine mammals indirectly, the impact is predicted to be of local spatial extent, long term duration, and will be transient in nature, with medium reversibility. The magnitude is therefore considered to be low.

11.12.2.1.3 Sensitivity of the receptor

154. Marine mammals may be sensitive to long-term habitat change and associated changes in foraging opportunities, where there may be reductions in the availability of key prey, such that animals may have to travel further to find prey or shift target species. However, owing to the highly localised impact on marine mammal prey species from the permanent changes of habitat resulting from the Marine Scheme, marine mammals will be able to forage widely and exploit a range of prey species, and hence are able to accommodate localised habitat changes. Impacts due to permanent changes to seabed habitats are not likely to have any impact on the conservation status of marine mammal populations.

155. Marine mammals are deemed to be of moderate vulnerability and high recoverability. The sensitivity of the receptor is therefore considered to be low.

11.12.2.1.4 Significance of the effect

156. As outlined in Volume 2, Chapter 9: Fish and Shellfish Ecology and Volume 2, Chapter 8: Benthic and Intertidal Ecology, it is considered that the potential for aggregations of fish which are prey species for marine mammals around hard structures is not significant. While it is acknowledged that artificial reefs affects and associated fish aggregations are potentially beneficial for marine mammals which predate these species, these were not found to be significant in EIA terms.

157. Therefore, permanent habitat change from the introduction of cable protection are not anticipated to result in any significant changes to the abundance or distribution of fish species which act as prey for marine mammals. Overall, the magnitude of the impact is deemed to be **low,** and the sensitivity of marine mammal receptors is considered to be **low**. The effect will, therefore, be of **low adverse significance**, which **is not significant** in EIA terms.

11.12.2.1.5 Secondary mitigation and residual effect

158. Given that there are no likely significant effects in EIA terms, secondary mitigation is not required.

11.12.2.2 INDIRECT EFFECTS ON MARINE MAMMALS THROUGH EFFECTS ON PREY SPECIES

159. The operation of the Offshore Export Cables will result in localised emissions of EMFs and heat which have the potential to affect fish and shellfish species which are prey for marine mammals. EMFs have the potential to affect the sensory mechanisms of certain fish and shellfish species, while heat emitted by the electrical current passing through the cable has the potential to cause localised heating of the sediment, affecting demersal species.

160. The following potential impacts to fish and shellfish receptors are assessed in Volume 2, Chapter 9: Fish and Shellfish Ecology:

- EMF effects (O&M); and
- Thermal emissions (O&M).

11.12.2.2.2 Magnitude of impact

161. In relation to the potential for EMF impacts to fish and shellfish species that which are prey to marine mammals, the conclusions drawn from Volume 2, Chapter 9: Fish and Shellfish Ecology found that for the maximum EMF strengths for the Marine Scheme (associated with a bipole

configuration rates at 525 kV) and the 320 kV symmetrical monopole configuration, is approximately 658 µT and 541 µT respectively. For both configurations the EMF strength falls baseline levels within 10-20 m of the Marine Scheme export cables, assuming 0.5 m depth of burial. Furthermore, where burial of the Marine Scheme export cables to a greater depth is possible (i.e., deeper than 0.5 m as outlined in Volume 2, Chapter 3: Project Description), EMF strengths at the seabed will be further reduced.

162. When considering the impacts of thermal emissions on fish and shellfish species which are prey for marine mammals, Volume 2, Chapter 9: Fish and Shellfish Ecology concludes that thermal emissions from cables will increase the temperature of surrounding sediments by a maximum of 2.5°C at 50 cm directly below the cable (Taormina *et al*., 2018). It was concluded that any increases in temperature within the sediments would be highly localised to the source (see Volume 2, Chapter 8: Benthic and Intertidal Ecology for details on the nature of sediment associated with the Marine Scheme).

163. For both pathways the impacts are predicted to be highly localised in spatial extent, long-term in duration, continuous and not reversible during the operational phase of the Marine Scheme. The overall magnitude of effect for EMF impacts and thermal emissions on fish and shellfish species which are prey to marine mammals are considered to be low.

164. Owing to the low overall magnitude of effect to fish and shellfish species which are prey to marine mammals, any indirect effects on marine mammals through adverse effects on prey are predicted to be of local spatial extent, long-term in duration, and continuous. Overall, the magnitude is therefore considered to be low.

11.12.2.2.3 Sensitivity of the receptor

165. For all species considered as part of Volume 2, Chapter 9: Fish and Shellfish Ecology (including marine finfish, diadromous fish shellfish and elasmobranchs) the potential for vulnerability to EMF emissions was deemed to be low to medium, with all species demonstrating a high recoverability.

166. The assessment of potential impacts arising from thermal emissions concluded that those species closely associated with the seabed (i.e., demersal fish and shellfish) were of low vulnerability and high recoverability.

167. Owing to the low overall vulnerability to fish and shellfish species which are prey to marine mammals to EMF effects and thermal emissions, any indirect effects on marine mammal through adverse effects on prey are predicted to be of low vulnerability and high recoverability. Marine mammals will be able to forage widely and exploit a range of prey species, and hence are able to accommodate localised changes in prey availability. Indirect impacts on marine mammals due to EMF and thermal emission impacts on their prey species are not likely to have any impact on the conservation status of marine mammal populations. Overall, the sensitivity of the receptor is therefore considered to be low.

11.12.2.2.4 Significance of the effect

168. As outlined in Volume 2, Chapter 9: Fish and Shellfish Ecology, the overall magnitude of impact for fish and shellfish species as result of EMF effects and thermal emissions from the Marine Scheme are deemed to be low with a negligible or minor adverse significance. Overall, the magnitude of impact of indirect effects on marine mammals through effects on prey species is deemed to be **low** and the sensitivity of marine mammal receptors is considered to be **low**. The effect will therefore be of **negligible adverse** significance, which is **not significant** in EIA terms.

