2.11

Rampion 2 WIND FARM

Volume 2, Chapter 11:

Marine mammals

GoBe wood.

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11. Marine mammals

11.1 Introduction

11.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the preliminary results of the assessment of the likely significant effects of the Rampion 2 Offshore Wind Farm (hereafter referred to as Rampion 2) with respect to marine mammals. Specifically, this chapter considers the potential impact of Rampion 2 seaward of Mean High-Water Springs (MHWS) during its construction, operation and decommissioning phases. It should be read in conjunction with the following relevant chapters and technical reports:

- **Chapter 1: Introduction**;
- **Chapter 2: Policy and legislative context**;
- **Chapter 4: The Proposed Development**;
- **Chapter 5: Approach to the EIA**;
- **Chapter 8: Fish and shellfish ecology** (due to the shared habitat of species, relevance of impacts to mammal prey species and similarity in potential impacts);
- **Chapter 14: Nature conservation**;
- **Draft Report to inform assessment appraisal (RIAA)**;
- **Appendix 11.1: Marine mammal baseline technical report**;
- **Appendix 11.2: Marine mammal quantitative underwater noise impact assessment**; and
- **Appendix 11.3: Underwater noise assessment technical report.**

11.1.2 This chapter describes:

- the legislation, planning policy and other documentation that has informed the assessment (**Section 11.2: Relevant legislation, policy and other information and guidance**);
- the outcome of consultation engagement that has been undertaken to date, including how matters relating to marine mammals within the Scoping Opinion received in August 2020 have been addressed (**Section 11.3: Consultation and engagement**);
- the scope of the assessment for marine mammals (**Section 11.4: Scope of the assessment**);
- the methods used for the baseline data gathering (**Section: 11.5: Methodology for baseline data gathering**);
- the overall baseline (**Section 11.6: Baseline conditions**);

- embedded environmental measures relevant to marine mammals and the relevant maximum design scenario (**Section 11.7: Basis for PEIR assessment**);
- the assessment methods used for the PEIR (**Section 11.8: Methodology for PEIR assessment**);
- the assessment of marine mammal effects (**Section 11.9 - 11.11: Preliminary assessment** and **Section 11.12: Preliminary assessment: Cumulative effects**);
- consideration of transboundary effects (**Section 11.13: Transboundary effects**);
- consideration of Inter-related effects (**Section 11.14: Inter-related effects**);
- a summary of residual effects for marine mammals (**Section 11.15: Summary of residual effects**);
- an outline of further work to be undertaken for the Environmental Statement (ES) (**Section 11.16: Further work to be undertaken for ES**);
- a glossary of terms and abbreviations is provided in **Section 11.17: Glossary of terms and abbreviations**; and
- a references list is provided in **Section 11.18: References**.

11.2 Relevant legislation, policy, and other information and guidance

Introduction

11.2.1 This section identifies the legislation, policy and other documentation that has informed the assessment of effects with respect to marine mammals. Further information on policies relevant to the Environmental Impact Assessment (EIA) and their status is provided in **Chapter 2: Policy and legislative context** of this PEIR.

Legislation and national planning policy

11.2.2 **Table 11-1** lists the legislation relevant to the assessment of the effects on marine mammal receptors.

Table 11-1 Legislation relevant to marine mammals

Legislation description	Relevance to assessment
The Habitats and Species Regulations 2017 and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (referred to as The Habitats Regulations)	
All cetaceans and pinnipeds in Northern European waters are listed under Annex IV	The Habitats Regulations make it an offence to kill, injure or disturb any EPS.

Legislation description	Relevance to assessment
of the EU Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the Habitats Directive) as European Protected Species (EPS) of Community Interest and in need of strict protection. The harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) also have protection under Annex II as species of Community Interest whose conservation requires the designation of Special Areas of Conservation (SACs). The Habitats Directive is transposed into UK law through the Conservation of Habitats and Species Regulations 2017 (as amended in 2019) which implements the Habitats Directives in territorial waters out to 12 nautical miles (nm). The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended in 2019) transpose the provisions of the Habitats Directive in offshore waters, beyond 12 nm. Together the sets of regulations are referred to as "the Habitats Regulations". The Habitats Regulations provide protection for designated sites, known as the national site network (formerly Natura 2000 sites) which include SACs and Special Protection Areas (SPAs). Ramsar sites are included as a matter of government policy.	An incidence of disturbance would be considered an offence if the disturbance is likely to have an ecologically significant adverse effect on a significant number of animals (note: for the purpose of simplification, in this guidance, references to 'adversely affect(ed)' should be taken to mean 'significantly affect the ability to survive, breed, or rear or nurture their young'). The second element is that the disturbance must be likely to significantly affect the local distribution or abundance of the species. A disturbance offence would be committed if either of these elements occurred. The risk of any injury, disturbance or death to an EPS is addressed in the Marine Mammal Mitigation Protocol (MMMP). The Proposed Development will have potential effects on marine mammal species, particularly during the construction phase. The protection conferred to these ecological features through legislation is accounted for within the scope of the assessment (see **Section 11.4**) and the embedded environmental measures detailed in **Section 11.7**. The Proposed Development does not directly overlap with any SAC designated for marine mammals, however, a number of SACs for marine mammals are within the same management units (MU) for these species as the Proposed Development. Full consideration of the potential for an impact on these SACs is given within the Screening Report (RED, 2020).
EU Directive 2008/56/EC – Marine Strategy Framework Directive	
The Marine Strategy Framework Directive (MSFD) provides a legislative framework for an ecosystem-based approach to the management of activities which supports the sustainable use of marine goods and services. The aim of the Directive is to	The Proposed Development will have potential effects on the marine environment, particularly during the construction phase. The protection conferred to these ecological features through legislation is accounted for within

Legislation description	Relevance to assessment
achieve 'Good Environmental Status' by 2020 across Europe's marine environment. Annex I of the MSFD includes the following requirements that are relevant to marine mammals: • Biological diversity is maintained; • The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic, and climatic conditions; • All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity; • Concentrations of contaminants are at levels not giving rise to pollution effects; and • Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.	the scope of the assessment (see **Section 11.4)** and the environmental measures embedded within the Proposed Development are detailed in **Section 11.7**.
Bonn Convention	
The Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention) requires signatories to conserve migratory species and their habitats by providing strict protection for endangered migratory species (Appendix I of the Convention) and lists migratory species which would benefit from multilateral Agreements for conservation and management (Appendix II).	There are 44 cetacean species and 6 pinniped species listed under Appendix I of the Bonn Convention. The UK ratified the Convention in 1985. The legal requirement for the strict protection of Appendix I species is provided by the Wildlife and Countryside Act (1981 as amended). The Proposed Development may have potential effects on marine mammal species, particularly during the construction phase. The protection conferred to these ecological features through legislation is accounted for within

Legislation description	Relevance to assessment
	the scope of the assessment (see **Section 11.4**) and the environmental measures embedded within the Proposed Development are detailed in **Section 11.7**.
Bern Convention	
The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) aims to ensure conservation and protection of wild plant and animal species and their natural habitats (listed in Appendices I and II of the Convention.	There are 30 species of cetacean listed under Annex II of the Bern Convention (strictly protected fauna), including harbour porpoise, bottlenose dolphins, common dolphins, Risso's dolphins, white-beaked dolphins and minke whales. All other cetacean species as well as both grey and harbour seals are listed under Annex III of the Bern Convention (protected fauna). The obligations of the Convention are transposed into national law by means of the Wildlife and Countryside Act (1981 as amended). The Proposed Development may have potential effects on these species, particularly during the construction phase. The protection conferred to these ecological features through legislation is accounted for within the scope of the assessment (see **Section 11.4**) and the embedded environmental measures detailed in **Section 11.7**.
Wildlife and Countryside Act 1981 (as amended)	
The Wildlife and Countryside Act consolidates and amends existing national legislation to implement the Convention on the Conservation of European Wildlife and Natural Habitats ('the Bern Convention') and Council Directive 79/409/EEC on the conservation of wild birds (Birds Directive). The act makes it an offence to intentionally (or recklessly) kill, injure or take any wild animal listed on Schedule 5 of the Act, and prohibits interference with places used for shelter or protection, or intentionally disturbing animals occupying such places. All cetacean species are protected within	The Proposed Development may have potential effects on marine mammal species, particularly during the construction phase. The protection conferred to these ecological features through legislation is accounted for within the scope of the assessment (see **Section 11.4**) and the embedded environmental measures detailed in **Section 11.7**.

Legislation description	Relevance to assessment
the 12 nm territorial waters under Schedule 5 of the Wildlife and Countryside Act.	
Conservation of Seals Act, 1970	
Both grey and harbour seal species are protected under the Conservation of Seals Act (1970) which provides closed seasons during which it is an offence to take or kill any seal except under licence. Following the Phocine Distemper Virus (PDV) outbreak in 1999, an Order was issued under the Conservation of Seals Act providing year- round protection to both grey and harbour seals on the east and south-east coast of England, from Berwick to Newhaven (under the Conservation of Seals (England) Order 1999).	The Proposed Development may have potential effects on seal species, particularly during the construction phase. The protection conferred to these ecological features through legislation is accounted for within the scope of the assessment (see **Section 11.4**) and the embedded environmental measures detailed in **Section 11.7**.
UK Biodiversity Action Plan and the UK Post-2010 Biodiversity Framework (2012)	
The UK Biodiversity Action Plan (BAP) identifies biological resources in the UK and plans for their conservation. This was succeeded by the UK Post-2010 Biodiversity Framework in 2012 in response to the Convention on Biological Diversity's Strategic Plan for Biodiversity 2011-2020 (published in 2010) and the EU Biodiversity Strategy (published in 2011). The UK Post-2010 Biodiversity Framework describes how the UK can meet the Aichi Biodiversity Targets. The UK BAP identified priority species that are the most threatened and require conservation.	UK BAP priority species include the cetacean and seal species present in UK waters. This list of priority species is still used to inform statutory lists of priority species in the UK. The Proposed Development will have potential effects on marine mammal species, particularly during the construction phase. The protection conferred to these ecological features through legislation is accounted for within the scope of the assessment (see **Section 11.4**) and the embedded environmental measures detailed in **Section 11.7**.

11.2.3 **Table 11-2** lists the national and local planning policy relevant to the assessment of the effects on marine mammal receptors.

Table 11-2 National and local planning policy relevant to marine mammals

Policy description	Relevance to assessment
The Overarching National Policy Statement (NPS) for Energy (EN-1) (July 2011)	
Paragraph 5.3.3 states that 'Applicants should ensure that the Environmental Statement clearly sets out any effects on	The potential effects of the construction, operation, and decommissioning phases of the Proposed Development on marine

Policy description	Relevance to assessment
internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity"	mammals have been assessed in the impact assessment (**Sections 11.9** to **11.12**). The assessment of impacts on SACs and Ramsars that have marine mammals as protected features is detailed in the HRA screening report (RED, 2020).
The Overarching National Policy Statement (NPS) for Renewable Energy Infrastructure (EN-3) (July 2011)	
Paragraph 2.6.64 states that 'Applicants should assess the effects on the offshore ecology and biodiversity for all stages of the lifespan of the proposed offshore wind farm'.	The potential effects of the construction, operation and decommissioning phases of the Proposed Development have been assessed in the impact assessment (**Sections 11.9** to **11.12**).
Paragraph 2.6.65 states that 'Consultation on the assessment methodologies should be undertaken at early stages with the statutory consultees as appropriate'.	Consultation with relevant statutory and non-statutory stakeholders has been carried out and is described in **Section 11.3**.
Paragraph 2.6.66 states that 'Any relevant data that has been collected as part of post-construction ecological monitoring from existing, operational offshore wind farms should be referred to where appropriate'.	Data on marine mammal usage of existing operational offshore wind farms has been used to inform the sensitivity assessment for operation phase impacts.
Paragraph 2.6.67 states that 'Applicants should assess the potential for the scheme to have both positive and negative effects on marine ecology and biodiversity'.	Both the adverse and beneficial effects of the Proposed Development have been assessed (**Sections 11.9** to **11.12**).
Paragraph 2.6.68 states 'The Secretary of State should consider the effects of a proposal on marine ecology and biodiversity taking into account all relevant information made available to it'.	The potential effects of the construction, operation and decommissioning phases of the Proposed Development have been assessed in the impact assessment (**Sections 11.9** to **11.12**).
Paragraph 2.6.69 states 'The designation of an area as a Natura 2000 site does not necessarily restrict the construction or operation of offshore wind farms in or near that area'.	The HRA Screening Report (RED, 2020) identified that there was no connectivity between the Proposed Development and any Natura 2000 sites (UK sites now within the National Site Network, NSN) for marine mammals.
Paragraph 2.6.70 states 'Mitigation may be possible in the form of careful design of the	This was considered when defining the ramp up/ soft start procedure for piling. In addition, both a piling and UXO MMMP

Policy description	Relevance to assessment
development itself and the construction techniques employed'.	approved by the Marine Management Organisation (MMO) in consultation with Natural England will be implemented during construction, the details of which will be agreed once the final Proposed Development Design is known.
Paragraph 2.6.71 states 'Ecological monitoring is likely to be appropriate during the construction and operational phases to identify the actual impact so that, where appropriate, adverse effects can then be mitigated and to enable further useful information to be published relevant to future projects'.	If deemed necessary, monitoring will be carried out in order to validate the predictions of the impact assessment (as required). The need for and details of any such monitoring will be agreed through consultation with the Statutory Nature Conservation Bodies (SNCBs) and presented in a marine mammal monitoring plan.
Paragraph 2.6.90 states 'Section 5.3 of EN-1 sets out the policy for the IPC in relation to generic biodiversity impacts and paragraphs 2.6.58 to 2.6.71 above sets out offshore wind-specific biodiversity policy. In addition, there are specific considerations from piling noise which apply to offshore wind energy infrastructure proposals with regard to marine mammals, including cetaceans and seals, which have statutory protection'.	The impacts from piling noise are assessed within **Section 1.1**. Where mitigation measures are required, these have been identified within (**Table 11-11** and **Section 11.9** to **11.11**).
Paragraph 2.6.91 states 'Offshore piling may reach noise levels which are high enough to cause injury, or even death, to marine mammals. If piling associated with an offshore wind farm is likely to lead to the commission of an offence (which would include deliberately disturbing, killing or capturing a European Protected Species), an application may have to be made for a wildlife licence to allow the activity to take place'.	A draft EPS licence has been submitted alongside this document as part of the application. Prior to any piling activity being undertaken for the Proposed Development, an EPS licence would be applied for.
Paragraph 2.6.92 states 'Where necessary the assessment of the effects on marine mammals should include details of: likely feeding areas; known birthing areas/haul out sites; nursery grounds; known migration or commuting routes; duration of potentially disturbing activity including	All of the specified marine mammal ecology details are included in this chapter. Construction and operational noise impacts and their likely effects on marine mammal behaviour and ecology have been assessed (**Sections 11.9** to **11.11**). This assessment also considers the cumulative

Policy description	Relevance to assessment
cumulative/in-combination effects; baseline noise levels; predicted noise levels in relation to mortality, Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS); soft-start noise levels; and operational noise'.	impacts of the Proposed Development and other relevant plans or projects (**Section 11.12**).
Paragraph 2.6.93 states 'The Applicant should discuss any proposed piling activities with the relevant body. Where assessment shows that noise from offshore piling may reach noise levels likely to lead to an offence, the Applicant should look at possible alternatives or appropriate mitigation before applying for an EPS licence'	Potential mitigation methods will be considered within the piling MMMP with the aim to reduce the risk of PTS to negligible levels. The details of the piling MMMP and potential mitigation methods have yet to be determined, however they will be agreed with Natural England ahead of the construction phase.
Paragraph 2.6.94 states 'The Secretary of State should be satisfied that the preferred methods of construction, in particular for foundations and the foundation type are designed to reasonably minimise significant disturbance effects. The Secretary of State may refuse the application if suitable noise mitigation measures cannot be imposed by requirements to any development consent'.	The Proposed Development has considered different foundation options, hammer energies and ramp-ups. A piling MMMP will be developed and approved by the MMO and Natural England prior to the commencement of construction which will detail the appropriate mitigation measures based on the finalised Proposed Development design.
Paragraph 2.6.95 states 'The conservation status of marine European Protected Species, and seals, are of relevance to the Secretary of State. The Secretary of State should take into account the views of the relevant statutory advisors'.	The conservation status of EPS and seals are considered within the impact assessment (**Sections 11.9** to **11.12**).
Paragraphs 2.6.97 to 2.6.99 state 'Mitigation: monitoring of a mitigation area for marine mammals surrounding the piling works prior to commencement of, and during, piling activities. During construction, 24 hour working practices may be employed to reduce the total construction programme and the potential for impacts. Soft-start procedures during pile driving may be implemented to avoid significant adverse impacts'.	A piling MMMP, approved by the MMO in consultation with Natural England, will be implemented during construction. The MMMP will include mitigation measures with the aim to reduce the risk of PTS to marine mammals. The details of the MMMP will be agreed with Natural England when the final Proposed Development design is available.

Policy description	Relevance to assessment
Marine Policy Statement (HM Government, 2011)	
The Marine Policy Statement is the framework for preparing Marine Plans and taking decisions affecting the marine environment. The high-level objective "Living within environmental limits" includes the following requirements relevant to marine mammals: • Biodiversity is protected, conserved and, where appropriate, recovered, and loss has been halted; • Healthy marine and coastal habitats occur across their natural range and are able to support strong, biodiverse biological communities and the functioning of healthy, resilient and adaptable marine ecosystems; and • Our oceans support viable populations of representative, rare, vulnerable, and valued species.	The potential effects of the construction, operation, and decommissioning phases of the Proposed Development on marine mammals have been assessed in the impact assessment (**Sections 11.9** to **11.12**).
South Inshore and Offshore Marine Plans	
These plans provide objectives and aim that are supported by detailed policies. The South Inshore Plan covers the coastline and shallow waters out to 12 nm. The South Offshore Plan covers the marine area from 12 nm to the Exclusive Economic Zone. The objectives that are relevant to marine mammals include: • Objective 10: To support marine protected area objectives and a well-managed ecologically coherent network with enhanced resilience and capability to adapt to change. • Objective 11: To complement and contribute to the achievement or maintenance of	The potential effects of the construction, operation, and decommissioning phases of the Proposed Development on marine mammals have been assessed in the impact assessment (**Sections 11.9** to **11.12**).

Policy description	Relevance to assessment
Good Ecological Status or Potential under the Water Framework Directive and Good Environmental Status under the Marine Strategy Framework Directive, with respect to descriptors for marine litter, non-indigenous species and underwater noise. • Objective 12: To safeguard space for, and improve the quality of, the natural marine environment, including to enable continued provision of ecosystem goods and services, particularly in relation to coastal and seabed habitats, fisheries and cumulative impacts on highly mobile species.	

Other relevant information and guidance

11.2.4 A summary of other relevant information and guidance relevant to the assessment undertaken for marine mammals is provided here.

- Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects – Southall *et al*., 2019. This piece of literature was used to provide the auditory thresholds for the species present, informing the underwater noise assessment.
- Beatrice Offshore Wind Farm: An interim estimate of the probability of porpoise displacement at different unweighted single-pulse sound exposure levels – Graham *et al*., 2017. This piece of literature was used to provide a dose-response curve for harbour porpoises, which as there is no corresponding data for other species, was used as the threshold for the disturbance for all cetacean species.
- Estimating the effects of pile driving sounds on seals: Pitfalls and possibilities – Whyte *et al*., 2020. This piece of literature was used to provide a dose-response curve for harbour seals, which as there is no corresponding data for grey seals, was used as the threshold for the disturbance of both seal species.

11.3 Consultation and engagement

Overview

11.3.1 This section describes the outcome of, and response to, the Scoping Opinion in relation to the marine mammal assessment and also provides details of the ongoing informal consultation that has been undertaken with stakeholders and individuals. An overview of engagement undertaken can be found in **Section 11.5** of **Chapter 1: Introduction**.

11.3.2 Given the restrictions which have been in place due to the COVID-19 pandemic during this period, all consultation has taken the form of conference calls using Microsoft Teams, email, and telephone communications.

Early engagement

11.3.3 No early engagement was required in relation to marine mammals, however a number of relevant stakeholders including Cefas, the MMO, Natural England, The Sussex Wildlife Trust (TSWT), The Wildlife Trusts (TWT), and Whale and Dolphin Conservation (WDC) were invited to participate in the Evidence Plan Process (EPP). Method statements were distributed to the above stakeholders as per the standard EPP.

Scoping opinion

11.3.4 Rampion Extension Development Limited (RED) submitted a Scoping Report (RED, 2020) and request for a Scoping Opinion to the Secretary of State (administered by the Planning Inspectorate (PINS)) on 2 July 2020. A Scoping Opinion was received on 11 August 2020. The Scoping Report set out the proposed marine mammal assessment methodologies, outline of the baseline data collected to date and proposed, and the scope of the assessment. **Table 11-3** sets out the comments received in Section 4 of the PINS Scoping Opinion 'Aspect based scoping tables – Offshore' and how these have been addressed in this PEIR. A full list of the PINS Scoping Opinion comments and responses is provided in **Appendix 5.1: Response to the Scoping Opinion, Volume 4**.

11.3.5 The information provided in the PEIR is preliminary and therefore not all the Scoping Opinion comments have been able to be addressed at this stage, however all comments will be addressed within the ES.

Table 11-3 PINS Scoping Opinion responses – marine mammals and underwater noise

PINS ID number	Scoping Opinion comment	How this is addressed in this PEIR
4.6.1	Temporary Threshold Shift (TTS) risk during construction. "The Inspectorate is of the view that were TTS to be excluded from underwater noise assessments, the risk of cognitive impairment (TTS)	Consideration of the potential for TTS effects on marine mammals has been included within **Sections 11.9** to **11.12** as appropriate.

PINS ID number	Scoping Opinion comment	How this is addressed in this PEIR
	will not be reflected in the overall assessment of risk to marine mammals, despite evidence in literature to suggest the potential for significant harm to individuals. The ES should therefore assess impacts to TTS from the Proposed Development across all marine mammal species scoped into the assessment where significant effects are likely to occur."	
4.6.2	Noise from cable laying, ground clearance, dredging etc during construction. "The Scoping Report seeks to scope out noise from these activities on the basis that noise impacts will be "low in terms of intensity and duration, with a very localised risk", and that that risk is effectively contained within the assessment of 'vessel disturbance' activity (and ZOI defined in that respect). Without further reference to durations and methodologies of such activities in relation to vessel disturbance, and empirical evidence of the magnitudes of noise impacts from these activities when compared to vessel noise, the Inspectorate does not agree that they can be scoped out on the basis of the information provided. The Inspectorate also considers that there is the potential that noise generated from these activities could combine with vessel noise resulting in an overall larger impact and potentially more significant effect on marine mammals."	The potential effects arising from underwater noise from these other, non-piling, sound sources have been assessed within **Sections 11.9** to **11.12**.
4.6.3	Reduction in prey availability during construction and operation. "The Inspectorate is content that the potential for reduction in prey availability to result in a significant	The potential for indirect effects to marine mammals due to potential changes in prey availability during construction has been considered within **Section 11.9**.

PINS ID number	Scoping Opinion comment	How this is addressed in this PEIR
	effect on marine mammals during operation can be scoped out of further assessment. The Inspectorate does not agree that such a conclusion is supported by the information available at this stage in respect of construction phase impacts. The Scoping Report states that there would be no significant direct effects on marine mammal prey species during construction (see the Benthic Ecology (5.5) and Fish and Shellfish Ecology (5.4) sections of the Scoping Report). The Inspectorate does not agree that significant indirect effects on marine mammals from loss of prey can be excluded at this stage."	
4.6.4	Risks to marine mammals of accidental pollution. "The Applicant seeks to scope out the risks to marine mammals of accidental pollution occurring during construction, operation & maintenance or decommissioning of the Proposed Development the on the basis that a Marine Pollution Contingency Plan (MPCP) and emergency response plans will be implemented in the unlikely event that any such incident occurs. The Inspectorate agrees that, with the implementation of such measures, any potential impacts on marine mammals are unlikely to result in significant effects and therefore further assessment is not required. However, the Inspectorate considers that the detail of such measures, including how they would be employed and be secured should be presented within the ES. The ES should include draft versions (with sufficient detail) of	The implementation of a MPCP and emergency response plans has been included as embedded environmental measures for the Proposed Development and have been detailed in **Table 11-11** below. The MPCP will also be detailed in the Environmental Statement as requested by the Inspectorate and therefore accidental pollution remains scoped out at this stage of assessment.

PINS ID number	Scoping Opinion comment	How this is addressed in this PEIR
	any plans containing such measures.	
4.6.5	Disturbance to seal haul out sites during construction. "The Scoping Report seeks to scope impacts of the construction phase resulting in disturbance at a seal haul out sites. The baseline information shows that there is approximately 25-30km between the Proposed Development and the harbour haul out sites. The Inspectorate does not consider that sufficient evidence has been provided to support the contention that significant effects on haul out sites can be ruled out due to the separation distance. As set out in item 4.6.13, the spatial extent of the study areas for marine mammals are yet to be fully defined by the Applicant therefore the Inspectorate considers it is premature to agree to scope out such effects from further assessment at this stage. The ES should include this assessment where significant effects are likely to occur."	Consideration of the potential for impacts to seal haul out sites during the construction phase is presented within **Section 11.9**.
4.6.6	Effects to marine mammals due to Electromagnetic Fields (EMF) during operation. "The Inspectorate agrees that significant effects on marine mammals due to direct effects of EMF are unlikely during operation of the Proposed Development and agrees that this matter can be scoped out of further assessment. However, the Inspectorate notes that indirect effects from changes to prey availability from EMF (in terms of fish and benthic ecology) during operation will be considered."	The potential for indirect effects to marine mammals from changes in prey availability due to EMF during operation is presented in **Section 11.10.**

PINS ID number	Scoping Opinion comment	How this is addressed in this PEIR
4.6.7	Zones of Influence (ZoI) and study areas. "The ZoI for assessment of effects on marine mammals are stated as to be defined "once project specific underwater noise modelling has been completed". The Inspectorate considers that different cetacean species may require different ZoI's and study areas to be defined and notes that species have different Management Units. The ES should describe the approach to defining ZoI and study area across all species with reference to the outcomes of the evidence plan process. The relevant species for consideration in the context of the Proposed Development are harbour porpoise, bottlenose dolphin, white-beaked dolphin, common dolphin and minke whale, as informed by previous studies and experience from Rampion 1. As per the comments raised in sections 2 and 3 of the Scoping Report, reliance on an evidence base from Rampion 1 will need to be explained and evidenced as to how it remains temporally and spatially applicable."	A baseline characterisation has been presented in **Section 11.6**, with full details presented in **Appendix 11.1, Volume 4**. These characterisations present detail on the management units and the data sources and populations used for assessment purposes. A combination of both historic data sources (i.e. Rampion 1) plus contemporary data sources, including site specific surveys, has been used to enable a robust assessment. A discussion is presented in **Appendix 11.1, Volume 4** regarding the densities of the various species as recorded from numerous extensive data sources and includes a justification for the exclusion of white-beaked dolphin from the assessment.
4.6.8	Baseline data. "Where the 'constantly expanding' marine mammal evidence base is used to provide new or updated baseline data than is referred to in the Applicant's Scoping Report and this Opinion, these should be set out clearly in the ES including reference to agreement as part of the evidence plan process."	A baseline characterisation has been presented in **Section 11.6**, with full details presented in **Appendix 11.1, Volume 4**, including details of discussions through the EPP.
4.6.9	Basis for scoping assessment. "Paragraph 5.7.22 omits any reference to seabed preparation works that may be required as set	Potential effects arising from seabed preparation works have been assessed as regards underwater

PINS ID number	Scoping Opinion comment	How this is addressed in this PEIR
	out in section 2 of the Scoping Report. The ES should consider the potential effects of such works on marine mammals."	noise and impacts to prey availability within **Section 11.9.**
4.6.10	Cumulative assessment study area and scope. "The Applicant's proposed assessment of cumulative effects on marine mammals does not make specific reference to the study area(s) (which is still to be defined) for each species. Paragraphs 5.7.36 – 5.7.38 explain that the study area for cumulative effects remains "to be defined through evidence of potential connectivity". There is no specific reference to spatial and temporal overlap between construction of the Proposed Development and the Aquind interconnector and the operation and maintenance activities associated with Rampion 1. These matters should be assessed in the ES where significant effects are likely.	Consideration of cumulative effects is presented within **Section 11.12**, with inclusion of all relevant projects informed based on the study areas (as detailed in **Section 11.6**).
4.8.2	The Inspectorate welcomes the consideration of underwater noise and vibration during the construction, operation and decommissioning phases of the Proposed Development. Effort should be made to agree the methodology with the relevant consultation bodies and agreements should be clearly outlined within the ES. Early engagement with the MMO is encouraged to ensure that any noise modelling utilising site-specific physical parameters and project specific detail is appropriate and fit for purpose.	A description of the early engagement undertaken with various stakeholders can be found throughout **Section 11.3**. While 'Early Engagement' was not undertaken, the MMO were present during the "Offshore Ornithology, Marine Mammals and HRA (offshore only)" ETG on the 18 September 2020 (see EPP section below). Alongside the MMO, Cefas, Natural England, The Sussex Wildlife Trust (TSWT), The Wildlife Trusts (TWT), and Whale and Dolphin Conservation (WDC) were also invited to participate in the EPP as described below.

PINS ID number	Scoping Opinion comment	How this is addressed in this PEIR
4.8.3	The baseline environment should be established beyond simply referring to the relevant aspect chapters where this information is presented. Potential noise and vibration impacts should be assessed against that baseline, noting that the underwater noise assessment draws entirely upon baseline data in other aspect chapters. The methods and noise propagation modelling software should be detailed within the ES; along with the project specific detail that it utilises with reference to spatial, temporal and physical design envelopes.	The underwater noise technical modelling report (**Appendix 11.3, Volume 4**) presents full details of the modelling methodology including establishment of the worst-case assumptions. The results of the modelling have been incorporated within the relevant aspect chapters to inform the assessments of impacts from underwater noise on the relevant aspects with due consideration of the baseline environment.
4.8.4.	The Inspectorate welcomes the collaboration with the other relevant aspects as set out in paragraph 5.9.1 of the Scoping Report. The ES should include appropriate cross-references between aspect chapters and avoid duplication and contradictory information.	Cross-referencing has been undertaken to relevant documents where appropriate to minimise duplication of information between chapters.
4.8.5.	The possible modelling of noise from UXO is not referenced in this section. Elsewhere in the Scoping Report there is reference to UXO surveys yet to be conducted and that UXO removal may be required. The ES should therefore consider the potential for UXO underwater noise impacts of the Proposed Development where significant effects are likely to occur (including cumulative effects with other underwater noise producing activities).	The predicted impact ranges from UXO clearance for a range of sizes has been modelled and is presented within (**Appendix 11.3, Volume 4**). The potential effects arising from underwater noise from a range of sources including UXO have been assessed within **Sections 11.9** to **11.12**.

Evidence Plan Process (EPP)

11.3.6 The EPP has been set up to provide a formal, non-legally binding, independently chaired forum to agree the scope of the EIA and HRA, and the evidence required to support the DCO Application. For marine mammals, further engagement has

been undertaken via the EPP within the offshore ornithology, marine mammals, and HRA Expert Topic Group (ETG).

11.3.7 On 18 September 2020, the first ETG meeting was held where the scope of the assessment relating to the Scoping Opinion was discussed. The proposed methodology was presented and there was a brief discussion of key datasets. There was some disagreement over some scoped-out areas including construction noise, reduction of prey, disturbance at haul outs and TTS. There was a discussion around TTS ranges, and literature was suggested to resolve the disagreement. A plan was agreed to assess the areas of concern, with the assessment being raised with the MMO, Cefas and Natural England if impacts are deemed significant.

11.3.8 A follow up ETG was held on 26 March 2021, at which a high-level overview of baseline data collected since the last ETG was given and specific impacts to be assessed were discussed. Specific agreement from Natural England was sought and given on the exclusion of white-beaked dolphin from the assessment due to site specific data and wider scale survey data identifying no records of this species. It was agreed that consideration would be given within the assessment to the potential for impacts from non-piling underwater noise source such as dredging and seabed preparation works, alongside an assessment of appropriately justified, modelled, operational noise from the large WTG sizes being proposed.

Informal consultation and engagement

1.1.1 RED carried out an Informal Consultation exercise for a period of four weeks from 14 January 2021 to 12 February 2021. This Informal Consultation exercise aimed to engage with a range of stakeholders including the prescribed and non-prescribed consultation bodies, local authorities, Parish Councils and general public with a view to introducing the Proposed Development and seeking early feedback on the emerging designs.

11.4 Scope of the assessment

Overview

11.4.1 This section sets out the scope of the PEIR assessment for marine mammals. This scope has been developed as the proposed development's design has evolved and responds to feedback received to date as set out in **Section 11.3**. As outlined in the PINS Advice Note Seven: Environmental Impact Assessment: Process, Preliminary Environmental Information and Environmental Statements (Version 7, PINS, 2020), information presented in the PEIR is preliminary, therefore this scope will be reviewed and may be refined as the proposed development evolves and as a result of ongoing consultation.

Spatial scope and study area

11.4.2 The spatial scope of the marine mammal assessment is defined as the area of the PEIR Assessment Boundary together with the ZOI that has formed the basis of the study area described in this section. The ZOI for this development has been

defined by the potential for a significant effect to occur from underwater noise, but also by wider MU extents[1], to reflect the highly mobile nature of marine mammals. As such, the study area includes the proposed development marine mammal survey area, which extended across the majority of the offshore PEIR Assessment Boundary plus a 4 km buffer (**Figure 11-1, Volume 3**), which is within the wider context of the relevant MUs for individual species.

11.4.3 When considering the wider MU scale study area, the potential species that may be found at the PEIR boundary need to be considered. The ES for the existing Rampion 1 project reported six species of marine mammal during site specific surveys: harbour porpoise, bottlenose dolphin, white-beaked dolphin, minke whale (assumed), common (harbour) seal, and grey seal. The site-specific surveys completed and analysed to date (April 2019 to November 2020) have recorded harbour porpoise, common dolphin, unidentified dolphin and unidentified phocid seal.

11.4.4 For seals, the Proposed Development lies close to the boundary of two seal MUs, the south east England and south England units (as depicted in SCOS, 2018). Cetaceans, however, have different MUs per species, with the relevant area provided for cetacean species given in IAMMWG, 2015. The PEIR boundary lies within the North Sea MU for harbour porpoise, the Offshore Channel, Celtic Sea & South West England MU for bottlenose dolphin, and the Celtic & Greater North Seas MU for common dolphin, white beaked dolphin and minke whale. These MUs are depicted in **Figure 11-1, Volume 3**.

11.4.5 The study area applied at PEIR will be reviewed and amended in response to such matters as refinement of the offshore components, the identification of impact pathways (particularly underwater noise once Proposed Development specific underwater noise modelling has been completed), evidence of wider connectivity and in response where appropriate to feedback from consultation or updates to the ES.

Temporal scope

11.4.6 The temporal scope of the assessment of marine mammals is the entire lifetime of Rampion 2 which therefore covers the construction, operation and decommissioning periods.

Potential receptors

11.4.7 The spatial and temporal scope of the assessment enables the identification of receptors which may experience a change as a result of the proposed development. The receptors identified that may experience likely significant effects for marine mammals as identified at the Scoping phase are outlined in **Table 11-4.**

[1] A defined area for management of a particular marine mammal population.

Table 11-4 Receptors requiring assessment for marine mammals

Receptor group	Receptors included within group
Marine mammal receptors	Any marine mammals present within the study area including those identified above (harbour porpoise, common dolphin, bottlenose dolphin, minke whale, harbour seal and grey seal)

11.4.8 The list of receptors will be kept under review during the EIA as more detailed information is obtained during baseline surveys and other forms of data collection by other aspects and will be reflected in the final ES.

Potential effects

11.4.9 Potential effects on marine mammal receptors that have been scoped in for assessment are summarised in **Table 11-5**. This comprises those impacts which were scoped in within the Scoping Report (RED, 2020), plus those which the PINS did not agree could be scoped out based on the information presented within the Scoping Report.

Table 11-5 Potential effects on marine mammal receptors scoped in for further assessment

Phase	Activity or impact	Potential effect
Construction	Noise generated from construction activities	Underwater noise resulting from percussive piling and clearance of UXO has the potential to result in PTS and TTS (injury) in marine mammals. Underwater noise from piling and UXO, plus other construction related activities (cable laying, ground clearance, dredging, seabed prep, and vessel movements, etc,) may result in disturbance to marine mammals.
	Vessel collision risk	Although an increase in baseline collision risk is considered highly unlikely, if an individual was collided with, the consequences would be serious to the fitness of that individual. Mitigation measures will be put in place to ensure that this risk is minimised as far as possible

Phase	Activity or impact	Potential effect
	Vessel disturbance	Marine mammals may potentially be disturbed by the presence of vessels (separate from the potential impacts from underwater noise), however mitigation measures will be put in place to ensure that the risk is minimised as far as possible.
	Changes to prey availability	Construction activities may have the potential to alter prey availability for marine mammals, resulting in indirect effects to marine mammals.
	Disturbance to seal haul out sites at landfall	Construction activities may have the potential to disturb seal species while at their haul out sites.
Operation and maintenance	Noise generated from operation	Operational noise from offshore wind farms to date has been found to be not significant for marine mammals. However, the size of WTGs planned at the Proposed Development do not have empirical data for operational noise and therefore scoped in as a precaution.
	Vessel collision risk	Although an increase in baseline collision risk is considered highly unlikely, if an individual was collided with, the consequences would be serious to the fitness of that individual. Mitigation measures will be put in place to ensure that this risk is minimised as far as possible.
	Vessel disturbance	Marine mammals may potentially be disturbed by the presence of vessels (separate from the potential impacts from underwater noise), however mitigation measures will be put in place to ensure that the risk is minimised.