11.12.2.2.5 Secondary mitigation and residual effect

169. Given that there are no likely significant effects in EIA terms, secondary mitigation is not required.

11.12.3. Effects During Decommissioning

170. At the end of the operation and maintenance phase of the Marine Scheme, the options for decommissioning works will be assessed, taking into consideration constraints (e.g., safety and liability) and the potential environmental impacts associated with decommissioning works.

171. The principal options for decommissioning include:

- Leaving the cable in-situ, trenched;
- Leaving the cable in-situ and providing additional protection;
- Remove sections of the cable; and
- Remove the cable entirely.

172. Of the four principle decommissioning options, the complete removal of the cable would have the most significant adverse effect on marine mammal receptors, due to the temporary habitat disturbance and potential for increased SSC. Should complete removal of the cable be required, the significance of these effects is considered to result in similar impacts to those indirect impacts on prey species assessed as part of the construction phase of the Marine Scheme, i.e., temporary habitat and species loss or disturbance, temporary increases in SSC and associated sediment deposition, and underwater sound. As the complete removal of the cable would have the most significant adverse effect on marine mammal receptors, any other decommissioning option would result in no more significant adverse effect that the complete removal of the cable.

173. Overall, the magnitude of the impact is deemed to be **low,** and the sensitivity of the receptor is considered to be **low**. The effect will, therefore, be of **low adverse significance**, which **is not significant** in EIA terms.

11.13. Proposed Mitigation and Monitoring

174. With consideration given to the designed-in measures for the Marine Scheme, the assessment has concluded no likely significant adverse effects to any marine mammal species. Therefore, there is no requirement for additional mitigation or monitoring over and above the designed-in measures already identified.

11.14. Cumulative Effects Assessment

11.14.1. Methodology

175. The consideration of plans or developments which have the potential to result in cumulative impacts on marine mammals considers developments with construction periods that overlap with the Marine Scheme, and which have sufficient information within the public domain to allow for a robust assessment to be undertaken. Activities associated with oil and gas operations and carbon capture and storage (CCS) assets within the North Sea have been considered qualitatively and the key sources of effects from these activities is associated with seismic survey activities.

176. The Cumulative Effects Assessment (CEA) takes into account the impact associated with the Marine Scheme together with other relevant plans, developments and activities. Cumulative effects are therefore the complete set of effects arising from the Marine Scheme together with the effects from other developments, on the same receptor or resource. Please see Volume 2, Chapter 3: EIA Methodology for further details.

177. The developments selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise and the development of a ‘long list’ of cumulative developments relevant to the Marine Scheme (see Volume 3, Appendix 3.4: Long-list of Cumulative Developments). Each development has been considered on a case by case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved, to create the ‘short list’ as summarised in Table 11.20. This approach was agreed during Scoping and further consultation and technical engagement undertaken with consultees, as detailed in Table 11.3.The specific projects scoped into the CEA for marine mammals, are outlined in Table 11.20 and presented in Figure 11.5.

178. It is appropriate to consider the Landfall area in further detail in the context of the Cambois Connection Onshore Scheme. Based on the maximum design scenario for the Marine Scheme, a trenchless technique, such as HDD, will be deployed to bring the Offshore Export Cables ashore via ducts that will be installed from a point landward of MHWS to an exit point at least 250 m seaward of MLWS, thus completely bypassing the intertidal area. All construction works and infrastructure associated with the Onshore Scheme will be above MHWS, and landward of the dune system on Cambois beach, and therefore there is no potential for any direct interaction with the intertidal area. Given there will be no construction works associated with the Onshore Scheme within the intertidal area, there is no potential for any direct effects on intertidal species. Furthermore, as any works associated with the construction of the Landfall are not considered to generate an underwater sound profile which will result in injury or disturbance to marine mammals the Onshore Scheme is not considered further within this CEA. Further detail on the Onshore Scheme is provided in Volume 2, Chapter 5 Project Description

Table 11.20 List of other developments considered within the CEA for marine mammals

Development/Plan[8]	Status	Distance from Marine Scheme (km)	Description of Development/Plan	Dates of Construction (if Applicable)[9]	Dates of Operation (if Applicable)	Phase Overlap with the Marine Scheme
BBWF	In planning	0 km (direct physical overlap)	Offshore wind farm and associated grid connection infrastructure	Construction anticipated to be 2025 to 2033	Operational from 2033	Construction and operation and maintenance
Eastern Green Link (EGL) 1	In planning	0 km (direct physical overlap)	HVDC electricity cable from the Torness area in East Lothian (Scotland) to Hawthorn Pit in County Durham	Construction anticipated to be 2024 to 2027	Operational from 2027	Construction and operation and maintenance
Eastern Green Link (EGL) 2	In planning	3 km	A sub-sea HVDC cable from Sandford Bay at Peterhead, Scotland to Drax in England.	Construction anticipated to be 2025 to 2029	n/a	Construction and operation and maintenance
Blyth Demonstration Phase 2 (&3) Cable Corridor	Consented	0 km (direct physical overlap at Landfall)	Export cable for the Blyth Demonstrator Offshore Wind Farm Phase 2 (&3)	Unknown	Unknown	Unknown
Northumberland Energy Park (Phase 3)	Consented	1 km	Port development	Unknown	Unknown	Unknown

[9] Construction programme for the Marine Scheme is anticipated to be from Q4 2026 to Q4 2029

Development/Plan[8]	Status	Distance from Marine Scheme (km)	Description of Development/Plan	Dates of Construction (if Applicable)[9]	Dates of Operation (if Applicable)	Phase Overlap with the Marine Scheme
Inch Cape Offshore Wind Farm	Consented	19 km	Offshore wind farm consisting of 72 turbines and offshore transmission infrastructure	2022 to 2025	2025	Construction and operation and maintenance
Neart Na Gaoithe Offshore Wind –	Under construction	17 km	Offshore wind farm located off the coast of Fife, Scotland	2022 to 2024	2024	Operation and maintenance
Seagreen 1	Under construction	5 km	Offshore wind farm development	2022 to 2023	2023	Operation and maintenance
Seagreen 1 A Project	Consented	23 km	Transmission infrastructure for Seagreen 1	2024 to 2026	2026	Construction and operation and maintenance
Inch Cape OFTO	Consented – Pending Variation	10 km	Transmission infrastructure of Inch Cape	2022 to 2025	2025	Construction and operation and maintenance
Neart Na Gaoithe OFTO	Under construction	22 km	Transmission infrastructure of Neart Na Gaoithe	2020 to 2024	2024	Operation and maintenance
Blyth Demonstrator Offshore Wind Farm Phase 2	Consented	1 km	A proposed development for a floating offshore wind farm located off the coast of Blyth which will be used exclusively to demonstrate innovative floating offshore wind technology	Unknown	Unknown	Unknown

11.15. Cumulative Effects Assessment

179. An assessment of the likely significance of the cumulative effects of the Marine Scheme upon marine mammal receptors arising from each identified impact is given below.

180. It should be noted that the Marine Scheme and BBWF overlap both spatially (within the BBWF array area) and temporally (with regards to construction, operation and maintenance and decommissioning).

11.15.1. Effects During Construction

11.15.1.1 CUMULATIVE NOISE RELATED IMPACTS FROM PRE-CONSTRUCTION AND CONSTRUCTION ACTIVIITES

181. This section of the cumulative effects assessment provides a quantitative impact assessment of the cumulative effects of sound related impacts to marine mammals. In line with the assessment of effects during construction (section 11.12.1), only the activities associated with Marine Scheme geophysical surveys (i.e., SBP and USBL operations) are considered to result in a potential impact to marine mammals species. These impacts could have cumulative impacts on marine mammals in combination with construction activities associated with offshore wind developments (i.e., impact piling).

182. Of the 12 developments identified in Table 11.20, six have construction timelines which have the potential to overlap with the construction phase of the Marine Scheme. Given the localised nature of works associated with the Marine Scheme, the intervening distance to the developments and their construction timelines, the Inch Cape Offshore Wind Farm, the Seagreen 1A Project and the Inch Cape OFTO have not been considered further as part of this assessment.

183. There is no information which is publicly available regarding the Blyth Demonstrator Offshore Wind Farm Phase 2 generation assets or export cable construction programme and therefore a detailed assessment is not possible. Notwithstanding, for completeness, the Applicant has re-considered the environmental information presented for the Blyth Demonstrator Offshore Wind Farm Phase 2 development (EDF, 2019). On the basis of the technology proposed (floating turbines with no percussive piling) and the conclusions of the updated impact assessments (no significant effects / scoped-out from further detailed assessment), cumulative effects would be highly unlikely, irrespective of programme considerations. It is also important to recognise that both the Marine Scheme and the Blyth Demonstrator Offshore Wind Farm Phase 2 development are complex developments with complicated construction programmes influenced by numerous different factors; it is highly unlikely for there to be a simultaneous installation / construction period.

184. Of the remaining four developments one is an offshore wind farm (the BBWF) and two are subsea cables (EGL1 and EGL 2).

185. The assessment of potential impacts arising from underwater sound on marine mammal receptors completed for the EGL1 and EGL 2 projects considered the physiological and behavioural impacts to these species arising from USBL and SBP operations. The assessment of potential for physiological (auditory) impacts considered the injury impact zones for USBL (based on both SPL_{peak} and SEL_{cum} thresholds), the injury impact distances for SBP operations and the JNCC guidelines for minimising the risk of injury in marine mammals (JNCC, 2017). The assessment of behavioural impacts considered the EDR of animals within 5 km of SBP operations and the estimated number of animals likely to be presented within the immediate vicinity of SBP operations at start-up. Overall, both projects concluded that, with the inclusion of embedded mitigation

measures for SBP operations, the potential for either physiological or behavioural disturbance to marine mammals was minor (<0.01% proportion of the MU disturbed for harbour porpoise, bottlenose dolphin, white-beaked dolphin and minke whale), and therefore not significant.

186. The assessment of impacts arising from underwater sound associated with the Marine Scheme on marine mammal receptors (presented in section 11.12) concluded these impacts to be of low adverse significance, which is not significant in EIA terms. As the significance of effect for the EGL 1 and EGL 2 projects and the Marine Scheme were concluded as not significant in isolation, it is therefore considered that there will be no significant cumulative effects on marine mammal species.

187. As such, the only development which is considered to have the potential result in a cumulative effect on marine mammals is the construction of the BBWF given that the Marine Scheme wholly overlaps the BBWF array area and that construction activities in the BBWF array area are expected to occur between 2025 and 2033.

11.15.1.1.2 Magnitude of impact

188. Sound related impacts to marine mammals arising from Marine Scheme pre-construction survey (i.e., SBP and USBL) works are highly influenced by the nature of the works and the receiving environment. Sound attenuates as it propagates throughout the water column and the magnitude of impact will be influenced by local oceanographic conditions (influencing both the path of the sound into the water column and how much sound is transmitted). It is noted that with respect to marine mammal injury, both the BBWF and the Marine Scheme have demonstrated that through the implementation of appropriate mitigation the risk of injury is reduced to negligible levels, and as such is not considered further in this CEA.

189. **SBP (disturbance)**: as assessed within section 11.12, sound emissions have the potential to result in behavioural impacts to marine mammal species. Using a 5 km EDR radius and based on relevant species densities, it was concluded that for each respective marine mammal MU, <1% of the population will exhibit behavioural disturbance.