Phase	Activity or impact	Potential effect
	Changes to prey availability	EMF from cabling has the potential to impact prey availability for marine mammals, resulting in potential indirect effects on marine mammals. This is assessed in **Volume 2, Chapter 8: Fish and Shellfish Ecology** and it is considered to not have an impact on marine mammals.
Decommissioning	As for construction but likely to be reduced in magnitude.	

Activities or impacts scoped out of assessment

11.4.10 A number of activities and impacts have been scoped out from further assessment, resulting from a conclusion of no likely significant effect. These conclusions have been made based on the knowledge of the baseline environment, the nature of planned works and the wealth of evidence on the potential for impact from such projects more widely. The conclusions follow (in a site-based context) existing best practice. Each scoped out activity or impact is considered in turn below (**Table 11-6)** and an indication given of whether the scope has evolved since Scoping. Those activities below are those which PINS, in its Scoping Opinion, has agreed can be scoped out based on current information.

Table 11-6 Activities or impacts scoped out of assessment

Activity or impact	Rationale for scoping out
Accidental pollution from construction and operation.	No Likely Significant Effect (LSE). The requirement for project level mitigation results in no likely significant effect.
EMF from operation.	No LSE. No significant direct effect to marine mammals detected from offshore wind farms.

11.5 Methodology for baseline data gathering

Overview

11.5.1 Baseline data collection has been undertaken to obtain information over the study areas described in **Section 11.3: Scope of the assessment**. The current baseline conditions presented in **Section 11.6: Baseline conditions** sets out data currently available information from the study area.

Desk study

11.5.2 The data sources that have been collected and used to inform this marine mammal assessment are summarised in **Table 11-7**.

Table 11-7 Data sources used to inform the marine mammal PEIR assessment

Source	Date	Summary	Coverage of study area
Rampion 2 surveys	Apr 2019 – Nov 2020 (full dataset will be included for the ES once analysis is complete)	Digital aerial surveys.	PEIR Assessment Boundary + 4 km buffer.
Rampion 1 surveys	Mar 2010 – Feb 2012	Boat based visual surveys.	Rampion 1 array area application boundary + 5 km buffer.
SCANS III (Hammond et al., 2017)	July 2016	Abundance estimates for small cetacean populations.	UK wide
JCP Phase III (Paxton et al., 2016)	1994-2010	Estimations of spatial and temporal abundance patterns.	UK wide
JCP Phase III Data Analysis Product	1994 and 2010	JCP dataset: 38 sources, totalling over 1.05 million km from a variety of platforms.	UK wide. Specific estimates provided for Hastings and Isle of Wight.
Heinänen and Skov (2015)	1991-2011 (Summer: Apr-Sep, Winter: Oct-Mar)	Density surface maps produced from the JCP dataset.	UK wide
MERP Cetacean distribution maps (Waggitt et al., 2020)	1980-2018	Species distribution maps available at monthly and 10 km^2 density scale.	UK wide
Sea Watch Foundation sightings	2007 - 2019	Sightings distribution maps.	Waters around the Isle of Wight.

Source	Date	Summary	Coverage of study area
(Castles, 2020)			
ORCA sightings	2011-2020	Sightings and effort data from opportunistic ferry surveys.	Ferry route between Portsmouth and Caen.
Seal haul-out counts (provided by SMRU)	August counts: 1996-2020 (harbour and grey seal) Autumn counts: 1989-2020 (grey seal pups)	Haul-out count data for population estimates.	UK wide
Seal telemetry (provided by SMRU)	1988-2018	Information on GPS location, track data and dive data.	UK wide
Sea at-sea usage (Russell et al., 2017)	1991-2015	Average seal at-sea distribution estimates at a 5km grid resolution.	UK wide
The Solent Seal Project (Castles et al., in review, Chesworth et al., 2010)	Counts: 1999-2019 Telemetry 2009	Annual august haul out counts of seals in the Solent. Telemetry data for 5 harbour seals tagged at Chichester and Langstone harbours.	The Solent
SAMM surveys (Laran et al., 2017)	Nov 2011 – Aug 2012	Large scale aerial surveys.	English Chanel and the Bay of Biscay.
French seal data (Vincent et al., 2017)	1999-2014	45 grey and 28 harbour seals tagged.	English Channel and French coast.

Site surveys

11.5.3 Monthly digital aerial surveys covering the survey area were conducted from April 2019 to March 2021, resulting in 24 surveys. At the time of PEIR, only 20 months

of data are available to include in the baseline characterisation (April 2019 – November 2020). The final baseline technical report for ES will be updated with the full 24 months of survey data.

11.5.4 Population estimates for each survey month were extracted by multiplying the mean number of animals per image, by the total number of images covering the study area. Using non-parametric, bootstrap methods, species-specific monthly abundance estimates were calculated from the raw count data, with upper and lower confidence limits included. Where appropriate, precision was also presented for each estimate. Dividing these estimates by the size of the area covered, generated the associated density estimates for all species. Detail on the site-specific surveys conducted is provided in **Table 11-8** (and reported on in full in **Appendix 11.1, Volume 4**).

Table 11-8 Site surveys undertaken

Survey type	Scope of survey	Coverage of study area	Survey status
Rampion 2 Monthly Digital Aerial Surveys	A suite of 24 monthly surveys to collect baseline data on marine mammals associated within the area of the proposed development	The survey tracks ensure representation of the entire survey area. As per the survey design, the survey tracks cover greater than 10% of the survey area. At the time of PEIR, approximately 11.58-12.24% of the survey area has been covered.	At the time of PEIR, only 20 months of data (April 2019 – November 2020) are available for this characterisation Additional monthly surveys have been taken all the way through to March 2021, resulting in a total of 24 months, however the data is still pending analysis so is not included in this PEIR but will be included in the ES.

Data limitations

11.5.5 The primary limitation relating to the marine mammal assessments within this PEIR is the incompleteness of the baseline data. As stated above, 20 months of data are available for PEIR and the assessments in the final ES will be updated with the full 24 months of data.

11.6 Baseline conditions

Introduction

11.6.1 The following sections provide a summary of the baseline conditions for marine mammal receptors. Detailed descriptions are included in **Appendix 11.1, Volume 4.**

Current baseline

11.6.2 The marine mammal baseline characterisation is presented in **Appendix 11.1, Volume 4**. The baseline characterisation details the occurrence of marine mammal species present in the study area, compiled through a combination of literature reviews and data obtained from site-specific surveys.

11.6.3 The site-specific surveys utilised for this PEIR resulted in the sightings of two identified species (harbour porpoise and common dolphin), alongside a number of unidentified cetaceans and seals. These surveys only recorded harbour porpoise between April and Oct 2019, and during these surveys a maximum of a single individual was sighted. This resulted in a maximum density estimate of 0.02 porpoise/km^2 within the survey area and an average density estimate across all 15 surveys of 0.004 porpoise/km^2. Only one common dolphin was sighted during the site-specific surveys in October 2019, resulting in a density estimate that month of 0.01 dolphins/km^2. The average density estimate across all surveys to date in the survey area was 0.001 dolphins/km^2. The unidentified cetaceans, presumed to be either a dolphin or porpoise species, were seen in six of the survey months. This resulted in a maximum dolphin/porpoise density estimate of 0.08 individuals/km^2 within the survey area and an average density estimate across all surveys of 0.01 individuals/km^2. The unidentified seals, presumed to be either grey or harbour seals, had a peak count in July when three seals were counted. This resulted in a maximum seal density estimate of 0.04 individuals/km^2 within the survey area and an average density estimate across all surveys of 0.003 individuals/km^2.

11.6.4 The conclusion of the baseline characterisation uses all the data sources selected (see **Section 11.5**) to identify the key marine mammal species within the study area, and a set of recommended density estimates and Management Units for each species to be used in this PEIR chapter (**Table 11-9** and **Figure 11.1, Volume 3**).

Table 11-9 Marine mammal density estimates, and reference population information used in the impact assessment

Species	Density (#/km^2)	Source	Reference population	Reference population size	Source
Harbour porpoise	0.213	SCANS III (Hammond *et al.*, 2017)	North Sea MU	345,373	(Hammond *et al.*, 2017)

Species	Density (#/km^2)	Source	Reference population	Reference population size	Source
Bottlenose dolphin	0.037	SAMMS surveys (Laran *et al*., 2017)	Offshore Channel and SW England	4,856	(IAMMWG, 2015)
White-beaked dolphin	Scoped out				
Common dolphin	0.171	SAMMS surveys (Laran *et al*., 2017)	Celtic and Greater North Seas	56,556	(IAMMWG, 2015)
Minke whale	0.002	SCANS III (Hammond *et al*., 2017)	Celtic and Greater North Seas	23,528	(IAMMWG, 2015)
Harbour seal	Grid cell specific	Habitat preference (Carter *et al*., 2020)	50% South & South-east England MUs combined	2,633	2019 counts provided by SMRU
Grey seal	Grid cell specific	Habitat preference (Carter et al., 2020)	South and South-east England MUs combined	36,368	2019 counts provided by SMRU

11.6.5 **Appendix 11.1, Volume 4** determines that the PEIR Assessment Boundary is not an important site for any marine mammal species and the predicted densities of all species that are present are relatively low. The main marine mammal species present during the site-specific surveys was the harbour porpoise with some sightings of common dolphins, seal species and unidentified small which could have been either a dolphin species or a porpoise. Bottlenose dolphins and minke whales have also been sighted during local and opportunistic surveys and so they have been scoped into the assessment within this PEIR chapter.

11.6.6 As detailed in **Appendix 11.1, Volume 4**, white-beaked dolphins are considered to be very rare visitors to the survey area, with no sightings during the site-specific surveys (20 months of data), SCANS III, JCP or ORCA surveys. Rampion 1 surveys recorded a single individual on one occasion during the full 30 surveys

undertaken for that project, with the only other records of white-beaked dolphin in the area from Sea Watch surveys, for which density estimates are not available. Based on the extremely low number of sightings of white-beaked dolphin, particularly in the more recent surveys, this species has been scoped out of the PEIR, as discussed and agreed at the ETG on 26 March 2021. Following the finalisation of the site surveys and inclusion of the remaining 4 months of data, the inclusion or otherwise of white-beaked dolphin will be reviewed for the ES.

11.6.7 Both harbour and grey seals can be observed within the English Channel, albeit at typically lower numbers than other areas of the UK. The Proposed Development is located within the South MU, however it is adjacent to the border of the South-east England MU, which consists of five geographically categorised haul-out groups for harbour seals including: Donna Nook, The Wash, Blakeney Point, Scroby Sands and the Greater Thames Estuary. As the Proposed Development has the potential to impact both management unit populations, Natural England have advised that it would be pragmatic for the reference population for the seal assessments to be comprised of 50% of the south management unit population and 50% of the south-east management unit population. Therefore, impacts to both MUs are considered for seal species.

11.6.8 The closest location to the Proposed Development where harbour seals are likely to haul out is around the Solent and adjacent harbours, approximately 11km distant, where low numbers of harbour seal hauled out have been estimated (40 individuals, SCOS, 2018). Three years worth of harbour seal photo-ID data indicate site fidelity in Chichester harbour (Castles *et al*., in review). Significantly larger harbour seal haul outs can be found into the North Sea, from the outer Thames northwards, however there is no evidence of connectivity between the Solent seals and the Southeast England MU seals and beyond (**Appendix 11.1, Volume 4**). Seal tagging data (Russell *et al*, 2017) indicates low harbour seal densities at sea in the English Channel, being less than one individual/km^2. The UK harbour seal population was estimated to be 32,600 individuals in the period 2015-2017 (SCOS, 2018).

11.6.9 The closest grey seal haul out site to the Proposed Development is at Chichester Harbour, where grey seal August counts are low (12 in 2019, Castles *et al*., in review). The UK grey seal population in 2018 was estimated at 152,800 (SCOS, 2020). Grey seal tagging data indicates a degree of connectivity among grey seals towards the western end of the English Channel and among those towards the eastern end of the English Channel, but not connectivity east to west (Vincent *et al*, 2017). Seal tagging data (Russell *et al.,* 2017) indicates low grey seal densities at sea in the English Channel, being less than 1 individual/km^2.

11.6.10 A summary of the species sighted during the site-specific surveys is presented in **Figure 11-2, Volume 3**.

Future baseline

11.6.11 It is challenging to predict the future trajectories of marine mammal populations in the absence of the Proposed Development. Some UK marine mammal populations have undergone periods of significant change in parts of their range, with a limited understanding of the driving factors responsible. For example, there is uncertainty about whether it is an increase in pup survival or increases in

fecundity that has been responsible for the recent exponential growth of grey seals in the North Sea (Russell, 2017). Additionally, monitoring is not in place at the relevant temporal or spatial scales to really understand the baseline dynamics of some marine mammal populations.

11.6.12 The most recent UK assessment of conservation status resulted in an assessment of *unknown*[2] for harbour porpoise (JNCC, 2019a), white-beaked dolphin (JNCC, 2019b), common dolphin (JNCC, 2019c), bottlenose dolphin (JNCC, 2019d), minke whale (JNCC, 2019e), *unfavourable – inadequate* for common seal (JNCC, 2019f), and *favourable* for grey seals (JNCC, 2019g). These assessments take into consideration the short term and long-term trends of the populations and provide an assessment of the future prospects of the population. For harbour porpoise both the short- and long-term trends in population size were categorised as unknown, with favourable status for range and habitat and the assessment resulted in a conclusion of having unknown future prospects. For white-beaked dolphin, common dolphin, bottlenose dolphin and minke whale, the long-term trends in population and habitat were unknown with favourable prospects for range, and the assessment resulted in a conclusion of *unknown* future prospects for each species overall. For grey seals the long-term trends in population size were categorised as increasing and the assessment resulted in a conclusion of the species having *favourable* future prospects. For harbour seals both the short- and long-term trends in population size were categorised as decreasing and the assessment resulted in a conclusion of the species having *poor* future prospects. However, it is important to note that the assessment for harbour seals noted that there has been a recent significant increase in population size for the species around the UK overall, with highly variable trends at different locations around the country.

11.6.13 The potential impacts of climate change on marine mammals were reviewed and synthesised by Evans and Bjørge (2013). They concluded that the impacts of climate change on marine mammals remain poorly understood. In the UK, changes are predicted to manifest in relation to changes in prey abundance and distribution as a result of warmer sea temperatures, and enhanced stratification forcing earlier occurrence of the spring phytoplankton bloom and potential cascading effects through the food chain (Evans and Bjørge 2013). The authors also conclude that the NW European species likely to be most affected in the future will be those that have relatively narrow habitat requirements and that shelf sea species like the harbour porpoise, white-beaked dolphin and minke whale may come under increased pressure with reduced available habitat, if they experience range shifts northwards. Although the main cause of widespread declines in UK harbour seal population is not known, the prevalence in the population of domoic acid derived from toxic algae may be a contributory factor and could be exacerbated by increased sea temperatures (Evans and Bjørge 2013). In addition, sea level rise and an increase in storm frequency and associated wave surges could affect the availability of haul out sites for seals. Increased storm frequency and associated conditions could also lead to increased pup and calf mortality.

[2] An assessment of unknown is determined when there is insufficient information to make a valid assessment. In the case of an unknown assessment a precautionary approach is taken.

11.6.14 In conclusion, it is likely that if the proposed development was not developed, the baseline with regard to marine mammal receptors is anticipated to remain unchanged aside from some natural variation (e.g. climate change).

11.7 Basis for PEIR assessment

Maximum design scenario

11.7.1 Assessing using a parameter-based design envelope approach means that the assessment considers a Maximum Design Scenario (MDS) whilst allowing the flexibility to make improvements in the future in ways that cannot be predicted at the time of submission of the DCO Application. The assessment of the maximum adverse scenario for each receptor establishes the maximum potential adverse impact and as a result impacts of greater adverse significance would not arise should any other development scenario (as described in **Chapter 4: The Proposed Development**) to that assessed within this Chapter be taken forward in the final scheme design.

11.7.2 The maximum assessment assumptions that have been identified to be relevant to marine mammals are outlined in **Table 11-10** below and are in line with the Project Design Envelope (**Chapter 4**).

Table 11-10 Maximum assessment assumptions for impacts on marine mammals

Project phase and activity/impact	Maximum assessment assumptions	Justification
Construction		
Construction noise impacts (including PTS, TTS and disturbance)	**WTG foundation installation:** 116 of the smaller WTGs supported on either 116 monopile (MP) foundations or 464 pin pile (PP) foundations (assuming 4 legs per jacket). MP foundations; hammer energy of up to 4,400kJ PP foundations; hammer energy of up to 2,500kJ 12 months duration **Offshore substation foundation installation:** 3 substation structures supported on either 3 MP foundations or 18 PP	The use of the smaller WTGs over the larger WTGs results in a greater number of WTGs being installed. As the hammer energy is the same for either WTG size, the smaller WTGs represent the maximum amount of energy emitted into the marine environment and therefore the largest risk to marine mammals. Both foundation types (MP and PP) are presented here as while the hammer energy is higher for MPs and gives the largest spatial impact, the additional number of PPs required may

Project phase and activity/impact	Maximum assessment assumptions	Justification
	foundations (assuming 6 legs per jacket) MP foundations; hammer energy of up to 4,400kJ PP foundations; hammer energy of up to 2,500kJ 12 months duration **Non-piling noise from seabed preparation, rock dumping and cable installation:** **Methods:** Trenching, dredging, jetting, ploughing, mass flow excavation, vertical injection, rock cutting	result in a greater impact due to the longer installation period. This is the maximum potential for underwater noise impacts.
Vessel collision risk	**WTG foundation installation:** 660 total return trips for all vessel types over a duration of 12 months. **Offshore substation foundation installation:** 96 total return trips for all vessel types over a duration of 12 months. **Array cable installation:** 331 total return trips for all vessel types over a duration of 12 months. **Offshore export cable installation:** 248 total return trips for all vessel types over a duration of 12 months.	The maximum number of WTGs and associated infrastructure will lead to the highest level of construction activities and therefore highest level of construction vessel round trips. The maximum number of vessels transits and the maximum duration of the construction will result in the greatest potential for vessel collisions with marine mammals.
Vessel disturbance	This is considered as per the justification for 'Vessel collision	The maximum number of WTGs and associated infrastructure will lead to the highest level of

Project phase and activity/impact	Maximum assessment assumptions	Justification
	risk' (construction - see above).	construction activities and therefore highest level of construction vessel round trips. The maximum number of vessels transits and the maximum duration of the construction will result in the greatest potential for marine mammal disturbance.
Changes in prey availability	The assessment for this impact is based on the MDS presented in **Chapter 8: Fish and shellfish Ecology.** See that chapter for a full description of the MDS.	The MDS described in **Chapter 8** is considered to be an accurate assessment. Therefore this chapter bases its assessment of the reduction in prey availability on the information presented within that chapter.
Disturbance to seal haul out sites at landfall	This is considered as per the justification for 'Construction noise impacts (including PTS and disturbance)', 'Vessel collision risk', 'Vessel disturbance' and 'Reduction in prey availability' (construction - see above).	All construction activities may potentially cause disturbance to seal haul out sites at landfall and therefore the MDS should consider all the other impacts.
Operation and maintenance		
Operational noise impacts	**WTG** Use of the larger WTGs	The use of the larger WTGs is likely to result in the loudest noise from operational WTGs.
Vessel collision risk	1,142 total return trips for all vessel types per year. **Peak vessel quantities:** A maximum of 26 vessels at any one time.	The maximum number of WTGs and associated infrastructure will lead to the highest level of WTGs and associated maintenance activities and therefore highest level of maintenance vessel round trips. The maximum number of vessels transits and the

Project phase and activity/impact	Maximum assessment assumptions	Justification
		maximum duration of the maintenance will result in the greatest potential for vessel collisions with marine mammals.
Vessel disturbance	This is considered as per the justification for 'Vessel collision risk' (operation and maintenance - see above).	The maximum number of WTGs and associated infrastructure will lead to the highest level of WTGs and associated maintenance activities and therefore highest level of maintenance vessel round trips. The maximum number of vessels transits and the maximum duration of the maintenance will result in the greatest potential for marine mammal disturbance.
Decommissioning		
Decommissioning noise impacts (including PTS and disturbance)	In the absence of detailed methodologies and schedules, decommissioning works and associated implications for marine mammals are considered analogous with those assessed for the construction phase. Therefore, this is considered as per the justification for 'Construction noise impacts (including PTS and disturbance)' (see above).	The scenario which represents the potential for the maximum level of infrastructure to be decommissioned. Decommissioning is likely to include removal of all of the WTG components and part of the foundations (those above seabed level) and removal of all other surface infrastructure. Some or all of the array cables, interconnector cables, and offshore export cables may be removed. The implications of decommissioning on marine mammals are expected to be less than the construction phase and are therefore not considered to be significant.
Vessel collision risk	In the absence of detailed methodologies and schedules,	The scenario which represents the potential for the maximum

Project phase and activity/impact	Maximum assessment assumptions	Justification
	decommissioning works and associated implications for marine mammals are considered analogous with those assessed for the construction phase. Therefore, this is considered as per the justification for 'Vessel collision risk' (construction - see above).	level of infrastructure to be decommissioned (see above).
Vessel disturbance	In the absence of detailed methodologies and schedules, decommissioning works and associated implications for marine mammals are considered analogous with those assessed for the construction phase. Therefore, this is considered as per the justification for 'Vessel disturbance' (construction - see above).	The scenario which represents the potential for the maximum level of infrastructure to be decommissioned (see above).
Changes in prey availability	In the absence of detailed methodologies and schedules, decommissioning works and associated implications for marine mammals are considered analogous with those assessed for the construction phase. Therefore, this is considered as per the justification for 'Reduction in prey availability' (construction - see above).	The scenario which represents the potential for the maximum level of infrastructure to be decommissioned (see above).
Disturbance to seal haul outs at landfall	In the absence of detailed methodologies and schedules, decommissioning works and associated implications for marine mammals are considered analogous with those assessed for the construction phase. Therefore,	The scenario which represents the potential for the maximum level of infrastructure to be decommissioned (see above).

Project phase and activity/impact	Maximum assessment assumptions	Justification
	this is considered as per the justification for 'Disturbance to seal haul outs at landfall' (construction - see above).	

Embedded environmental measures

11.7.3 As part of the proposed development design process, a number of embedded environmental measures have been adopted to reduce the potential for impacts on marine mammals. These embedded environmental measures will evolve over the development process as the EIA progresses and in response to consultation. They will be fed iteratively into the assessment process.

11.7.4 These measures typically include those that have been identified as good or standard practice and include actions that will be undertaken to meet existing legislation requirements. As there is a commitment to implementing these embedded environmental measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of the proposed development and are set out in this PEIR.

11.7.5 **Table 11-11** sets out the relevant embedded environmental measures within the design and how these affect the marine mammal assessment.

Table 11-11 Relevant marine mammal embedded environmental measures

ID	Environmental measure proposed	Project phase measure introduced	How the environmental measures will be secured	Relevance to the marine mammals assessment
C-51	A Vessel Management Plan (VMP) will be developed pre-construction.	Scoping	DCO requirements or DML conditions	The VMP will reduce the risk of vessel disturbance and collision risk. The assessment of vessel disturbance and collision risk are assessed in
C-52	A piling Marine Mammal Mitigation Protocol (MMMP) will be implemented during construction and will be developed in accordance with JNCC (2010) guidance and up to date current best practice. The piling MMMP will include details of soft starts to be used during piling operations with lower hammer energies used at the beginning of the piling sequence before increasing energies to the higher levels.	Scoping – updated at PEIR	DCO requirements or DML conditions	The piling MMMP will reduce the impact of underwater noise generated from piling activities, lowering the risk of injury, including PTS.
C-53	An Outline Marine Pollution Contingency Plan (MPCP) will be developed. This MPCP will outline procedures to protect	Scoping	DCO requirements or DML conditions	The MPCP will reduce the risk of an accidental pollution event occurring.

ID	Environmental measure proposed	Project phase measure introduced	How the environmental measures will be secured	Relevance to the marine mammals assessment
	personnel working and to safeguard the marine environment and mitigation measures in the event of an accidental pollution event arising from offshore operations relating to the proposed development. The MPCP will also include relevant key emergency contact details.			
C-54	A Decommissioning Marine Mammal Mitigation Protocol (MMMP) will be implemented during decommissioning. The Decommissioning MMMP will be in line with the latest relevant available guidance.	Scoping	DCO requirements or DML conditions	The decommissioning MMMP will reduce the impact of underwater noise generated from decommissioning activities, lowering the risk of injury, including PTS.
C-95	The assessment will take into consideration the mitigation and control of impacts on marine mammals that will be incorporated into an Outline Project Environmental Monitoring and Management Plan (PEMMP).	Scoping	DCO requirements or DML conditions.	The Outline PEMMP will summarise mitigation measures and monitoring requirements for marine mammals and assist in reducing the impacts from the development.

ID	Environmental measure proposed	Project phase measure introduced	How the environmental measures will be secured	Relevance to the marine mammals assessment
C-102	A UXO Marine Mammal Mitigation Protocol (MMMP) will be developed in consultation with Natural England to appropriately manage the risk to marine mammals during UXO clearance.	Scoping	DCO requirements or DML conditions	The UXO MMMP will reduce the impact of underwater noise generated from the removal of UXOs, lowering the risk of injury, including PTS.

11.8 Methodology for PEIR assessment

Introduction

11.8.1 The project-wide generic approach to assessment is set out in **Chapter 5: Approach to the EIA**. The assessment methodology for marine mammals for the PEIR is consistent with that provided in in the Scoping Report (RED, 2020).

Impact assessment criteria

11.8.2 The approach to determining the significance of effect is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts. This section describes the criteria applied in this chapter to assign values to the sensitivity of receptors and the magnitude of potential impacts.

11.8.3 The criteria for defining sensitivity in this chapter are outlined in **Table 11-12** below.

Table 11-12 Definition of terms relating to receptor sensitivity

Sensitivity	Definition used in this chapter
Very High	No ability to adapt behaviour so that survival and reproduction rates are affected. No tolerance – Effect will cause a change in both reproduction and survival rates. No ability for the animal to recover from any impact on vital rates (reproduction and survival rates).
High	Limited ability to adapt behaviour so that survival and reproduction rates may be affected. Limited tolerance – Effect may cause a change in both reproduction and survival of individuals. Limited ability for the animal to recover from any impact on vital rates (reproduction and survival rates).
Medium	Ability to adapt behaviour so that reproduction rates may be affected but survival rates not likely to be affected. Some tolerance – Effect unlikely to cause a change in both reproduction and survival rates. Ability for the animal to recover from any impact on vital rates (reproduction and survival rates).
Low	Receptor is able to adapt behaviour so that survival and reproduction rates are not affected.

Sensitivity	Definition used in this chapter
	Receptor is able to tolerate the effect without any impact on reproduction and survival rates. Receptor is able to return to previous behavioural states/activities once the impact has ceased.

11.8.4 The criteria for defining magnitude in this chapter are outlined in **Table 11-13** below.

Table 11-13 Definition of terms relating to magnitude of an impact

Magnitude of impact	Definition used in this chapter
Major	The impact will affect the behaviour and distribution of sufficient numbers of individuals, with sufficient severity, to affect the favourable conservation status and/or the long-term viability of the population at a generational scale. (Adverse)
	Impact is expected to result in a long-term, large scale increase in the population trajectory at a generational scale. (Beneficial)
Moderate	Temporary changes in behaviour and/or distribution of individuals at a scale that will result in potential reductions to lifetime reproductive success to some individuals although not enough to affect the population trajectory over a generational scale. Permanent effects on individuals that may influence individual survival but not at a level that will alter population trajectory over a generational scale. (Adverse)
	Benefit to the habitat influencing foraging efficiency resulting in increased reproductive potential and increased population health and size. (Beneficial)
Minor	Short-term and/or intermittent and temporary behavioural effects in a small proportion of the population. Reproductive rates of individuals may be impacted in the short term (over a limited number of breeding cycles). Survival and reproductive rates very unlikely to be impacted to the extent that the population trajectory will be altered.

Magnitude of impact	Definition used in this chapter
	(Adverse)
	Short term (over a limited number of breeding cycles) benefit to the habitat influencing foraging efficiency resulting in increased reproductive potential. (Beneficial)
Negligible	Very short term, recoverable effect on the behaviour and/or distribution in a very small proportion of the population. No potential for the any changes in the individual reproductive success or survival therefore no changes to the population size or trajectory. (Adverse)
	Very minor benefit to the habitat influencing foraging efficiency of a limited number of individuals. (Beneficial)

11.8.5 The significance of the effect upon marine mammals is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The method employed for this assessment is presented in **Table 11-14**. Where a range of significance of effect is presented in **Table 11-14**, the final assessment for each effect is based upon expert judgement.

Table 11-14 Matrix used for the assessment of the significance of the effect

		Magnitude of Impact			
		Major	**Moderate**	**Minor**	**Negligible**
Sensitivity/ importance/ value	**Very High**	Major (Significant)	Major (Significant)	Moderate (Potentially significant)	Minor (Not significant)
	High	Major (Significant)	Moderate (Potentially significant)	Minor (Not significant)	Minor (Not significant)
	Medium	Moderate (Potentially significant)	Minor (Not significant)	Minor (Not significant)	Negligible (Not significant)
	Low	Minor (Not significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)

11.9 Preliminary assessment: Construction phase

Introduction

11.9.1 The impacts of the construction of the Proposed Development have been assessed on marine mammals in the study area. The effects arising from the construction of the Proposed Development are listed in **Table 11-10** along with the maximum design scenario assumptions against which each construction phase impact has been assessed.

11.9.2 A description of the significance of effects upon marine mammal receptors caused by each identified impact is given below.

Construction noise impacts (including PTS, TTS and disturbance)

Overview

11.9.3 Construction activities, particularly pile driving, results in high levels of underwater noise emitted into the marine environment. Different sources result in different types and intensities of underwater noise, with pile driving and UXO clearance causing impulsive noise, with these sounds sources resulting in the highest intensity sound likely to be emitted as part of the construction phase. Other sound sources such as vessels involved in construction and noise arising from cable installation or other construction activities are typically of a lower intensity, (mainly) non-impulsive nature and are likely to be continuous sounds, which pose a reduced magnitude of impact to marine mammals compared to piling and UXO.

11.9.4 Due to the expected duration and intensity of the underwater noise from piling compared to the other sound sources, the focus of the potential effects from underwater noise presented below focuses on that from piling, with consideration of the potential impacts from other sources provided following the piling assessment.

11.9.5 To inform the assessment of impacts from underwater noise, modelling has been undertaken which details the expected sound levels and predicted impact ranges (for relevant thresholds) from the various sound sources. Three representative locations were modelled: the North West (NW) location as is shallow water and close to the coast, the South (S) location as is in the deepest water of the site, and the East (E) location as is the deepest water that either a monopile or jacket foundation could be installed. No hydraulic monopiles have been considered or modelled for the S location due to the water depths involved. The modelling methodology and results are presented within **Appendix 11.2, Volume 4.**

Piling noise assessment

Overview

11.9.6 A detailed underwater noise impact assessment of the effects which may arise from underwater noise from piling on marine mammals is presented in **Appendix 11.2, Volume 4** with the information below a summary of the information provided therein.

11.9.7 In line with recent industry experience, the maximum hammer energies permitted for offshore wind project piling are typically rarely used, with average hammer energies much lower than those stated in the MDS assumptions. In recognition of this, two scenarios are included in the below assessment: a worst-case scenario (worst case scenario) which is based on the maximum hammer energy; and a most likely scenario (MLS) which is based on a reduced hammer energy. Details regarding the MLS assumptions can be found in **Appendix 11.2, Volume 4**.

11.9.8 For both worst case scenario and MLS, cumulative PTS and TTS have been calculated based on up to two piles installed within a 24-hour period for monopiles. For pin piles, the modelling has assumed four piles to be installed in 24-hours.

PTS

11.9.9 Under the worst case scenario, the largest predicted cumulative PTS-onset impact range for harbour porpoises is 6.1km, resulting in a potential PTS-onset impact to 13 harbour porpoise per piling day, which represents 0.004% of the North Sea MU (**Table 11-15**). Under the MLS, the largest predicted cumulative PTS-onset impact range is 5.7km, resulting in a potential PTS-onset impact to 12 harbour porpoise per piling day, which represents 0.003% of the North Sea MU (**Table 11-16**).

Table 11-15 Impact area, maximum range, number of harbour porpoise and percentage of MU predicted to experience PTS-onset for the worst case scenario.

	Monopile (4,000 kJ)			**Pin-pile (2,000 kJ)**		
	NW	S	E	NW	S	E
Instantaneous PTS: 202 dB unweighted SPL_{peak}						
Area (km^2)	0.57	N/A	1.3	0.34	0.92	0.85
Max range (km)	0.43	NA	0.66	0.34	0.54	0.52
# of harbour porpoise	<1	NA	<1	<1	<1	<1
% MU	0.000%	NA	0.000%	0.000%	0.000%	0.000%
Cumulative PTS: 155 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km^2)	6.9	NA	63	2.7	77	38
Max range (km)	2.20	NA	6.10	1.50	5.9	4.7
# Porpoise	1	NA	13	1	16	8
% MU	0.000%	NA	0.004%	0.000%	0.005%	0.002%

Table 11-16 Impact area, maximum range, number of harbour porpoise and percentage of MU predicted to experience PTS-onset for the MLS

	Monopile (4,000 kJ)			Pin-pile (2,000 kJ)		
	NW	S	E	NW	S	E
Instantaneous PTS: 202 dB unweighted SPL_{peak}						
Area (km^2)	0.54	NA	1.3	0.29	0.76	0.71
Max range (km)	0.42	NA	0.65	0.31	0.5	0.48
# Porpoise	<1	NA	<1	<1	<1	<1
% MU	0.000%	NA	0.000%	0.000%	0.000%	0.000%
Cumulative PTS: 155 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km^2)	6.0	NA	57	1.5	57	27
Max range (km)	2.10	NA	5.7	1.1	5.0	4.0
# Porpoise	1	NA	12	<1	12	6
% MU	0.000%	NA	0.003%	0.000%	0.003	0.002%

11.9.10 Under the worst case scenario, the largest predicted cumulative PTS-onset impact range for bottlenose and common dolphins is <0.1 km, resulting in a potential PTS-onset impact to <1 individual dolphin per piling day, which represents 0.000% of the MUs for each species (**Table 11-17**). Under the MLS, the number of individuals impacted will be lower than those predicted for the worst case scenario and therefore no additional consideration is required.

Table 11-17 Impact area, maximum range and number of bottlenose and common dolphins predicted to experience PTS-onset for the worst case scenario.

	Monopile (4,400 kJ)			Pin-pile (2,500 kJ)		
	NW	S	E	NW	S	E
Instantaneous PTS: 230 dB unweighted SPL_{peak}						
Area (km^2)	<0.1	NA	<0.1	<0.1	<0.1	<0.1
Max range (km)	<0.05	NA	<0.05	<0.05	<0.05	<0.05
Bottlenose dolphins	<1	NA	<1	<1	<1	<1

	Monopile (4,400 kJ)			Pin-pile (2,500 kJ)		
Common dolphins	<1	NA	<1	<1	<1	<1
Cumulative PTS: 185 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km^2)	<0.1	NA	<0.1	<0.1	<0.1	<0.1
Max range (km)	<0.10	NA	<0.10	<0.10	<0.10	<0.10
Bottlenose dolphins	<1	NA	<1	<1	<1	<1
Common dolphins	<1	NA	<1	<1	<1	<1

11.9.11 The largest predicted cumulative PTS-onset impact range for minke whales is 13km under the worst case scenario and 12 km under the MLS. Despite these large PTS-onset impact ranges, the density of minke whales predicted to be in this area is low enough (0.002 whales/km^2 SCANS III) that even with impact ranges of this scale, there is only a potential PTS-onset impact to <1 individual whale per piling day, which represents 0.0000% of the MU (**Table 11-18** and **Table 11-19**).

Table 11-18 Impact area, maximum range and number of minke whales predicted to experience PTS-onset for the worst case scenario.

	Monopile (4,400 kJ)			Pin-pile (2,500 kJ)		
	NW	S	E	NW	S	E
Instantaneous PTS: 219 dB unweighted SPL_{peak}						
Area (km^2)	<0.01	NA	<0.01	<0.01	<0.01	<0.01
Max range (km)	<0.05	NA	<0.05	<0.05	<0.05	<0.05
# whales	<1	NA	<1	<1	<1	<1
Cumulative PTS: 183 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km^2)	8.6	NA	200	1.3	260	130
Max range (km)	3.20	NA	12.0	1.4	13.0	9.6
# whales	<1	NA	<1	<1	<1	<1

Table 11-19 Impact area, maximum range and number of minke whales predicted to experience PTS-onset for the MLS.

	Monopile (4,000 kJ)			Pin-pile (2,000 kJ)		
	NW	S	E	NW	S	E
Instantaneous PTS: 219 dB unweighted SPL_{peak}						
Area (km^2)	<0.1	NA	<0.1	<0.1	<0.1	<0.1
Max range (km)	<0.05	NA	<0.05	<0.05	<0.05	<0.05
# whales	<1	NA	<1	<1	<1	<1
Cumulative PTS: 183 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km^2)	7.4	NA	190	0.5	220	100
Max range (km)	3.00	NA	12.0	0.85	11.0	8.6
# whales	<1	NA	<1	<1	<1	<1

11.9.12 Under the worst case scenario, the largest predicted PTS-onset impact range for harbour and grey seals is <0.1 km, resulting in a potential PTS-onset impact to <1 individual harbour or grey seal per piling day (**Table 11-20**). Under the MLS, the number of individuals impacted will be lower than those predicted for the worst case scenario and therefore no additional consideration is required.