190. **USBL (disturbance)**: as assessed within section 11.12, behavioural disturbance as a result of USBL operations (considering the 5 km EDR as with SBP operations) is not considered to be appropriate. As such a simple geometric spreading model was used which identified that the maximum range of disturbance is estimated to be 64 m, which, considering the marine mammal population densities in the region, equates to >0.1 individual of each marine mammal species being affected.

191. **Piling (disturbance)**: within the BBWF EIAR, the potential for disturbance to marine mammals as a result of underwater noise associated with piling activities considered the following disturbance criteria:

Table 11.21 BBWF EIAR disturbance criteria for marine mammals (BBWF, 2022)

Effect	Non-Impulsive Threshold	Impulsive Threshold (other than piling	Impulsive Threshold (piling)
Mild disturbance (all marine mammals)	n/a	140 dB re 1µ Pa (rms)	Based on SEL 5 dB contours
Strong disturbance (all marine mammals)	120 dB re 1µ Pa (rms)	160 dB re 1µ Pa (rms)	Based on SEL 5 dB contours

192. The assessment of marine mammals disturbed as a result of underwater noise from BBWF piling activities considered the seasonal peak densities of animals predicted to experience potential disturbance from concurrent piling at a maximum hammer energy of 4,000 kJ. Table 11.22 below summarises the numbers of animals disturbed by BBWF piling operations and the associated percentage of the MU population disturbed.

Table 11.22 Number of animals disturbed during BBWF piling operations

Species	Numbers of animals disturbed**	Percentage of MU population disturbed (%)
Harbour porpoise	2,822	0.81
Bottlenose dolphin	5	2.25
White-beaked dolphin	830	1.89
Minke whale	132	0.66
Harbour seal	3	0.39***
Grey seal	1,358	3.19***

* strong threshold (Weighted SEL) 160 dB re 1 µPa (rms) (BBWFL, 2022a)
** based on seasonal peak density
*** of the ES SMU and NEE SMU combined

193. The estimated number of individuals potentially disturbed by BBWF piling operations used disturbance ranges based on the maximum hammer energy, and marine mammal density was derived from SCANS III and Carter *et al.*, (2022) density estimates. Population modelling, using the interim Population Consequences of Disturbance (iPCoD) model, was undertaken for all species except white-beaked dolphin.

194. Through the use of these disturbance criteria BBWF was able to qualify the magnitude of effect and spatial extent of disturbance. Concluding that while there is the potential for disturbance to marine mammals as a result of piling activities, the cumulative iPCoD modelling conducted by BBWF demonstrated that this is not expected to result in population consequences for any marine mammal species. Bottlenose dolphin, minke whale, harbour seal and grey seal results show a median of the ratio of impacted population to unimpacted population at all modelled time points 25 years after the commencement of piling. For harbour porpoise cumulative iPCoD modelling concluded that median ratio of size of the impacted to unimpacted population at a modelled time point 25 years after commencement of piling was 99.2%, with a small impact on population size over time (i.e., 345,311 for the impacted population and 349,064 for the unimpacted population) (BBWFL, 2022a). For each of these species it was concluded that there was no potential for long-term effects as a result of cumulative impacts from piling activities.

195. It is noted that iPCoD modelling for white-beaked dolphin was not undertaken for the BBWF as the population parameters required for the model (e.g., relevant population, age calf/pup becomes independent, age at first reproduction etc.) are not available. It was however concluded that, given the vast extent of available habitat for this species, the wide-ranging nature of white-beaked dolphin and the low percentage of animals within the CGNS MU that will be potentially disturbed by cumulative developments, the likelihood of potential cumulative impacts is considered to be low.

196. Therefore, while there is the potential for cumulative underwater sound effects on marine mammals, given the BBWF piling is not anticipated to result in any population level consequences and the

very low numbers of marine mammals predicted to be affected by the Marine Scheme, the cumulative magnitude is considered to be low.

11.15.1.1.3 Sensitivity of receptor

197. The behavioural response exhibited by marine mammals directly exposed to an underwater sound source are highly viable and context specific. A behavioural response can include increased alertness, altered vocal behavioural, alteration of movements or driving behaviour or temporary or permanent habitat abandonment. The behavioural response of a marine mammal species to an underwater sound is influenced by its ability to perceive sounds within its functional hearing ground (as outlined in section 11.12.14).

198. Marine mammals are considered to be of high conservation value. Rates of disturbance from acoustic emissions associated with the Marine Scheme are unlikely to significantly affect individual vital rates. Individuals are likely to recover from any impacts, and populations are unlikely to experience significant impacts. As a result, these species are deemed to be of low vulnerability to acoustic impacts. As any impacts are likely to be highly recoverable, the sensitivity of marine mammal receptors is therefore considered to be low.

11.15.1.1.4 Significance of effect

199. When considering the highly localised nature of underwater sound and the transient nature of works associated with the Marine Scheme, any direct spatial overlap in underwater noise emissions with the BBWF will be for a short duration and over a limited spatial extent.

200. Overall, the magnitude of the cumulative underwater sound effects to marine mammals is deemed to be **low** and the sensitivity of the receptor is considered to be **low**. The cumulative effect will, therefore, be of **low adverse** significance, which is **not significant** in EIA terms.

11.15.1.1.5 Secondary mitigation and residual effect

201. Given that there are no likely significant cumulative effects in EIA terms, secondary mitigation is not required.

11.15.1.2 CUMULATIVE INDIRECT EFFECTS ON MARINE MAMMALS THROUGH EFFECTS ON PREY SPECIES

11.15.1.2.1 Introduction of impact

202. This section of the cumulative effects assessment provides a qualitative assessment of the cumulative effects of indirect impacts on marine mammal prey species. The potential for this impact to result in a cumulative effect on marine mammal receptors will arise from offshore developments that have a construction phase which will potentially overlap with the construction of the Marine Scheme. Cumulative construction activities have the potential to result in impacts to fish and shellfish species which are prey to marine mammals.

203. Of the 12 developments identified as part of Table 11.20, six have construction timelines which have the potential to overlap with the construction phase of the Marine Scheme. Given the localised nature of works associated with the Marine Scheme, the intervening distance to the developments and their construction timelines, the Inch Cape Offshore Wind Farm, the Seagreen 1A Project and the Inch Cape OFTO have not been considered further as part of this assessment. Of the remaining four developments one is an offshore wind farm (the BBWF) and two are subsea cables (EGL1 and EGL 2).

204. In addition to the impacts of the Marine Scheme to fish and shellfish receptors which are prey for marine mammals (as assessed in Volume 2, Chapter 9: Fish and Shellfish Ecology), this assessment considers impacts assessed as part of the EGL1 and EGL2 projects during construction and decommissioning which considered the following impact pathways:

- Temporary physical disturbance to fish and shellfish habitats;
- Temporary increases in SSC and associated deposition;
- A reduction in marine water quality;
- Underwater noise; and
- Vessel collision risk.

205. For each of these impact pathways the assessment considered the sensitivity of fish and shellfish species to temporary disturbance and/or displacement from their associated spawning or nursery grounds, the distribution of species within the study area and the ability of species to respond to temporary environmental changes. For all impact pathways noted above, installation activities associated with the EGL1 and EGL2 projects were concluded to have a negligible or minor adverse effect on fish and shellfish species and are therefore considered to be not significant.

206. The assessment of impacts arising from indirect effect on marine mammals through effects on prey species associated with the Marine Scheme (presented in section 11.12) concluded these impacts to be of negligible adverse significance, which is not significant in EIA terms. As the significance of effect for the EGL 1 and EGL 2 projects and the Marine Scheme were concluded as not significant in isolation, it is therefore considered that there will be no significant cumulative effects on marine mammal species.

207. As such, the only development which is considered to have the potential result in a cumulative indirect effect on marine mammals through effects on prey species is the construction of the BBWF given that the Marine Scheme wholly overlaps the BBWF array area and construction will occur between 2025 and 2033 therefore also overlapping construction of the Marine Scheme.

11.15.1.2.2 Magnitude of impact

208. As presented within Volume 2, Chapter 9: Fish and Shellfish Ecology, it is concluded that any construction activities which have the potential to result in an increase in SSC would not result in a significant effect on fish, shellfish or benthic species which are considered to be key prey species for marine mammals. The BBWF considered the potential for seabed clearance, foundation drilling and infrastructure installation to result in an increase in SSC and associated deposition, however it was concluded that for all marine and diadromous species with are prey for marine mammals, the potential impacts were negligible to minor which is not significant in EIA terms once designed in mitigation had been applied. The BBWF further concluded that any sediment plumes associated with construction activities will be confined to the lower reaches of the water column within the immediate vicinity of activities and will likely disperse and fall out of suspension locally. No significant adverse effects on fish and shellfish receptors were identified by the BBWF EIA (BBWF, 2022).

209. While any impact on fish and shellfish receptors associated with the Marine Scheme and the BBWF may affect marine mammals indirectly, potential cumulative impacts to fish and shellfish species that are prey to marine mammals are predicted to be of local spatial extent and will be reversible. The magnitude is therefore, considered to be low.

11.15.1.2.3 Sensitivity of receptor

210. A cumulative increase in sediment loading in the water column as a result of overlapping construction phases from the Marine Scheme and the BBWF, and the associated increased

turbidity, has the potential to reduce the foraging success of marine mammals (particularly for visual predators such as seals). However marine mammals are highly mobile generalist predators, and as such are considered to be highly tolerable to effects on prey species and foraging conditions.

211. Given the small spatial footprint of these effects, the relative low value of foraging habitats within the Marine Scheme and the BBWF (as detailed in Volume 2, Chapter 9: Fish and Shellfish Ecology) and the limited potential for significant temporary or long-term impacts from any impact on prey species , any potential impacts to marine mammal species are considered to be minor and are not likely to impact the Favourable Conservation Status of any marine mammal species.

212. Marine mammals are deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

11.15.1.2.4 Significance of effect

213. The potential for indirect effects on prey species will be highly localised (i.e., restricted to the environment immediately adjacent to construction activities) and the highly mobile nature of marine mammals means that they will be able to avoid these areas in pursuit of prey. The demersal environment associated with the Marine Scheme and the BBWF have not been identified as critical foraging resources for marine mammal species (BBWF, 2022).

214. Overall, the magnitude of the cumulative effect is deemed to be **low,** and the sensitivity of the receptor is considered to be **low**. The cumulative effect will, therefore, be of **negligible adverse significance**, which is **not significant** in EIA terms.

11.15.1.2.5 Secondary mitigation and residual effect

215. Given that there are no likely significant cumulative effects in EIA terms, secondary mitigation is not required.

11.15.2. Effects During Operation and maintenance

11.15.2.1 CUMULATIVE PERMANENT HABITAT CHANGE, INCLUDING THE POTENTIAL FOR CHANGE IN FORAGING OPPORTUNITIES

216. The introduction of artificial hard substrates to the marine environment will potentially alter the structure of existing benthic communities. There are records of marine mammals utilising offshore infrastructure (such as offshore export cables) and exploiting fish aggregations at these locations (Russell *et al.*, 2014; Todd *et al*., 2009).

217. The primary impact pathways that have the potential to result in cumulative permanent habitat change is associated with the introduction of external protection into the marine environment through the addition of hard substrate (i.e., cable protection). Developments which are operational within the marine environment are considered part of the existing marine mammal baseline characterisation, with any impacts arising from fish aggregation around artificial structures and hard substrate considered appropriately as part of section 11.7. Therefore, this section only considers permanent habitat modification due to the introduction of hard substrates associated with developments that have a construction phase overlapping the operational life of the Marine Scheme and that are within the Marine Mammal Study Area.