Table 11-20 Impact area, maximum range and number of harbour and grey seals predicted to experience PTS-onset for the worst case scenario

	Monopile (4,400 kJ)			Pin-pile (2,500 kJ)		
	NW	S	E	NW	S	E
Instantaneous PTS: 218 dB unweighted SPL_{peak}						
Area (km^2)	<0.01	NA	<0.01	<0.01	<0.01	<0.01
Max range (km)	<0.05	NA	<0.05	<0.05	<0.05	<0.05
Harbour seals	<1	NA	<1	<1	<1	<1
Grey seals	<1	NA	<1	<1	<1	<1
Cumulative PTS: 185 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km^2)	<0.1	NA	<0.1	<0.1	<0.1	<0.1

	Monopile (4,400 kJ)			Pin-pile (2,500 kJ)		
Max range (km)	<0.1	NA	<0.1	<0.1	<0.1	<0.1
Harbour seals	<1	NA	<1	<1	<1	<1
Grey seals	<1	NA	<1	<1	<1	<1

11.9.13 Although the numbers of individuals predicted to be at risk per piling day for all species are low enough to not be considered significant in EIA terms, all cetaceans assessed are EPS and under EPS legislation it is an offence to injure a single individual (including PTS auditory injury). Therefore, RED have committed to a piling MMMP (C-52, **Table 11-11**) with the aim to reducing the risk of PTS to as low as reasonably possible. The MMMP is likely to include details regarding any of the following measures where appropriate; a soft start procedure, deployment of acoustic deterrent devices and specifics regarding marine mammal observation protocols. In addition to this embedded environmental measure, Brandt *et al.* (2018), Graham *et al.* (2019) and Benhemma-Le Gall *et al*. (in review) observed that for harbour porpoise it is likely that the presence of construction vessels will result in any individuals being displaced away from the site, ensuring that the vicinity of the pile is free of harbour porpoise by the time that piling begins.

TTS

11.9.14 The ranges that indicate TTS-onset were modelled and are presented alongside an estimate of the potential number of animals within these impact ranges. However, as TTS-onset is defined primarily as a means of predicting PTS-onset, there is currently no threshold for TTS-onset that would indicate a biologically significant amount of TTS; therefore it was not possible to carry out a quantitative assessment of the magnitude or significance of the impact of TTS on marine mammals and therefore TTS is not considered during the assessment stage of this PEIR. The current set of TTS-onset threshold will result in a significant overestimate of the impact due to the extremely large resulting impact ranges representing the smallest measurable amount of TTS. This approach was agreed with the CEFAS at the ETG meeting dated 18 September 2020.

11.9.15 **Table 11-21** and **Table 11-22** outline the potential for TTS-onset for harbour porpoise for both monopiles and pin-piles under the worst case scenario and MLS respectively. The largest predicted cumulative TTS-onset impact range is 31km, resulting in a potential TTS-onset impact to 341 harbour porpoise per piling day which represents 0.099% of the North Sea MU.

Table 11-21 Impact area, maximum range, number of harbour porpoise and percentage of MU predicted to experience TTS-onset for the worst case scenario

	Monopile (4,400 kJ)			Pin-pile (2,500 kJ)		
	NW	S	E	NW	S	E
Instantaneous TTS: 196 dB unweighted SPL_{peak}						
Area (km^2)	2.8	NA	7.3	1.8	5.7	4.9
Max range (km)	0.97	NA	1.6	0.77	1.4	1.3
# Porpoise	1	NA	2	<1	1	1
% MU	0.000%	NA	0.001%	0.000%	0.000%	0.000%
Cumulative TTS: 140 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km^2)	550	NA	1300	440	1600	1100
Max range (km)	21	NA	30	19	31	28
# Porpoise	117	NA	277	94	341	234
% MU	0.034%	NA	0.080%	0.027%	0.099%	0.068%

Table 11-22 Impact area, maximum range, number of harbour porpoise and percentage of MU predicted to experience TTS-onset for the MLS

	Monopile (4,000 kJ)			Pin-pile (2,000 kJ)		
	NW	S	E	NW	S	E
Instantaneous TTS: 196 dB unweighted SPL_{peak}						
Area (km^2)	2.7	NA	7	1.5	4.8	4.1
Max range (km)	0.95	NA	1.6	0.71	1.2	1.2
# Porpoise	1	NA	1	<1	1	1
% MU	0.000%	NA	0.000%	0.000%	0.000%	0.000%
Cumulative TTS: 140 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km^2)	510	NA	1300	380	1400	1000
Max range (km)	20	NA	29	17	29	26

	Monopile (4,000 kJ)			Pin-pile (2,000 kJ)		
# Porpoise	109	NA	277	81	298	213
% MU	0.032%	NA	0.080%	0.023%	0.086%	0.062%

11.9.16 **Table 11-23** outlines the potential for TTS-onset for bottlenose and common dolphins for both monopiles and pin-piles under the worst case scenario. The largest predicted cumulative TTS-onset impact range is <0.1 km, resulting in a potential TTS-onset impact to <1 individual dolphin of each species per piling day which represents 0.000% of the relevant MU for each species. Given the low numbers predicted for the worst case scenario, the MLS numbers were not presented here since they will be lower than those predicted for the worst case scenario.

Table 11-23 Impact area, maximum range, number of bottlenose and common dolphins and predicted to experience TTS-onset for the worst case scenario

	Monopile (4,400 kJ)			Pin-pile (2,500 kJ)		
	NW	S	E	NW	S	E
Instantaneous TTS: 224 dB unweighted SPL_{peak}						
Area (km^2)	<0.01	NA	<0.01	<0.01	<0.01	<0.01
Max range (km)	<0.05	NA	<0.05	<0.05	<0.05	<0.05
Bottlenose dolphins	<1	NA	<1	<1	<1	<1
Common dolphins	<1	NA	<1	<1	<1	<1
Cumulative TTS: 170 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km^2)	<0.01	NA	<0.01	<0.01	<0.01	<0.01
Max range (km)	<0.1	NA	<0.1	<0.1	<0.1	<0.1
Bottlenose dolphins	<1	NA	<1	<1	<1	<1
Common dolphins	<1	NA	<1	<1	<1	<1

11.9.17 **Table 11-24** and **Table 11-25** outline the potential for TTS-onset for minke whales for both monopiles and pin-piles under the worst case scenario and MLS

respectively. The largest predicted cumulative TTS-onset impact range is 42km, resulting in a potential TTS-onset impact to five whales per piling day which represents 0.021% of the relevant MU.

Table 11-24 Impact area, maximum range, number of minke whales and percentage of MU predicted to experience TTS-onset for the worst case scenario.

	Monopile (4,400 kJ)			**Pin-pile (2,500 kJ)**		
	NW	S	E	NW	S	E
Instantaneous TTS: 213 dB unweighted SPL_{peak}						
Area (km^2)	0.02	NA	0.04	<0.01	0.03	0.03
Max range (km)	0.09	NA	0.12	0.07	0.10	0.09
# whales	<1	NA	<1	0	<1	<1
% MU	0.000%	NA	0.000%	0.000%	0.000%	0.000%
Cumulative TTS: 168 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km^2)	730	NA	2000	530	2400	1700
Max range (km)	26	NA	41	22	42	38
# whales	1	NA	4	1	5	3
% MU	0.004%	NA	0.017%	0.004%	0.021%	0.013%

Table 11-25 Impact area, maximum range, number of minke whales and percentage of MU predicted to experience TTS-onset for the MLS.

	Monopile (4,000 kJ)			**Pin-pile (2,000 kJ)**		
	NW	S	E	NW	S	E
Instantaneous TTS: 213 dB unweighted SPL_{peak}						
Area (km^2)	0.02	NA	0.04	<0.01	0.02	0.02
Max range (km)	0.09	NA	0.12	0.06	0.09	0.09
# whales	<1	NA	<1	<1	<1	<1
% MU	0.000%	NA	0.000%	0.000%	0.000%	0.000%
Cumulative TTS: 168 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						

	Monopile (4,000 kJ)			Pin-pile (2,000 kJ)		
Area (km²)	710	NA	2000	470	2200	1600
Max range (km)	26	NA	41	21	41	36
# whales	1	NA	4	1	4	3
% MU	0.004%	NA	0.017%	0.004%	0.004	0.013%

11.9.18 **Table 11-26** and **Table 11-27** outline the potential for TTS-onset for harbour and grey seals for both monopiles and pin-piles under the worst case scenario and MLS respectively. The largest predicted cumulative TTS-onset impact range is 15km, resulting in a potential TTS-onset impact to <1 seal of each species per piling day.

Table 11-26 Impact area, maximum range, number of harbour and grey seals predicted to experience TTS-onset for the worst case scenario.

	Monopile (4,400 kJ)			Pin-pile (2,500 kJ)		
	NW	S	E	NW	S	E
Instantaneous TTS: 212 dB unweighted SPL_{peak}						
Area (km²)	0.03	NA	0.06	0.02	0.04	0.04
Max range (km)	0.10	NA	0.14	0.08	0.11	0.11
Harbour seals	<1	NA	<1	<1	<1	<1
Grey seals	<1	NA	<1	<1	<1	<1
Cumulative TTS: 170 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km²)	35	NA	280	23	400	230
Max range (km)	5.2	NA	13.0	4.3	15.0	12.0
Harbour seals	<1	NA	<1	<1	<1	<1
Grey seals	<1	NA	<1	<1	<1	<1

Table 11-27 Impact area, maximum range, number of harbour and grey seals predicted to experience TTS-onset for the MLS.

	Monopile (4,000 kJ)			Pin-pile (2,000 kJ)		
	NW	S	E	NW	S	E
Instantaneous TTS: 212 dB unweighted SPL_{peak}						
Area (km^2)	0.03	NA	0.05	0.02	0.03	0.03
Max range (km)	0.10	NA	0.01	0.07	0.10	0.10
Harbour seals	<1	NA	<1	<1	<1	<1
Grey seals	<1	NA	<1	<1	<1	<1
Cumulative TTS: 170 dB VHF Weighted SEL_{cum} (2 monopiles or 4 pin-piles in 24 hrs)						
Area (km^2)	33	NA	260	19	360	200
Max range (km)	5.0	NA	13.0	3.9	14.0	11.0
Harbour seals	<1	NA	<1	<1	<1	<1
Grey seals	<1	NA	<1	<1	<1	<1

Disturbance

11.9.19 For all marine mammal species considered in this assessment, the highest level of disturbance in spatial terms is predicted to be from the installation of monopiles, however no hydraulic piing of monopiles is proposed to occur at the south location which is the deepest location and where noise propagates furthest. If the south location is not considered for hydraulic piling of monopiles, the worst case scenario for monopiles is the east location. For pin piles, the worst case scenario is in the south location (**Figure 11-3, Volume 3**, see **Appendix 11.2, Volume 4** for more information). **Table 11-28** summarises the number of individuals and the percentage of MUs for all species predicted to experience potential disturbance for the worst case scenario and MLS.

11.9.20 Under the worst case scenario for monopiles, a total of 551 harbour porpoise are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.16% of the reference population. For the concurrent piling of monopiles at the northwest and east locations simultaneously, a total of 630 harbour porpoise are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.18% of the reference population. Under the worst case scenario for pin piles, 633 harbour porpoises are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.18% of the reference population. This represents the highest level of disturbance in both spatial and temporal terms.

11.9.21 Given the results of the expert elicitation on the likely effects of behavioural disturbance on vital rates (Booth *et al*. 2019), a total of 58 days piling for monopiles (assuming two monopiles are installed concurrently) and 116 days piling for pin-piles (assuming four piles per day) is unlikely to cause any effect on fertility rates, although there is the potential for calf survival to be affected. However, it is highly unlikely that the same mother-calf pair would repeatedly return to the area in order to receive these levels of repeated disturbance over this many days. Any potential impact on calf survival rates is likely to be temporary and is not expected to result in any changes in the population trajectory or overall size.

11.9.22 Under the worst case scenario for monopiles, a total of 96 bottlenose dolphins are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 1.97% of the reference population. For the concurrent piling of monopiles at the northwest and east locations simultaneously, a total of 110 bottlenose dolphins are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 2.27% of the reference population. Under the worst case scenario for pin piles, 110 bottlenose dolphins are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 2.27% of the reference population. This represents the highest level of disturbance in both spatial and temporal terms.

11.9.23 The number of bottlenose dolphins predicted to experience behavioural disturbance as a result of pile-driving is considered to be conservative. This is due to the fact that the density estimate used (0.037dolphin/km^2) is the summer density estimate for the English Channel, however densities are expected to be much lower in the winter (0.010 dolphins/km^2) and therefore the numbers used for this assessment are highly precautionary for the predicted level of impact in winter months.

1.1.2 Previous iPCoD modelling for bottlenose dolphins has shown that disturbance from piling at the Moray West offshore windfarm to ~5% of the population did not result in any significant effect on the long-term population size (Moray Offshore Windfarm (West) Limited, 2018). A cumulative impact assessment of Scottish east coast offshore wind farm construction on the east coast bottlenose dolphin population showed that increasing the number of days of consecutive piling and increasing the proportion of the population disturbed per day resulted in an increased risk of population decline (**Figure 11.4, Volume 3**, Smith *et al*., 2019). However, the proportion of the population predicted to be impacted by the Proposed Development (up to 2.27% per day) and the number of days of piling expected to occur (up to 116 piling days assuming four pin-piles are installed in one 24-hour period) is highly unlikely to result in any decline in the bottlenose dolphin population.

11.9.24 Under the worst case scenario for monopiles, a total of 442 common dolphins are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.78% of the reference population. For the concurrent piling of monopiles at the northwest and east locations simultaneously, a total of 506 common dolphins are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.89% of the reference population. Under the worst case scenario for pin piles, 508 common dolphins are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents

0.90% of the reference population. This represents the highest level of disturbance in both spatial and temporal terms.

11.9.25 Under the worst case scenario for monopiles, a total of five minke whales are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.02% of the reference population. For the concurrent piling of monopiles at the northwest and east locations simultaneously, a total of six minke whales are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.03% of the reference population. Under the worst case scenario for pin piles, six minke whales are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.03% of the reference population. This represents the highest level of disturbance in both spatial and temporal terms.

11.9.26 Under the worst case scenario for monopiles, a total of <1 harbour seal is predicted to be potentially disturbed once hammer energy reaches its maximum, which represents <0.002% of the reference population. For the concurrent piling of monopiles at the northwest and east locations simultaneously, a total of <1 harbour seal is predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.002% of the reference population. Under the worst case scenario for pin piles, <1 harbour seal is predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.002% of the reference population. This represents the highest level of disturbance in both spatial and temporal terms.

11.9.27 Under the worst case scenario for monopiles, a total of two grey seals are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.005% of the reference population. For the concurrent piling of monopiles at the northwest and east locations simultaneously, a total of two grey seals are predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.005% of the reference population. Under the worst case scenario for pin piles, one grey seal is predicted to be potentially disturbed once hammer energy reaches its maximum, which represents 0.004% of the reference population. This represents the highest level of disturbance in both spatial and temporal terms.

Table 11-28 Number of and percentage of MUs for all species predicted to experience potential disturbance for the worst case scenario and MLS.

	NW & E concurrent	NW single	S single	E single	NW single	S single	E single
worst case scenario	**Monopile (4,400 kJ)**					**Pin-pile (2,500 kJ)**	
# of Harbour porpoise	630	285	NA	551	226	633	475
% MU	0.18%	0.08%	NA	0.16%	0.07%	0.18%	0.14%

	NW & E concurrent	NW single	S single	E single	NW single	S single	E single
worst case scenario	**Monopile (4,400 kJ)**					**Pin-pile (2,500 kJ)**	
# of Bottlenose dolphin	110	50	NA	96	39	110	83
% MU	2.27%	1.02%	NA	1.97%	0.81%	2.27%	1.70%
# of Common dolphins	506	229	NA	442	181	508	382
% MU	0.89%	0.40%	NA	0.78%	0.32%	0.90%	0.67%
# of Minke whale	6	3	NA	5	2	6	5
% MU	0.03%	0.01%	NA	0.02%	0.01%	0.03%	0.02%
# harbour seal	<1 (0 – <1)	<1 (0 – <1)	NA	<1 (0 – <1)	<1 (0 – <1)	<1 (0 – <1)	<1 (0 – <1)
# grey seal	2 (0 – 3)	<1 (0 – 1)	NA	2 (0 – 3)	<1 (0 – 1)	<1 (0 – 1)	1 (0 – 2)
MLS	Monopile (4,000 kJ)			Pin-pile (2,000 kJ)			
# of Harbour porpoise	622	280	NA	543	213	604	452
% MU	0.18%	0.08%	NA	0.16%	0.06%	0.17%	0.13%
# of Bottlenose dolphin	108	49	NA	94	37	105	79
% MU	2.23%	1.00%	NA	1.94%	0.76%	2.16%	1.62%
# of Common dolphins	499	225	NA	436	171	485	363
% MU	0.88%	0.40%	NA	0.77%	0.30%	0.86%	0.64%
# of Minke whale	6	3	NA	5	2	6	4

	NW & E concurrent	NW single	S single	E single	NW single	S single	E single
worst case scenario	**Monopile (4,400 kJ)**					**Pin-pile (2,500 kJ)**	
% MU	0.03%	0.01%	NA	0.02%	0.01%	0.03%	0.02%

Magnitude of impact

11.9.28 The impact in each case is predicted to be of local spatial extent, short term duration, intermittent and is reversible. The Applicant considers that piling is short term (for the Proposed Development alone assessment), given the likely number of piling days within the construction period and the fact that piling will not be constant on or between piling days. There is evidence that marine mammals return to the vicinity of construction and that any disturbance effect is short lived (e.g. Brandt et al (2018) showed that porpoise detections returned to normal within 24-48 hours after piling ceased), therefore pile driving is not considered to be a long-term impact). The magnitude of both PTS and disturbance will inherently change between species in response to the number of individuals affected and the proportion of the MU affected for that species. The magnitude of PTS and disturbance for each species is presented in **Table 11-29** and **Table 11-30**. The implementation of the MMMP (C-52, **Table 11-11**) results in the magnitude of PTS being **negligible.** For disturbance, the magnitude varies between species with the highest magnitude being considered as **moderate** for both bottlenose and common dolphins.

Sensitivity or value of receptor

11.9.29 As outlined in **Appendix 11.2, Volume 4**, the potential for PTS resulting from exposure to pile driving noise to affect the survival and reproduction of individuals is considered low, given the current uncertainty surrounding these effects and how critical sound can be for echolocation, foraging, and communication in cetaceans, all cetaceans have been assessed as having a **medium** sensitivity to PTS. At the recent BEIS funded expert elicitation workshop (Booth and Heinis, 2018) experts concluded that the probability of PTS significantly affecting the survival and reproduction of either seal species was very low. As a result of this, and the fact that seals do not generally use hearing as their primary sensory modality for finding prey and navigation in the same way as cetaceans do, the sensitivity of seals to PTS has been assessed as **low**.

11.9.30 With the exception of grey seals, all of the marine mammals are assessed to have a **medium** sensitivity to disturbance caused during the construction phase. Grey seals have a **low** sensitivity, due to observed responsiveness to piling combined with their capital breeder life history and their tolerance of periods of fasting.