218. The potential cumulative permanent habitat change effects on fish and shellfish receptors with are prey for marine mammals are assessed in Volume 2, Chapter 9: Fish and Shellfish Ecology. Of the 13 developments identified in Table 11.20, eight are identified as having the potential to result

in cumulative habitat change effects through a direct spatial overlap with the Marine Mammal Study Area. These developments include:

- BBWF;
- Eastern Green Link 1;
- Eastern Green Link 2;
- Blyth Demonstrator Offshore Wind Farm - Phase 2;
- Blyth Demonstration Phase 2 (&3) Cable Corridor;
- Seagreen 1;
- Inch Cape Offshore Wind Farm; and
- Inch Cape OFTO.

11.15.2.1.2 Magnitude of impact

219. The introduction of cable protection across the Marine Scheme considers a range of measures, including rock protection, concrete mattresses, sand, rock and grout bags and cable protection systems (see Volume 2, Chapter 5: Project Description).

220. For the Marine Scheme and the five other developments identified above, the area of cumulative permanent habitat loss is summarised in Table 11.23 below. The values presented in this table consider the likely worse-case scenario for each development and are therefore likely to be overestimates. The area of permanent habitat loss for the Blyth Demonstration Phase 2 cable corridor is unknown, however given the proportionally shorter length of the cable corridor when compared against the Marine Scheme (approximately 10 km), it is assumed that the quantity of cable protection required for the development will be significantly smaller (i.e., less than 1.46 km^2).

221. The project with the greatest extent of overlap is the BBWF given that the Marine Scheme boundary wholly overlaps the BBWF array area. However, the Marine Scheme Offshore Export Cables and any associated cable protection will only occupy a very small proportion of the total BBWF array area.

Table 11.23 Area of cumulative permanent habitat loss

Development	Area of permanent habitat loss (km^2)	Source
Marine Scheme	1.46	Volume 2, Chapter 5: Project Description
BBWF	7.80	BBWFL, 2022a
EGL1	0.73	National Grid and Scottish Power, 2022
EGL2	2.00	National Grid and SSEN, 2022
Blyth Demonstrator Offshore Wind Farm – Phase 2	0.06	EDF Renewables, 2020
Blyth Demonstration Phase 2 (&3) Cable Corridor	Unknown	EDF Renewables, 2020
Seagreen 1	2.23	Seagreen Alpha Wind Energy Limited, 2012
Inch Cape Offshore Wind Farm	1.87	Inch Cape Offshore Limited, 2020

Development	Area of permanent habitat loss (km^2)	Source
Inch Cape OFTO	0.60	Inch Cape Offshore Limited, 2020
Total	**16.75**	

222. The potential for cumulative impacts in terms of long-term habitat change and the associated potential for change in foraging opportunities will be influenced by the extent of cable burial and the nature of cable protection adopted by both the Marine Scheme and the cumulative developments. It is also important to note that cable protection is unlikely to be installed continuously in the same area and therefore the permanent loss of habitat for fish and shellfish species which are prey for marine mammals will not be concentrated within the Marine Mammals Study Area. Furthermore, owing to variations in the nature of the seabed and substrate types across the Marine Mammal Study Area, it is unlikely that the presence of cable protection will consistently affect the same habitat types and therefore the impact on fish and shellfish habitat will be much smaller in the context of the wider habitat distribution throughout the North Sea.

223. Given the nature and extent of the cumulative introduction of hard substrate into the marine environment, the cumulative impact is predicted to be of local spatial extent, long term duration, continuous and medium reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be low.

11.15.2.1.3 Sensitivity of receptor

224. Marine mammals may be sensitive to long-term habitat change and associated changes in foraging opportunities, where there may be reductions in the availability of key prey, such that animals may have to travel further to find prey or shift target species. However, owing to the highly localised impact on marine mammal prey species from the permanent changes of habitat resulting from the Marine Scheme (as assessed in Volume 2, Chapter 9: Fish and Shellfish Ecology), marine mammals will be able to forage widely and exploit a range of prey species, and hence are able to accommodate localised habitat changes. Impacts due to permanent changes to seabed habitats are not likely to have any impact on the conservation status of marine mammal populations.

225. Marine mammals are deemed to be of moderate vulnerability and high recoverability. The sensitivity of the receptor is therefore considered to be low.

11.15.2.1.4 Significance of effect

226. As outlined in Volume 2, Chapter 9: Fish and Shellfish Ecology and Volume 2, Chapter 8: Benthic and Intertidal Ecology, it is considered that the cumulative effects on fish, shellfish and benthic receptors which may be prey species for marine mammals is not significant. While it is acknowledged that artificial reefs affects and associated fish aggregations are potentially beneficial for marine mammals which predate these species, these were not found to be significant in EIA terms. Cumulative permanent habitat loss for marine mammal prey species (such as herring and sandeel) which are dependent on soft seabed sediments were also found to be not significant in EIA terms.

227. Therefore, permanent habitat change from the introduction of cable protection are not anticipated to result in any cumulative significant changes to the abundance or distribution of fish species which act as prey for marine mammals. Overall, the magnitude of the impact is deemed to be **low,** and the sensitivity of marine mammal receptors is considered to be **low**. The effect will, therefore, be of **low adverse significance**, which **is not significant** in EIA terms.

11.15.2.1.5 Secondary mitigation and residual effect

228. Given that there are no likely significant cumulative effects in EIA terms, secondary mitigation is not required.

11.15.2.2 CUMULATIVE INDIRECT EFFECTS ON MARINE MAMMALS THROUGH EFFECTS ON PREY SPECIES

229. This section of the cumulative effects assessment provides a qualitative assessment of the cumulative effects of indirect impacts on marine mammal prey species. The potential for this impact to result in a cumulative effect on marine mammal receptors will arise from offshore developments which have a direct spatial overlap with the Marine Scheme.

230. The operation of the Offshore Export Cables will result in localised changes in EMFs and thermal emissions which have the potential to result in a direct or indirect impact to fish and shellfish species which are prey to marine mammals. EMFs have the potential to affect the sensory mechanisms of certain fish and shellfish species, while heat emitted by the electrical current passing through the cable has the potential to cause localised heating of the sediment. The extent of potential impacts arising from EMFs and thermal emissions will be limited to the immediate vicinity of the operational cable.

231. The potential cumulative indirect effects on marine mammals through effects on prey species are assessed in Volume 2, Chapter 9: Fish and Shellfish Ecology. Of the 13 developments identified in Table 11.20, five are identified as having the potential to result in cumulative indirect impacts on marine mammals through a direct spatial overlap with the Marine Mammal Study Area. These developments include:

- BBWF;
- Eastern Green Link 1;
- Eastern Green Link 2;
- Blyth Demonstrator Offshore Wind Farm - Phase 2; and
- Blyth Demonstration Phase 2 Export Cable.

11.15.2.2.2 Magnitude of impact

232. Cables within the boundary of the BBWF and the Blyth Demonstrator will be protected by trenching as far as is practicable, with the minimum burial depth of cables within the BBWF 0.5 m (BBWFL, 2022a) and a worst-case assumption of 1.5 m for the Blyth Demonstrator (Narec, 2013). For both EGL1 and EGL2 the minimum depth of cable burial is 0.6 m (National Grid and Scottish Power, 2022; National Grid and SHE Transmission, 2022). Given these burial depths at the implementation of additional external cable protection methods where necessary, it is anticipated that EMF levels associated with these developments will remain highly localised.

233. Given the overlap with the BBWF array area, there is potential for inter array, interconnector and other export cables to be in close proximity to the Marine Scheme Offshore Export Cables. However, given that it is assumed that there will not be any crossings of the BBWF cables. While there is potential for some cumulative impact between the Marine Scheme and BBWF, the extent of EMF effects will be within close proximity of the source, likely within 10-20 m prior to decaying to natural GMF (as is the case for the Marine Scheme; Volume 2 Chapter 9 Fish and Shellfish Ecology section 9.122.1). Therefore, even where other development cables are in close proximity to the Marine Scheme the resultant elevated EMF is limited.

234. The burial and cable protection commitments outlined above will also serve to reduce the degree of sediment heating at the seabed. It is therefore considered that the risk of any heat from these

cables being emitted beyond the seabed is low. Furthermore, any cumulative effects of thermal emissions will be limited to the immediate areas where cable crossings are required, with emissions dropping rapidly with distance from crossing points.

235. For both impact pathways, the cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect marine mammals indirectly. The magnitude is therefore considered to be low.

11.15.2.2.3 Sensitivity of receptor

236. For all species considered as part of Volume 2, Chapter 9: Fish and Shellfish Ecology (including marine finfish, diadromous fish shellfish and elasmobranchs) the potential for vulnerability to EMF emissions was deemed to be low to medium, with all species demonstrating a high recoverability.

237. The assessment of potential impacts arising from thermal emissions concluded that those species closely associated with the seabed (i.e., demersal fish and shellfish) were of low vulnerability and high recoverability.

238. Owing to the low overall vulnerability to fish and shellfish species which are prey to marine mammals to EMF effects and thermal emissions, any indirect effects on marine mammal through adverse effects on prey are predicted to be of low vulnerability and high recoverability. Marine mammals will be able to forage widely and exploit a range of prey species, and hence are able to accommodate localised changes in prey availability. Indirect impacts on marine mammals due to EMF and thermal emission impacts on their prey species are not likely to have any impact on the conservation status of marine mammal populations.

239. Overall, the sensitivity of the receptor is therefore considered to be low.

11.15.2.2.4 Significance of effect

240. The magnitude of the cumulative effect to fish and shellfish receptors that are prey to marine mammals (as presented in Volume 2, Chapter 9: Fish and Shellfish Ecology) are considered to be **negligible to minor** for all species in relation to EMF effects and thermal emissions. Overall, the magnitude of cumulative indirect effects on marine mammals through effects on prey species is deemed to be **low,** and the sensitivity of the receptor is considered to be **low**. The cumulative effect will, therefore, be of **low adverse** significance, which is **not significant** in EIA terms.

11.15.2.2.5 Secondary mitigation and residual effect

241. Given that there are no likely significant cumulative effects in EIA terms, secondary mitigation is not required.

11.15.3. Effects during Decommissioning

242. At the end of the operation and maintenance phase of the Marine Scheme, the options for decommissioning works will be assessed, taking into consideration constraints (e.g., safety and liability) and the potential environmental impacts associated with decommissioning works.

243. The principal options for decommissioning include:

- Leaving the cable in-situ, trenched;
- Leaving the cable in-situ and providing additional protection;
- Remove sections of the cable; and
- Remove the cable entirely.

244. Of the four principle decommissioning options the complete removal of the cable would have the most significant adverse effects on marine mammal receptors, due to the temporary habitat disturbance and potential for increased SSC. Should complete removal of the cable be required, the cumulative significance of these effects is considered to result in similar cumulative effects as those assessed as part of the cumulative construction phase of the Marine Scheme. As the complete removal of the cable would have the most significant adverse effects on marine mammal receptors, any other decommissioning option would result in no more significant adverse cumulative effects that the complete removal of the cable.

245. Overall, the magnitude of the cumulative effect is deemed to be **low,** and the sensitivity of the receptor is considered to be **low**. The cumulative effect will, therefore, be of **low adverse significance**, which **is not significant** in EIA terms.