Significance of residual effect

11.9.31 The impact of behavioural disturbance and PTS from piling noise under both the worst case scenario and the MLS are not considered to have a significant effect on any marine mammal species considered in this assessment (**Table 11-29** and **Table 11-30**).

11.9.32 Despite the differences in sensitivity and magnitude between species, all of the impacts are considered as a maximum to be of **minor adverse significance**, which is **not significant** in EIA terms.

Table 11-29 Impact significance for all marine mammals to the impact of PTS from impact piling.

	Monopiles & Pin-piles worst case scenario & MLS		
	Magnitude	Sensitivity	Impact
Harbour porpoise	Negligible	Medium	Minor adverse (not significant)
Bottlenose dolphin	Negligible	Medium	Minor adverse (not significant)
Common dolphin	Negligible	Medium	Minor adverse (not significant)
Minke whale	Negligible	Medium	Minor adverse (not significant)
Harbour seal	Negligible	Low	Minor adverse (not significant)
Grey seal	Negligible	Low	Minor adverse (not significant)

Table 11-30 Impact significance for all marine mammals to the impact of behavioural disturbance from impact piling.

	Monopiles & Pin-piles (worst case scenario & MLS)		
	Magnitude	Sensitivity	Impact
Harbour porpoise	Minor	Medium	Minor adverse (Not Significant)
Bottlenose dolphin	Moderate	Medium	Minor adverse (Not Significant)
Common dolphin	Moderate	Medium	Minor adverse (Not Significant)
Minke whale	Minor	Medium	Minor adverse (Not Significant)
Harbour seal	Negligible	Medium	Minor adverse (Not Significant)
Grey seal	Negligible	Low	Minor adverse (Not Significant)

UXO noise assessment

Overview

11.9.33 Clearance of UXO, if any are located prior to the construction of the proposed development, will be necessary to reduce the risk to personnel and equipment during the construction process. RED is proposing to consent UXO clearance (if required) through a separate Marine Licence prior to the works being undertaken to enable a more detailed assessment to be undertaken based on increased data availability. However, as the clearance of UXO is an activity which is likely to occur, for completeness it has been considered within this assessment and under commitment 102 (C-102, **Table 11-11**).

11.9.34 Due to the early stage for the Proposed Development and the consequent lack of detailed site-specific magnetometer data and the need for UXO clearance activities to be undertaken sufficiently close to construction to ensure the safety certification remains valid, it is not currently possible to define the number (if any) of UXO which may require clearance prior to the start of construction. Therefore, the assessment below presents potential impact ranges from a variety of charge sizes that may be found within the PEIR Assessment Boundary.

11.9.35 The UXO clearance operations will follow the avoid, reduce, mitigate process, with first intention being to avoid the need to detonate the UXO by micrositing infrastructure. In many instances, this will not be possible and therefore, for clearance operations, two primary types of clearance will be considered:

- High order – this comprises using a donor charge of explosive (typically between 5 – 20 kg) to trigger a detonation of the explosive within the UXO; and
- Low order – this comprises a number of methods which use a small amount (up to 2 kg) of explosive to destroy the explosive material without detonating it, such as burning out the explosive (deflagration) or disrupting the explosive using high pressure water jets (named “low yield”).

11.9.36 The worst-case scenario will be all high order clearance, with impact ranges from low order techniques being smaller than those presented herein. The clearance techniques used at the time will employ industry best practice, with due consideration given to developing technology/techniques which are currently being introduced to the market (i.e. low order techniques). Supporting environmental information submitted with the Application at the time the Marine Licence is sought will set out the proposed approach based on the practicable techniques available and the dependability of the methods at that time. **Table 11-31** below details the expected PTS impact ranges for high order clearance from the potential variety of UXO sizes which may be encountered.

11.9.37 The risk of PTS effects from UXO will be managed through the development of a UXO MMMP (C-102, **Table 11-11**) which will mitigate impacts from UXO, including consideration of alternative clearance techniques (e.g. low order instead of high) and displacement methods such as Acoustic Deterrent Devices (ADDs) to remove animals from the risk area. A further potential environmental measure for UXO clearance is the use of bubble curtains for high order detonations which will reduce the impact ranges from those predicted herein (**Table 11-31**). It is likely that by the time the Applicant applies for a UXO Marine Licence, industry knowledge around

the contribution of bubble curtains to reducing underwater noise will be further advanced and this knowledge will be incorporated within the assessments and mitigation design if it is decided that this is appropriate (e.g. ongoing Department of Business Enterprise and Industrial Strategy workstream of underwater noise impacts from UXO).

Table 11-31 Summary of the PTS and TTS impact ranges for UXO detonation using the impulsive, unweighted SPLpeak noise criteria from Southall et al. (2019) for marine mammals

Southall et al. (2019) Unweighted SPLpeak		25 kg	55 kg	120 kg	240 kg	525 kg
PTS	219 dB (LF)	810 m	1.0 km	1.3 km	1.7 km	2.2 km
	230 dB (HF)	260 m	340 m	450 m	560 m	730 m
	202 dB (VHF)	4.6 km	6.0 km	7.7 km	9.8 km	13 km
	218 dB (PCW)	900 m	1.1 km	1.5 km	1.9 km	2.5 km
TTS	213 dB (LF)	1.5 km	1.9 km	2.5 km	3.2 km	4.1 km
	224 dB (HF)	490 m	640 m	830 m	1.0 km	1.3 km
	196 dB (VHF)	8.5 km	11 km	14 km	18 km	23 km
	212 dB (PCW)	1.6 km	2.1 km	2.8 km	3.5 km	4.6 km

11.9.38 With respect to potential for disturbance to marine mammals as a result of UXO clearance, in the absence of empirical evidence or agreed metrics, an effective deterrence range of 26km around the source location has been applied here on an assumption of high-order detonation. That range is derived from JNCC advice (JNCC 2020) for application within harbour porpoise SACs to determine the area of significant disturbance from UXO clearance. The 26km radius (area of 2,124 km^2) has been applied here for all species. The resulting number of animals as a proportion of the reference population is detailed in **Table 11-32**. This is quantified by calculating the numbers of animals likely to be within the effective deterrence range by multiplying the area of the impact footprint by the appropriate density estimate.

Table 11-32 Estimated number of marine mammals potentially at risk of disturbance during UXO clearance (assuming an EDR of 26 km, resulting in a 2,123.72 km^2 impact area).

Species	Density (no. /km^2)[3]	No. Impacted	%MU
Bottlenose dolphin	0.037	79	1.6
Common dolphin	0.171	363	0.6
Minke whale	0.002	4	0.02
Harbour porpoise	0.213	452	0.13
Harbour seal	<1	No data to calculate	<0.002
Grey seal	<1	No data to calculate	<0.005

11.9.39 The impact of UXO disturbance will be of local spatial extent, short term duration and both intermittent and infrequent; as noted above, the works will be subject to a separate Marine Licence and a specific MMMP. The number of animals expected to be disturbed by high-order clearance of a UXO (**Table 11-32**) both in total and as a percentage of the MU population, in all cases are slightly less than that for impact piling, with the potential for impact therefore slightly less. It should be noted for seals that all relevant cells for seal density are <1, with the number of seals disturbed assumed to therefore be within the same order as for piling disturbance as a worst case.

Magnitude of impact

11.9.40 The magnitude of effects from underwater noise (PTS) from UXO on marine mammals when considering the embedded environmental measures (UXO MMMP, C-102, **Table 11-11**) is deemed to be **minor**, and for disturbance (for consistency with the piling disturbance assessment) is **moderate** (bottlenose dolphin and common dolphin), **Low** (harbour porpoise and minke whale) or **negligible** (grey and harbour seal), with the potential for short-term and/or intermittent behavioural effects only, with survival and reproductive rates very unlikely to be impacted.

Sensitivity or value of receptor

11.9.41 The potential for PTS resulting from exposure to UXO noise to affect the survival and reproduction of individuals is considered low, given the current uncertainty surrounding these effects and how critical sound can be for echolocation, foraging, and communication in cetaceans, all cetaceans have been assessed as having a **medium** sensitivity to PTS. At the recent BEIS funded expert elicitation workshop (Booth and Heinis, 2018) experts concluded that the probability of PTS significantly affecting the survival and reproduction of either seal species was very

[3] Drawing on **Table 11-19**

low. As a result of this, and the fact that seals do not generally use hearing as their primary sensory modality for finding prey and navigation in the same way as cetaceans do, the sensitivity of seals to PTS has been assessed as **low**.

11.9.42 With the exception of grey seals, all of the marine mammals assessed to have a **medium** sensitivity to disturbance caused from noise from UXO. Grey seals have a **low** sensitivity, due to their capital breeder life history and their tolerance of periods of fasting.

Significance of residual effect

11.9.43 Overall, the maximum sensitivity of marine mammals to underwater noise from UXO is **medium**, with a magnitude of effect predicted to be from **negligible to moderate**. Therefore, the significance of effect of underwater noise from UXO clearance is predicted to be of **minor adverse significance** which is **not significant** in EIA terms.

Underwater noise from seabed preparation, rock dumping and cable installation

Overview

11.9.44 While impact piling will be the worst-case noise source during the construction phase, there will also be several other construction activities that will produce underwater noise which may occur either alongside piling or separately. These include dredging, drilling, cable laying, rock placement and trenching.

11.9.45 Modelling presented in **Appendix 11.3, Volume 4**, using the non-impulsive weighted SEL_{cum} PTS and TTS thresholds from Southall *et al*. (2019), resulted in estimated PTS and TTS impact ranges of <100m (the resolution limit for the model) for all marine mammal species for each non-piling construction activity. As such, to be at risk of auditory injury, an animal would have to stay within the immediate vicinity of the noise source for 24 hours. This is considered unrealistic and therefore, the risk of auditory injury to marine mammals from these other activities is considered to be *de minimis*.

11.9.46 The potential effects of cabling techniques used in the offshore wind farm industry was reviewed in a report by the Department for Business Enterprise and Regulatory Reform (BERR) in association with DEFRA (BERR and DEFRA 2008). The report reviewed various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging. The review concluded that it would be “highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals”.

11.9.47 There is evidence that dolphins, porpoise and minke whales avoid areas when high levels of dredging activity occur, however this effect was only short range (up to 5 km) and temporary (Pirotta *et al.* 2013; Verboom, 2014 and Culloch *et al*., 2016). Therefore, any potential displacement as a result of dredging activities will be both temporary and localised and therefore unlikely to significantly affect marine mammal populations. It is also highly likely that the presence of vessels will act as a deterrent and disturb marine mammals out of the area before any non-piling construction activity begins (as has been documented for harbour porpoise,

e.g. Brandt *et al.* 2018; Graham *et al.,* 2019 and Benhemma-Le Gall *et al.,* in review).

Magnitude of impact

11.9.48 Noise impacts from other construction activities will be localised, short-term, intermittent, and reversible and as such the magnitude of the impact is considered to be **negligible**, indicating that the potential is for very short-term and recoverable effects, with no potential for survival and reproductive rates to be impacted to the extent that the population trajectory will be altered.

Sensitivity or value of the receptor

11.9.49 With the exception of grey seals, all of the marine mammals assessed to have a **medium** sensitivity to disturbance caused from noise. Grey seals have a **low** sensitivity, due to their capital breeder life history and their tolerance of periods of fasting.

Significance of residual effect

11.9.50 Overall, the maximum sensitivity of marine mammals to underwater noise from other construction activities is **medium**, with a maximum magnitude of effect predicted to be **negligible**. Therefore, the significance of effect of underwater noise from other construction activities is predicted to be of **minor adverse significance** which is **not significant** in EIA terms.

Vessel collision risk

Overview

11.9.51 The area surrounding the proposed development (for this assessment considered to be the study area established in **Chapter 13: Shipping and navigation**) experiences an average of 17 unique vessels per day passing through the array area in the summer, and 17 unique vessels per day in the winter (see **Chapter 13: Shipping and navigation**). The Proposed Development is also in relative proximity to the shipping lanes through the English Channel, with the Traffic Separation Scheme being approximately 2.4 nm from the PEIR Assessment Boundary at its closest point, and 4.2nm from the outer edge of the westbound lane. Using the study area assessed for **Chapter 13; Shipping and Navigation**, there are approximately 119 vessels travelling through the wider area around the Proposed Development per day, with the majority of vessel traffic following the major shipping lanes through the English Channel to the south of the Proposed Development. Therefore, it can be stated that the introduction of vessels during construction is not a novel impact for marine mammals present in the area.

11.9.52 During construction of the wind farm, a potential source of impact from increased vessel activity is physical trauma from collision with a boat or ship. These injuries include blunt trauma to the body or injuries consistent with propeller strikes. The risk of collision of marine mammals with vessels will be directly influenced by the type of vessel and the speed with which it is travelling (Laist *et al*., 2001) and

indirectly by ambient noise levels underwater and the behaviour the marine mammal is engaged in.

11.9.53 There is currently a lack of information on the frequency of occurrence of vessel collisions as a source of marine mammal mortality. There is little evidence from marine mammals stranded in the UK that injury from vessel collisions is an important source of mortality. The UK Cetacean Strandings Investigation Programme (CSIP) documents the annual number of reported strandings and the cause of death for those individuals examined post-mortem. The CSIP data shows that very few strandings have been attributed to vessel collisions, therefore, while there is evidence that mortality from vessel collisions can and does occur, it is not considered to be a key source of mortality highlighted from post-mortem examinations.

11.9.54 Harbour porpoises, dolphins and seals are relatively small and highly mobile, and given observed responses to noise, are expected to detect vessels in close proximity and largely avoid collision. Predictability of vessel movement by marine mammals is known to be a key aspect in minimising the potential risks imposed by vessel traffic (e.g. Nowacek *et al*., 2001, Lusseau, 2003, 2006). The vessel management plan (C-51, **Table 11-11**) will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals.

11.9.55 It is highly likely that a proportion of vessels will be stationary or slow moving throughout construction activities for significant periods of time, particularly smaller vessels. Therefore, the actual increase in vessel traffic moving around the PEIR Assessment Boundary and to/from the port to the site will occur over short periods of the offshore construction activity.

11.9.56 Additionally, the proposed implementation of a VMP (C-51, **Table 11-11**) will minimise the risk of vessel collisions, and the guidance from the Marine Wildlife Watching Code (MWWC) is likely to be considered which includes additional mitigation measures such as reducing speed to the safest minimum possible when passing close to marine mammals, ensuring that vessel movements are steady and predictable, and maintaining recommended minimum distances from marine mammals.

Magnitude of impact

11.9.57 Due to the proposed implementation of a VMP (C-51, **Table 11-11**) and consideration of the MWWC, the magnitude of vessel collisions with marine mammals during construction activities relating to the Proposed Development is considered to be **minor**, indicating that the potential is for short-term and/or intermittent behavioural effects, with survival and reproductive rates very unlikely to be impacted to the extent that the population trajectory will be altered.

Sensitivity or value of receptor

11.9.58 All marine mammal receptors are deemed to be of medium vulnerability given that vessel collision is not considered to be a key source of mortality highlighted from post-mortem examinations of stranded animals. However, should a collision event occur, this is likely to injure the animal, from which they may have limited ability to

recover from and could potentially be fatal. Therefore, as a result of the low vulnerability to a strike but the serious consequences of a strike, the sensitivity of marine mammal receptors to vessel collisions is considered to be **high to very high**.

Significance of residual effect

11.9.59 Overall, the sensitivity of all marine mammals to vessel collisions has been assessed as **high to very high** and the magnitude is predicted to be **minor**. The actual occurrence of vessel collisions is highly unlikely given that a Vessel Management Plan (C-51, **Table 11-11**) will be implemented, therefore with the mitigation in place the effect is concluded to be of **minor adverse significance**, which is **not significant** in EIA terms.

Vessel disturbance

Overview

11.9.60 Increased vessel traffic during construction has the potential to result in disturbance of marine mammals, either from the noise generated by the vessels or from the presence of the vessels. Disturbance from vessels is only likely to occur where vessel movements associated with the construction of the Proposed Development is greater than the background vessel presence. The maximum design scenario (**Table 11-10**) lists the maximum number of vessels that will be involved in construction, with an average of up to four return trips per day. The total duration of the installation campaign for WTGs is expected to be a maximum of 12 months.

11.9.61 During the period of piling operations, it is considered unlikely that vessel noise will impact marine mammal receptors at levels additional to the piling activity itself. It is difficult to separate out the effect of vessel presence and activity from the effect of pile driving in isolation, since the data collected to date on the response of animals to pile driving, will have included a degree of vessel activity in combination with the piling, therefore it could be considered that the typical vessel activity related to pile driving, may be already assessed to some extent under the pile driving assessment. Individuals have more potential to be impacted by increased vessel movements during periods when piling is not taking place. Graham e*t al*. (2019) identified that for harbour porpoise, the presence of vessels alone was sufficient to reduce the presence of harbour porpoise within approximately 1 km of the vessel, which confirms that other, non-piling, vessels are likely to result in a degree of vessel disturbance separate from that of piling.

11.9.62 The magnitude and characteristics of vessel noise varies depending on ship type, ship size, mode of propulsion, operational factors (loading, etc.) and speed. Vessels of varying size produce different frequencies, generally becoming lower frequency with increasing size. The distance at which animals may react is difficult to predict and behavioural responses can vary a great deal depending on context.

11.9.63 Harbour porpoises have a high-frequency hearing range (e.g. Southall *et al*., 2019), and it has been suggested that porpoises are consequently more likely to be sensitive to vessels that produce medium to high frequency noise components

(Hermannsen *et al*., 2014). Harbour porpoise are known to avoid vessels and behavioural responses have been demonstrated in porpoise exposed to vessel noise that contains limited high-frequency components (Dyndo *et al*., 2015). Therefore, the sensitivity of porpoise to vessel noise will likely depend on the frequency of the noise components produced by the vessel, however, Thomsen et al. (2006) estimated that porpoise will respond to both small (~2kHz) and large (~0.25kHz) vessels at approximately 400m. Wisniewska *et al*. (2018) presented data that suggested that whist very close-range vessel passes may result in an interruption in foraging in porpoise, this is short lived with porpoises observed to resume foraging 10 minutes after the vessel encounter. Tagging data, showing porpoises remaining within areas with high shipping levels further showed incidence of responses was low, indicating little fitness cost to exposure to vessel noise.

11.9.64 A study on the impacts from construction related activities at the Beatrice and Moray East offshore windfarms in Scotland has shown that harbour porpoise are displaced by offshore windfarm construction vessels (Benhemma-Le Gall *et al*., in review). Construction related vessels assessed in this study included key offshore service vessels used for pile-driving and jacket or turbine installation, as well as other construction-related vessel traffic including fishing vessels working as guard vessels, passenger vessels for crew-transfers and some port service craft or unassigned vessels; and across the Moray Firth during the study period, the median construction-related vessel density was 1.4 vessels/km^2. Passive acoustic monitoring at the site showed that porpoise occurrence (hourly occurrence of porpoise detections) declined within 2 km of construction vessels (from 0.37 when vessel intensity was zero, down to 0.02 for a vessel intensity of 9.8 min/km^2), but that responses declined with increasing distance to vessels, out to 4 km where no response was observed.

11.9.65 Heinänen and Skov (2015) suggested that harbour porpoise density was significantly lower in areas with vessel transit rates of greater than 20,000 ships/year (80 per day within an area of 5 km^2). Vessel traffic in the Proposed Development array area averages 17 vessels per day (see **Chapter 13**). Throughout the construction of the Proposed Development, there will be an average of up to four return trips from construction vessels and the Vessel Management Plan (C-51, **Table 11-11**) will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals.

11.9.66 Pirotta *et al*. (2015), noted similar small scale, short-term reductions in foraging in bottlenose dolphin due to vessels, with the intensity of the reaction highly variable on a spatial and temporal basis. This further supports previous suggestions that the reaction will likely be linked to the favourability of habitat or behaviour of prey in response to the vessel presence (reviewed in Pirotta *et al.,* 2015). There is limited information available on the responses of other cetacean species to vessels, however based on the evidence available for bottlenose dolphin and harbour porpoise, it is assumed that the other species have a similar sensitivity as harbour porpoises.

11.9.67 Jones et al. (2017) presents an analysis of the predicted co-occurrence of ships and seals at sea which demonstrates that UK wide there is a large degree of

predicted co-occurrence, particularly within 50 km of the coast close to seal haul-outs. There is no evidence relating decreasing seal populations with high levels of co-occurrence between ships and animals. In fact, in areas where seal populations are showing high levels of growth (e.g. southeast England) ship co-occurrences are highest (Jones et al. 2017). Thomsen et al. (2006) estimated that both harbour and grey seals will respond to both small (~2 kHz) and large (~0.25 kHz) vessels at approximately 400 m.

11.9.68 Additionally, the proposed implementation of a VMP (C-51, **Table 11-11**) will reduce the risk of vessel disturbance by controlling the speed and movement of vessels, resulting in slower moving vessels travelling more predictable routes which are less likely to cause disturbance.

Magnitude of impact

11.9.69 With the proposed implementation of a VMP (C-51, **Table 11-11),** the magnitude of vessel disturbance to marine mammals during construction activities relating to the proposed development is considered to be **minor**, indicating that the potential is for short-term and/or intermittent behavioural effects, with survival and reproductive rates very unlikely to be impacted to the extent that the population trajectory will be altered. It is anticipated that any animals displaced from the area will return when vessel disturbance has ended.

Sensitivity or value of receptor

11.9.70 All marine mammal receptors are deemed to be of low vulnerability given the existing evidence of behavioural responses to vessels (see above). Therefore, the sensitivity of marine mammal receptors to vessel disturbance is considered to be **low**.

Significance of residual effect

11.9.71 Overall, the sensitivity of all marine mammals to vessel disturbance has been assessed as **low** and the magnitude is predicted to be **minor**. Therefore, the effect has been assessed as **minor adverse significance**, which is **not significant** in EIA terms.

Changes to prey availability

Overview

11.9.72 Given that marine mammals are dependent on fish as prey, there is the potential for indirect effects on marine mammals as a result of impacts upon fish species or the habitats that support them. The key prey species of each marine mammal receptor are listed in **Table 11-33**.

Table 11-33 Common prey species for each of the marine mammal receptors. Key species are in bold

Receptor Species	Prey Species	References
Bottlenose dolphin	Cod, saith, whiting, salmon, haddock, cephalopods	Santos *et al*., 2001
Common dolphin	Mackerel, lanterfish, lancet fish, *Gadidae* spp., *Gobiidae* spp., cephalopods	Brophy *et al*., 2009
Harbour porpoise	Whiting, sandeel, herring, haddock, saith, pollock, bobtail squid	Pierce *et al*. (2007)
Minke whale	Sandeel, herring, sprat, mackerel, goby, Norway pout/poor cod	Pierce *et al*. (2004)
Harbour seal	Sandeel, whiting, dragonet, cod, herring, sprat, dover sole, plaice, lemon sole, dab, flounder, goby, bullrout, sea scorpion, octopus, squid	Wilson and Hammond (2016) SCOS (2017)
Grey Seal	Sandeel, cod, whiting, haddock, ling, plaice, sole, flounder, dab	SCOS (2017)

11.9.73 **Chapter 8: Fish and shellfish ecology** concludes no significant impacts on all of the relevant prey species described in **Table 11-33** during the construction phase. While there may be certain species that comprise the main part of their diet, all marine mammal species in this assessment are considered to be generalist feeders and are thus not reliant on a single prey species.

Magnitude of impact

11.9.74 Due to the lack of significant effect on prey species and the generalist / opportunist nature of the receptors in question, together with the low numbers of marine mammals in vicinity of the Proposed Development , the magnitude of changes to prey availability to marine mammals during construction activities relating to the Proposed Development is considered to be **negligible**, indicating that the potential is for very short-term and recoverable effects, with no potential for survival and

reproductive rates to be impacted to the extent that the population trajectory will be altered.

Sensitivity of value of the receptor

11.9.75 Changes to prey availability could increase the energy expenditure required for feeding through increased effort. However, as marine mammals are generalists they can switch prey species removing the requirement for additional energy expenditure. No impact on survival and reproduction is predicted and therefore the sensitivity of the receptor is considered to be **medium**.

Significance of residual effect

11.9.76 Overall, the magnitude of all marine mammal receptors to a change in prey availability has been assessed as **negligible**, with a sensitivity of **medium**. Due to the very low magnitude of the effect, there will be no indirect effect to on the marine mammal receptors, with the significance of effect predicted to be of **minor adverse significance**, which is **not significant** in EIA terms.

Disturbance to seal haul out sites at landfall

Overview

11.9.77 Both grey and harbour seals are known to haul out in low numbers at Chichester Harbour and other sites in the local area (Castles *et al*., in review). There is very little documented evidence on the effects of noise in air on seals at haul-outs. Much of the data available on harbour seal disturbance at haul-out sites is in relation to the presence of vessels close to the haul-outs. Noise from onshore/landfall construction works are predicted to have attenuated to below background levels within 300m from the works and as such will not be audible to seals at any nearby haul out sites (>11km from the landfall). Therefore, the only likely potential for disturbance to seals at haul out sites from the construction of the proposed development is from the transit of vessels. Previous studies have demonstrated the disturbance effects on harbour seals at haul-out sites. For example, controlled disturbance vessel trials have shown that harbour seals would reduce the amount of time hauled out around the point of disturbance and they would embark on a foraging trip before hauling out again at the next low-tide cycle (Paterson *et al*. 2015). This was also shown in Andersen *et al*. (2012) where extended inter-haul-out trips occurred directly after a disturbance event. This is particularly important in terms of energetic consequences if this disturbance occurs at a time that is critical for seals to be hauled-out, such as during the annual moult or the breeding season.

11.9.78 The other primary concern with respect to hauled out seals is the potential proximity of construction vessels, as vessel traffic is known to disturb seals at haul out sites and often result in the animals flushing into the water (Jansen et al., 2015). However, in the proposed study area, the local haul out sites are already exposed to relatively high levels of vessel activities as are located within active harbours (see **Chapter 13: Shipping and navigation**) and it is therefore considered that there will be a *de minimis* disturbance effect to seals at haul out

caused by the additional vessels for the Proposed Development (see the vessel disturbance assessment above, and **Table 11-10**).

11.9.79 As discussed within **Appendix 11.2, Volume 4**, seals are generally considered to be resilient to disturbance and interruptions to foraging. The sound levels at the haul out sites are lower than those expected from background noise from vessels transiting through the Solent as such the animals are likely to acclimatised to the sound levels received. Therefore, it is not considered that there will be any disturbance from such sites or blocking effects from the noise altering ingress and egress of the seals from the haul out sites.

Magnitude of impact

11.9.80 The impact is predicted to be of local spatial extent, short term duration, intermittent and is reversible. The magnitude is therefore considered to be **v negligible**, indicating that the potential is for very short-term and recoverable effects, with no potential for survival and reproductive rates to be impacted to the extent that the population trajectory will be altered.

Sensitivity or value of receptor

11.9.81 As outlined in **Appendix 11.2, Volume 4**, disturbance as result of pile driving may temporarily affect harbour seal fertility and survival of “weaned of the year”. Due to observed relative low responsiveness to piling, their generalist diet, their life history and their ability to store fat, the sensitivity of harbour seals is therefore considered to be **medium**. For grey seals, due to observed low responsiveness to piling, their capital breeder life history and their tolerance of periods of fasting, the sensitivity is considered to be **low**.

Significance of residual effect

11.9.82 Overall, the sensitivity of seals to disturbance has been assessed as both **medium and low** and the magnitude is predicted to be **negligible**. Therefore, the resulting impact significance for disturbance to seal haul outs is of **minor adverse significance**, which is **not significant** in EIA terms.

11.10 Preliminary assessment: Operation and maintenance phase

Operational noise

11.10.1 Underwater noise from operational WTGs will be a continuous low-level sound which is generated from the vibration of the rotating machinery within the WTG which is transmitted into the marine environment through the WTG structure and foundations. Modelling of the predicted sound levels from the operation of WTGs is presented in the **Appendix 11.2, Volume 4**, with the highest power WTGs expected to result in the loudest noise (when operating at maximum capacity, with lower sound levels expected the majority of the time). To predict operational WTG noise levels, the extrapolated source level for the measured data at each of the sites has been taken, and then a linear correction factor has been included to

scale up the source levels. A linear fit was applied to the data to keep conservatism in the extrapolation and to take account of the deeper water depths, leading to the highest, and thus worst-case, estimation of source level noise from the larger WTGs. It is acknowledged that this fit is speculative: the available data is very limited. Newer, larger, direct drive (gearbox-less) designs tend to be more efficient and losses (e.g., in energy which produce noise and vibration) are significantly reduced. Preliminary measurements of such direct-drive WTGs have been collected off the east coast of the United States (HDR, 2019), showing extrapolated source levels of 136 dB re 1 µPa (SPLRMS) @ 1 m for a 6 MW WTG. Thus, the linear extrapolation represents a considerably greater noise output and can be considered highly precautionary. By applying a linear fit to existing data, the source level predicted for the Proposed Development maximum WTG assumption is 162.7dB re. 1µPa (SPL_{RMS}) @ 1m. Using the non-impulsive weighted SEL_{cum} PTS and TTS thresholds from Southall *et al.* (2019) resulted in estimated PTS and TTS impact ranges of <100m for all marine mammal species.

11.10.2 Numerous reviews (e.g. MMO, 2014) and studies (e.g. Madsen *et al*., 2006, Teilmann *et al*., 2006, CEFAS, 2010, Brasseur *et al*., 2012, Diederichs *et al*. 2008) of the effects of operational WTGs on marine mammals have demonstrated that the likelihood of any behavioural impacts is low and will be extremely localised if any such were to arise. Notably, a number of studies have suggested that operational wind farms may provide beneficial foraging areas for marine mammals (e.g. Lindeboom *et al*., 2011), with a monitoring programme at the Egmond aan Zee Offshore Wind Farm in the Netherlands reported that significantly more porpoise activity was recorded within the wind farm compared to the reference area during the operational phase (Scheidat *et al*., 2011). Russell *et al*. (2014) also observed tagged harbour and grey seals swimming in a grid-like pattern between WTGs within a wind farm, strongly suggesting that the structures provide favourable foraging habitats, with the individuals evidently not displaced by operational noise.

Magnitude of impact

11.10.3 The impact is predicted to be of limited local extent, long term duration and continuous. The magnitude is therefore considered to be **negligible**.

Sensitivity or value of the receptor

11.10.4 Given the evidence of the presence of marine mammals within and around existing operation wind farms, marine mammals are deemed to be of low vulnerability and have high recoverability to the impact of operational noise. The sensitivity of all marine mammal receptors is therefore considered to be **low**.

Significance of residual effect

11.10.5 Overall, the sensitivity of all marine mammal receptors has been assessed as **low** and the magnitude is predicted to be **minor**. Therefore, the significance of the effect has been predicted to be of **minor adverse significance** which is **not significant** in EIA terms.

Vessel collision risk

Overview

11.10.6 The worst case scenario identifies that there will be up to 1,126 return visits to the Proposed Development per year during the operation phase. This equates to an average of approximately three return trips per day. Vessel types will include crew transport vessels (CTVs), service operation vessels (SOVs), supply vessels, cable and remedial protection vessels and jack-up vessels (JUVs).

11.10.7 Harbour porpoises, dolphins and seals are relatively small and highly mobile, and given observed responses to noise, are expected to detect vessels in close proximity and largely avoid collision. Predictability of vessel movement by marine mammals is known to be a key aspect in minimising the potential risks imposed by vessel traffic (Nowacek et al. 2001, Lusseau 2003, 2006). The embedded mitigation provided by the proposed VMP (C-51, **Table 11-11**) will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals.

Magnitude of impact

11.10.8 The magnitude of vessel collisions with marine mammals during operation and maintenance activities relating to the proposed development is considered to be **minor**, indicating that the potential is for short-term and/or intermittent behavioural effects, with survival and reproductive rates very unlikely to be impacted to the extent that the population trajectory will be altered.

Sensitivity or value of receptor

11.10.9 All marine mammal receptors are deemed to be of medium vulnerability given that vessel collision is not considered to be a key source of mortality highlighted from post-mortem examinations of stranded animals. However, should a collision event occur, this is likely to injure the animal, from which they may have limited ability to recover from and could potentially be fatal. Therefore, as a result of the low vulnerability to a strike but the serious consequences of a strike, the sensitivity of marine mammal receptors to vessel collisions is considered to be **high to very high**.

Significance of residual effect

11.10.10 Overall, the sensitivity of all marine mammals to vessel collisions has been assessed as **high to very high** and the magnitude is predicted to be of **minor**. The actual occurrence of vessel collisions is highly unlikely given that a Vessel Management Plan (C-51, **Table 11-11**) will be implemented, and therefore the application of the mitigation enables a conclusion for the effect to be of **minor adverse significance**, which is **not significant** in EIA terms.

Vessel disturbance

Overview

11.10.11 The worst case scenario identifies that there will be up to 1,126 return visits to the Proposed Development during the operation phase. This equates to an average of approximately three return trips per day. Vessel types will include crew transport vessels (CTVs), service operation vessels (SOVs), supply vessels, cable and remedial protection vessels and jack-up vessels (JUVs).

11.10.12 Whilst very few studies have considered potential thresholds of vessel traffic which may increase the risk of disturbance, Heinänen and Skov (2015) identified a significant reduction in harbour porpoise density where vessels movements exceeded 80 per day within an area of 5 km^2. Vessel traffic in the area around the proposed development will not exceed this value even with the addition of the operational phase vessel traffic.

Magnitude of impact

11.10.13 The magnitude of vessel disturbance to marine mammals during operation and maintenance activities relating to the Proposed Development is considered to be **minor**, indicating that the potential is for short-term and/or intermittent behavioural effects, with survival and reproductive rates very unlikely to be impacted to the extent that the population trajectory will be altered. It is anticipated that any animals displaced from the area will return when vessel disturbance has ended.

Sensitivity or value of receptor

11.10.14 All marine mammal receptors are deemed to be of low vulnerability given the existing evidence of behavioural responses to vessels (see **Section 11.9**). Therefore, the sensitivity of marine mammal receptors to vessel disturbance is considered to be **low**.

Significance of residual effect

11.10.15 Overall, the sensitivity of all marine mammals to vessel disturbance has been assessed as **low** and the magnitude is predicted to be **minor**. The actual occurrence of vessel collisions is highly unlikely given that a Vessel Management Plan (C-51, **Table 11-11**) will be implemented, therefore the effect is of **minor adverse significance**, which is **not significant** in EIA terms.

Changes to prey availability

Overview

11.10.16 Given that marine mammals are dependent on fish and cephalopods as primary prey species, there is the potential for indirect effects on marine mammals as a result of impacts upon prey species or the habitats that support them (e.g. from EMF). The key prey species of each marine mammal receptor are listed in **Table 11-33**.

11.10.17 As per the construction phase (see **Section 11.9**), **Chapter 8: Fish and shellfish ecology** concludes no significant impacts on all of the relevant prey species described in **Table 11-33** during the operation and maintenance phase.

11.10.18 As noted previously it is even possible that offshore wind farms can increase prey availability or provide more favourable foraging grounds for marine mammals.

Magnitude of impact

11.10.19 Due to the lack of significant effect on prey species and the generalist / opportunist nature of the receptors in question, the magnitude of changes to prey availability to marine mammals during operation and maintenance activities relating to the proposed development is considered to be **negligible**, indicating that the potential is for very short-term and recoverable effects, with no potential for survival and reproductive rates to be impacted to the extent that the population trajectory will be altered.

Significance of residual effect

11.10.20 Overall, the magnitude of all marine mammal receptors to a change to prey availability has been assessed as **negligible** and therefore will not lead to any change in the prey populations. The sensitivity of marine mammal receptors is considered to be **medium**. Consequently, there will be no indirect effects on the marine mammal receptors considered, resulting in an impact of **minor adverse significance**, which is **not significant** in EIA terms.

11.11 Preliminary assessment: Decommissioning phase

Overview

11.11.1 Impacts from decommissioning are expected to be similar to those listed for construction, if Proposed Development infrastructure is removed from the seabed at the end of the development's operational life phase. The nature and scale of impacts arising from decommissioning are expected to be of similar, or reduced magnitude to those generated during the construction; certain activities such as piling will not be required. The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment.

11.11.2 The sensitivity of receptors during the decommissioning is assumed to be the same as given for the construction phase (see **Section 11.9**). The magnitude of effect is considered to be no greater or potentially less than those considered for the receptors within the construction phase. Therefore, it is anticipated that any decommissioning impacts will be no greater, and probably less than those assessed for the construction phase.

11.11.3 If it is deemed closer to the time of decommissioning that removal of certain parts of the development (for example export and inter-array cables) will have a greater environmental impact than leaving in situ, it may be preferable to leave those parts in situ. In this case, the impacts will be similar to those described for the operation

and maintenance phase. If certain parts of the development are left in situ, effects dependent on the operation of the wind farm will not occur.

11.11.4 To date, no large offshore wind farm has been decommissioned in UK waters. It is anticipated that any future programme of decommissioning will be developed in close consultation with the relevant statutory marine and nature conservation bodies. This will enable the guidance and best practice at the time to be applied to minimise any potential impacts.

Decommissioning noise impacts (including PTS, TTS and disturbance)

11.11.5 Piling foundations will likely be cut approximately 1m below the seabed, however, given the operational lifetime of the Proposed Development is assumed to be approximately 30 years, the specific decommissioning plan and programme will not be determined until closer to the time. The Energy Act (2004) requires that a decommissioning plan must be submitted to and approved by the Secretary of State for Business, Energy and Industrial Strategy, a draft of which will be submitted prior to the construction of the Proposed Development. The decommissioning plan and programme will be updated during the Proposed Development's lifespan to take account of changing best practice and new technologies. The approach and methodologies employed at decommissioning will be compliant with the legislation and policy requirements at the time of decommissioning. The potential impacts during the decommissioning phase are anticipated to be similar or less than during construction (with no piling). If noise generating methods are used for decommissioning, best-practice environmental measures as understood at the time will be used to mitigate the potential for PTS, including a decommissioning MMMP (C-54, **Table 11-11**). Accordingly, the impact from PTS, TTS and disturbance to marine mammals from decommissioning has been assessed as of a maximum of **minor adverse significance**, which is **Not Significant** in EIA terms.