11.16. Inter-Related Effects

246. Inter-related effects are the effects of multiple stressors, affecting one receptor or a group of receptors. Inter-related effects include interactions between the impacts of the different stages of the Marine Scheme (i.e. interaction of impacts across construction, operation and maintenance and decommissioning), as well as the interaction between impacts on a receptor within a Marine Scheme stage. A description of the likely inter-related effects arising from the Marine Scheme on marine mammals is provided below.

247. Throughout the lifetime of the Marine Scheme, the effects to marine mammals are not anticipated to interact in a way that will result in a greater significance of impact than the assessments that have been presented for each individual phase of the Marine Scheme (as presented in section 11.12). Therefore, no significant inter-related effects on marine mammals are anticipated as a result of the Marine Scheme.

248. Additionally, any inter-related effects as a result of multiple impact pathways acting on marine mammals is not anticipated. Any potential impacts to marine mammals have been assessed as part of this Chapter and any other topic specific assessment considered relevant to marine mammals (Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions and Volume 2, Chapter 9: Fish and Shellfish Ecology) have concluded no significant interrelated effects as a result of the Marine Scheme.

249. These inter-related effects as described above are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phases. Therefore, these inter-related effects would not be significant in EIA terms.

11.17. Transboundary Effects

250. Transboundary effects arise when impacts from a development within one European Economic Area (EEA) state's territory affects the environment of another EEA state(s).

251. Impacts on marine mammals from the construction, operation and maintenance and decommissioning of the Marine Scheme will be localised to the extent of the Marine Scheme and the immediate surrounding (which are wholly within UK territorial waters). The Marine Scheme is approximately 230 km from the UK EEZ boundary. The UK-Netherlands median line is the nearest international boundary which could be crossed.

252. Several of the cetacean species assessed as part of the Marine Scheme EIA have MUs with ranges which extend into international waters (i.e., harbour porpoise, common dolphin, Risso's dolphin and

minke whale (Figure 11-1). No significant impacts arising from proposed activities (both in isolation or cumulatively (as assessed within sections 11.12 and 11.15 respectively) are anticipated for any marine mammal species during any phase of the Marine Scheme. Furthermore, no adverse impacts to marine mammal species which are a qualifying feature of a protected site within European waters are considered likely (as assessed within HRA Screening (BBWFL, 2023). Overall, the limited and localised nature of impacts arising from the Marine Scheme both in isolation and cumulatively are not anticipated to result in transboundary impacts to marine mammal species.

11.18. Summary of Impacts, Mitigation Measures and Likely Significant Effects

253. Information on marine mammals within the Marine Mammal Study Area was collected through a desk-based review of publicly available data and information sources and informed by consultation with key stakeholder. Table 11.24 presents a summary of the potential impacts, mitigation measures and the conclusion of likely significant effects in EIA terms in respect to marine mammals. The impacts assessed include:

- Noise related impacts from pre-construction and construction activities;
- Indirect effects on marine mammals through effects on prey species; and
- Permanent habitat change, including the potential for change in foraging opportunities.

254. Overall, it is concluded that there will be **no significant effects** arising from the Marine Scheme during the construction, operation and maintenance or decommissioning phases.

255. Table 11.25 presents a summary of the potential cumulative impacts, mitigation measures and the conclusion of likely significant effects on marine mammals in EIA terms. The cumulative effects assessed include:

- Cumulative noise related impacts from pre-construction and construction activities;
- Cumulative indirect effects on marine mammals through effects on prey species; and
- Cumulative permanent habitat changes, including the potential for change in foraging opportunities.

256. Overall, it is concluded that there will be **no significant cumulative effects** from the Marine Scheme alongside other developments/plans.

Table 11.24 Summary of likely significant environmental effects and mitigation

Description of Impact	Phase			Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Secondary Mitigation	Residual Effect	Proposed Monitoring
	C	O	D						
Scotland and England (UK)									
Noise related impacts from pre-construction and construction activities	✓	×	✓	Low	Low	Not Significant	No secondary mitigation is considered necessary	N/A	There is no requirement for additional mitigation over and above the pre-defined designed in measures.
Indirect effects on marine mammals through effects on prey species	✓	×	✓	Low	Low	Not Significant	No secondary mitigation is considered necessary	N/A	There is no requirement for additional mitigation over and above the pre-defined designed in measures.
Permanent habitat change, including the potential for change in foraging opportunities	×	✓	×	Low	Low	Not Significant	No secondary mitigation is considered necessary	N/A	There is no requirement for additional mitigation over and above the pre-defined designed in measures.
Indirect effects on marine mammals through effects on prey species	×	✓	×	Low	Low	Not Significant	No secondary mitigation is considered necessary	N/A	There is no requirement for additional mitigation over and above the pre-defined designed in measures.

Table 11.25 Summary of likely significant cumulative environment effects and mitigation

Description of Impact	Phase			Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Secondary Mitigation	Residual Effect	Proposed Monitoring
	C	O	D						
Scotland and England (UK)									
Cumulative noise related impacts from pre-construction and construction activities	✓	×	✓	Low	Low	Not Significant	No secondary mitigation is considered necessary	N/A	There is no requirement for additional mitigation over and above the pre-defined designed in measures.

Description of Impact	Phase			Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Secondary Mitigation	Residual Effect	Proposed Monitoring
	C	O	D						
Cumulative indirect effects on marine mammals through effects on prey species	✓	×	✓	Low	Low	Not Significant	No secondary mitigation is considered necessary	N/A	There is no requirement for additional mitigation over and above the pre-defined designed in measures.
Cumulative permanent habitat changes, including the potential for change in foraging opportunities	×	✓	×	Low	Low	Not Significant	No secondary mitigation is considered necessary	N/A	There is no requirement for additional mitigation over and above the pre-defined designed in measures.
Cumulative indirect effects on marine mammals through effects on prey species	×	✓	×	Low	Low	Not Significant	No secondary mitigation is considered necessary	N/A	There is no requirement for additional mitigation over and above the pre-defined designed in measures.

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