Vessel collision risk

11.11.6 The potential impacts during the decommissioning phase are anticipated to be similar or less than during construction. Therefore, the significance of effect from vessel collisions on marine mammals has been assessed as being of **minor adverse significance**, which is **Not Significant** in EIA terms.

Vessel disturbance

11.11.7 The potential impacts during the decommissioning phase are anticipated to be similar or less than during construction. Therefore, the significance of effect from vessel disturbance on marine mammals has been assessed as being of **minor adverse significance**, which is **Not Significant** in EIA terms.

Changes to prey availability

11.11.8 The potential impacts during the decommissioning phase are anticipated to be similar or less than during construction. Therefore, the significance of effect from changes to prey availability on marine mammals has been assessed as being of **minor adverse significance**, which is **Not Significant** in EIA terms.

Disturbance to seal haul out sites at landfall

11.11.9 The potential impacts during the decommissioning phase are anticipated to be similar or less than during construction. Therefore, the significance of effect from disturbance to seal haul out sites has been assessed as being of **minor adverse significance**, which is **Not Significant** in EIA terms.

11.12 Preliminary assessment: Cumulative effects

Approach

11.12.1 A preliminary cumulative effects assessment (CEA) has been carried out for the Proposed Development which examines the result from the combined impacts of the Rampion 2 with other developments on the same single receptor or resource and the contribution of Rampion 2 to those impacts. The detailed method followed in identifying and assessing potential cumulative effects in relation to the offshore environment is set out in **Chapter 5, Section 5.10**.

11.12.2 The offshore screening approach is based on PINS Advice Note Seventeen (PINS, 2019), with relevant components of the RenewableUK (RenewableUK, 2013) accepted guidance, which includes aspects specific to the marine elements of an offshore wind farm, addressing the need to consider mobile wide-ranging species (foraging species, migratory routes etc).

Scope of the cumulative effects assessment

Overview

11.12.3 For marine mammals, a Zone of Influence (ZOI) has been applied for the CEA to ensure direct and indirect cumulative effects can be appropriately identified and assessed. The ZOI has been determined as the largest distance over which an impact may occur. For the purpose of assessing non-noise related impacts, this is defined by the relevant study areas for other developments (e.g. impacts from vessels are considered within the shipping and navigation study area as there will be no cumulative effect with vessel movement outside this area). For underwater noise, noisy activities from piling within the same management units as those identified as relevant for the Proposed Development have been considered, with consideration of other developments that may result in lower-level noise on a local scale.

11.12.4 A short list of other developments that may interact with the Proposed Development ZOIs during their construction, operation and maintenance, or decommissioning is presented in **Appendix 5.4: Cumulative effects assessment shortlisted developments, Volume 4** and on **Figure 5.4.1, Volume 4**. This short list has been generated applying criteria set out in **Chapter 5** and has been collated up to the finalisation of the PEIR through desk study, consultation, and engagement.

1.1.3 A tiering structure has been used for screening and assessment of other developments as in accordance with PINS Advice Note Seventeen (**Chapter 5**). Definitions of Tiers are set out in **Table 5-3** of **Chapter 5: Approach to EIA,**

Volume 4. Where other projects are expected to be completed before construction of the Proposed Development and the effects of those projects are fully determined, effects arising from them are considered as part of the baseline and may be considered as part of both the construction and operational assessment. For this chapter, two additional tiers have also been applied as set out in **Table 11-34.**

Table 11-34 Description of tiers of other developments considered for CEA (adapted from PINS Advice Note 17)

Tier	Criteria
Tier 1	• Operational and under construction projects which were not in place when baseline data was collected. • Projects with a legally secure consent that have been awarded a CfD but have not yet been implemented. • All Tier 1 offshore wind farm projects that are operational or are due to be commissioned prior to the construction of the proposed development will have no potential for the overlap in the construction and pile driving with the pile driving at the proposed development, therefore these projects have been scoped out of the assessment.
Tier 2:	• Tier 2 includes all projects/plans that have a legally secure consent, but have no CfD; therefore, there is uncertainty about the timeline for construction of these projects. • The potential for cumulative construction phase impacts have been considered where there is a reasonable chance of overlap of pile driving with the proposed development.
Tier 3:	• Tier 3 projects are projects for which an application has been submitted, but not yet determined. There is therefore information on which to base a quantitative assessment of cumulative impact but there is a degree of uncertainty as to the final approved design of the project and the timeline for construction. • Tier 3 offshore wind farm projects have the potential for cumulative construction impacts.
Tier 4	• Tier 4 projects are relevant marine infrastructure projects that the regulatory body are expecting to be submitted for determination and projects for which PEIR has been submitted, but not yet a full ES. There is therefore some information on which to base a quantitative assessment of cumulative impact but there is a large degree of uncertainty as to the final design of the project and the timeline for construction.

Tier	Criteria
	• Tier 4 offshore wind farm projects have the potential for cumulative construction impacts.
Tier 5	• Tier 5 projects are relevant marine infrastructure projects that the regulatory body are expecting to be submitted for determination (e.g. projects listed under the Planning Inspectorate programme of projects). • For Tier 5 projects there is a lot of uncertainty and not enough information to allow a robust assessment. However, as a very precautionary approach, the Tier 5 UK offshore wind farm projects that we are currently aware of have been included in the CEA.

11.12.5 Screening Projects: Only those developments in the short list that fall within the marine mammals ZOI (which varies between impacts as detailed in **paragraph 11.12.3**) have the potential to result in cumulative effects within the proposed development. All developments falling outside the marine mammal ZOI are excluded from this assessment. Furthermore, the following types of other development have the potential to result in cumulative effects on marine mammals:

- sub-sea cables and pipelines (telecom and power cables);
- offshore wind farms; and
- seismic surveys.

11.12.6 Screening Impacts: Certain impacts assessed for Rampion 2 alone are not considered in the marine mammal CEA due to a) the highly localised nature of the impacts b) management and mitigation measures in place at Rampion 2 and on other projects will reduce the risk occurring (e.g. MMMPs) and c) where the potential significance of the impact from Rampion 2 alone has been assessed as negligible. The impacts excluded from the marine mammal CEA for these reasons are:

- auditory injury (PTS): where PTS may result from activities such as pile driving and UXO clearance, suitable mitigation will be put in place to minimise injury risk to marine mammals (as a requirement of European Protected Species legislation);
- collision with vessels: it is expected that all offshore energy projects will employ a vessel management plan to reduce the already low risk of collisions with marine mammals;
- changes in water quality: highly localised and negligible significance;
- changes in prey availability: highly localised and negligible significance; and
- barrier effects/ operational noise: highly localised and negligible significance.

11.12.7 Therefore, the impacts that are considered in the marine mammal CEA are as follows:

- the potential for disturbance from underwater noise during construction of developments; and
- the potential for disturbance from vessel activity associated with each development.

11.12.8 Screening species: Due to the fact that underwater noise from the construction of Rampion 2 is anticipated to have a negligible effects on seals (<1 animal disturbed per piling day), both harbour and grey seals have been scoped out of the CEA. All developments listed in **Table 11-35** are screened in for the cumulative assessment for harbour porpoise, minke whales and common dolphins as they are all present within the respective species management units. All offshore wind farm projects have been screened out for bottlenose dolphins as they are not located within the relevant management unit.

11.12.9 On the basis of the above, the following specific developments contained within the short list in **Appendix 5.4, Volume 4** are scoped into this CEA. The other developments considered as part of the CEA are described in **Table 11-35** and **Figure 5.4.1, Volume 4**.

11.12.10 In order to assess the temporal overlap of the potential impacts from the different developments, it has been assumed that the earliest start of construction for Rampion 2 would commence at the start of 2024 and would continue for 4 years to the end of 2027.

Table 11-35 Developments to be considered as part of the CEA

ID (Figure 5.4.1)	Type	Other development	Status	Confidence	Tier	Distance to Rampion 2 ECC (km)	Distance to Rampion 2 array (km)	HP	MW	BD	CD
W29	Offshore wind farm	Hornsea Project Two	Under Construction (Commissioning expected 2023)	High	1	366.5	364.3	Y	Y	N	Y
W40	Offshore wind farm	Neart na Gaoithe	Under Construction (Commissioning expected 2021)	High	1	626.1	611.5	Y	Y	N	Y
W38	Offshore wind farm	Moray East	Under Construction (Commissioning expected 2021)	High	1	837.6	822.8	Y	Y	N	Y
W6	Offshore wind farm	Borssele I	Under Construction (Commissioning expected 2021-2022)	High	1	244.7	263.1	Y	Y	N	Y
W7	Offshore wind farm	Borssele II	Under Construction (Commissioning expected 2021-2022)	High	1	240.8	259.4	Y	Y	N	Y
W59	Offshore wind farm	Triton Knoll	Under Construction (Commissioning expected 2021)	High	1	311.1	307.6	Y	Y	N	Y

ID (Figure 5.4.1)	Type	Other development	Status	Confidence	Tier	Distance to Rampion 2 ECC (km)	Distance to Rampion 2 array (km)	HP	MW	BD	CD
W11	Offshore wind farm	Dogger Bank A	Consented (Construction expected 2022 – 2024)	High	1	464.5	462.3	Y	Y	N	Y
W12	Offshore wind farm	Dogger Bank B	Consented (Construction expected 2022 – 2024)	High	1	477.7	473.2	Y	Y	N	Y
W13	Offshore wind farm	Dogger Bank C	Consented (Construction expected 2023 – 2026)	High	1	509.3	508.7	Y	Y	N	Y
W56	Offshore wind farm	Sofia	Consented (Construction expected 2023 – 2026)	High	1	489.4	487.9	Y	Y	N	Y
W17	Offshore wind farm	East Anglia Three	Consented (Construction expected 2023 – 2026)	High	2	285.1	298.8	Y	Y	N	Y
W33	Offshore wind farm	Inch Cape	Consented (Construction expected from 2021)	High	1	648.8	634.2	Y	Y	N	Y
W52	Offshore wind farm	Seagreen Alpha	Under construction (Commissioning expected 2023)	High	1	656.4	642.1	Y	Y	N	Y

ID (Figure 5.4.1)	Type	Other development	Status	Confidence	Tier	Distance to Rampion 2 ECC (km)	Distance to Rampion 2 array (km)	HP	MW	BD	CD
W53	Offshore wind farm	Seagreen Bravo	Under construction (Commissioning expected 2023)	High	1	654.4	640.9	Y	Y	N	Y
W30	Offshore wind farm	Hornsea Three	Consented (Construction expected 2024 – 2028)	High	2	387.4	390.4	Y	Y	N	Y
W27	Offshore wind farm	Hornsea Four	Consented (Construction expected 2025 – 2030)	High	3	361.6	358.3	Y	Y	N	Y
W42	Offshore wind farm	Norfolk Vanguard	Consent under determination (Construction expected 2024 – 2028)	High	3	294.0	303.6	Y	Y	N	Y
W39	Offshore wind farm	Moray West	Consented (Construction expected 2022 – 2024)	High	1	834.9	819.9	Y	Y	N	Y
W41	Offshore wind farm	Norfolk Boreas	Consent under determination (Construction expected 2022 – 2025)	High	3	313.4	324.2	Y	Y	N	Y
W16	Offshore wind farm	East Anglia One North	Application Submitted (Construction expected 2023 – 2026)	High	3	247.7	261.4	Y	Y	N	Y

ID (Figure 5.4.1)	Type	Other development	Status	Confidence	Tier	Distance to Rampion 2 ECC (km)	Distance to Rampion 2 array (km)	HP	MW	BD	CD
W18	Offshore wind farm	East Anglia Two	Application Submitted (Construction expected 2023 – 2026)	High	3	217.9	232.9	Y	Y	N	Y
C1	IC	Aquind (UK to France)	Application submitted (Construction expected 2021 – 2024)	High	3	5.4	0.0	Y	Y	Y	Y

11.12.11 Baseline data and further information on other developments will continue to be collected prior to the finalisation of the ES and iteratively fed into the assessment. An updated cumulative effects assessment will be reported in the ES.

11.12.12 The cumulative Project Design Envelope is described below in **Table 11-36**. The impacts included address those scoped in for the cumulative assessment within the Scoping Report (RED, 2020). Other developments included are drawn from **Table 11-35** in the context of the potential for temporal overlap of relevant works.

Table 11-36 Cumulative Project Design Envelope for marine mammals

Project phase and activity/impact	Scenario	Justification
Cumulative increase in underwater noise	MDS as described for the construction of the proposed development assessed cumulatively with the following projects within the marine mammal study area: Tier 1: Construction phase of Hornsea Four, Neart na Gaoithe, Moray East, Borssele I, Borselle II, Triton Knoll, Dogger Bank A, Dogger Bank B, Sofia, Inch Cape, Seagren Alpha and Bravo and Moray West. Tier 2: Construction of East Anglia Three and Hornsea Three. Tier 3: Construction of Hornsea Four, Norfolk Vanguard, Norfolk Boreas, East Anglia One North and East Anglia Two. Tier 4: None Tier 5: Seismic surveys in the North Sea (x4 at any one time)	The identified projects may introduce underwater noise into the marine environment. As noted in **Table 11-34,** those projects which are due to be constructed prior to the construction of the proposed development have been excluded from the CEA as there will be no overlap between piling events. Cumulative operational phase impacts will be reduced and are not considered separately.
Cumulative increase in vessel disturbance	Tier 1: Vessels associated with the construction and operation of Hornsea Four, Neart na Gaoithe, Moray East, Borssele I, Borselle II, Triton Knoll, Dogger Bank A, Dogger Bank B, Sofia, Inch Cape, Seagren Alpha and Bravo and Moray West.	The identified projects are those within the local area which may act cumulatively to increase the risk from vessels.

Project phase and activity/impact	Scenario	Justification
	Tier 2: Vessels associated with the construction and operation of East Anglia Three and Hornsea Three. Tier 3: Vessels associated with the construction and operation of Hornsea Four, Norfolk Vanguard, Norfolk Boreas, East Anglia One North, East Anglia Two and the Aquind interconnector.	

11.12.13 A description of the significance of cumulative effects upon marine mammals arising from each identified impact is given below. The cumulative effects assessment has been based on information available in the ESs for the other projects where these are available; it is noted that the project parameters quoted within these ESs are often refined during the determination period and in the post-consent phase such that the final schemes built out may have a reduced impact compared to what has been concluded in the ES.

Cumulative increase in underwater noise during construction

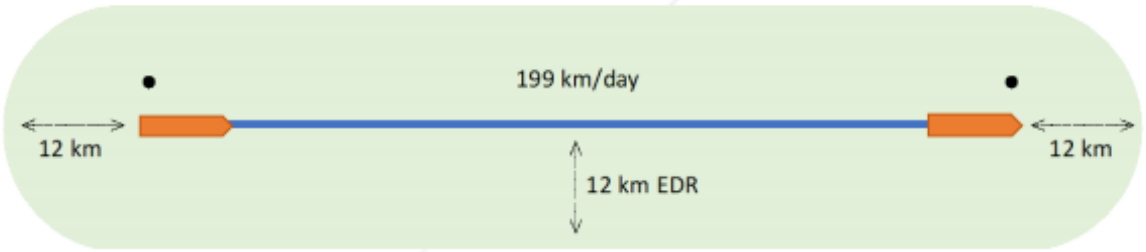
11.12.14 UXOs and pile driving: Different OWF EIAs have assessed disturbance using a variety of thresholds and methods, including effective deterrence ranges, fixed noise thresholds and dose-response curves. This means that the predicted number of animals disturbed is not comparable between projects. In order to standardise the CEA approach, the assessment of disturbance from construction and decommissioning activities at OWF sites follows the advice provided in JNCC (2020) where unabated pile driving of a monopile and clearance of a UXO are both precited to have an Effective Deterrence Range (EDR) of 26km for harbour porpoise. In the absence of recommended EDRs for other species, this has been applied to all marine mammal species. In order to quantify the number of animals predicted to experience disturbance at each OWF project, the SCANS III density (Hammond et al., 2017) for the corresponding survey block has been applied for each cetacean species.

11.12.15 Seismic surveys: The potential number of seismic surveys that could be undertaken is unknown. Therefore, it has been assumed that one seismic survey is conducted in the Irish Sea at any one time, and four seismic surveys are conducted within the North Sea at any one time (to account for concurrent surveys in the northern and southern North Sea in both UK waters and those of neighbouring North Sea nations). It has been assumed that the EDR for seismic surveys is 12 km as per the advice provided in JNCC (2020). It is considered that this approach is sufficiently precautionary (i.e. it is unlikely that this number of seismic surveys will be occurring concurrently, less so concurrently with Rampion 2 construction) to also account for any behavioural disturbance resulting from high-resolution geophysical site surveys (HRGS) within relevant regions (e.g. to

support wind farm development). While the potential for behavioural disturbance from HRGS is poorly understood, it is acknowledged to be of a considerably lower magnitude than that of seismic survey (e.g. precautionary 5 km EDR suggested in JNCC, 2020).

11.12.16 It is acknowledged that seismic surveys are a moving sound source and not a point source. Therefore the approach presented in BEIS (2020) has been adopted here. Therefore it has been assumed that a seismic survey vessel travelling at 4.5 knots (8.3 km/h) could, in theory, survey a total of 199 km of survey line in a single 24 hr period and therefore impact an area of 4,294 km^2 per day (**Graphic 11-1**). To estimate the number of harbour porpoise and minke whales predicted to be disturbed from seismic surveys in the North Sea, the average density across the North Sea was calculated[4].

Graphic 11-1 Maximum worst-case theoretical area of impact over a single day from a seismic survey travelling at 4.5 knots using 12 km EDR (BEIS, 2020)



11.12.17 Cables: it is expected that the construction of the Aquind inter-connector cable would not present a significant underwater sound source above the level of the associated vessel activity (see additional details in the construction noise assessment within **Section 11.9**). Therefore, this development has not been included in the assessment of cumulative increase in disturbance from underwater noise but is included in the assessment of cumulative increase in vessel disturbance.

Harbour porpoise

11.12.18 All developments included in the CEA are located within the North Sea and so are considered as relevant to the cumulative effects assessment on the North Sea MU for harbour porpoise. Across all years considered in the CEA (2021-2030 inclusive) (**Table 11-37**), the year with the highest expected level of disturbance impact to harbour porpoise is 2023, this is the year prior to the start of construction work at Rampion 2, and therefore Rampion 2 is not contributing to this disturbance level. During the four years when construction activity could occur at Rampion 2 (2024-2027 inclusive) the maximum number of porpoises predicted to be disturbed across all Tier 1-2 projects is between 3,610 and 12,658 (1.0% and 3.7% MU) and across all Tier 1-5 projects is between 15,717 and 27,343 (4.6% and 7.9% MU) (**Table 11-38**).

[4] For harbour porpoise: SCANS III estimate for the North Sea = 0.52 porpoise/km^2. For minke whales: SCANS III estimate for the North Sea/575,000 km^2 = 0.015 whales/km^2.

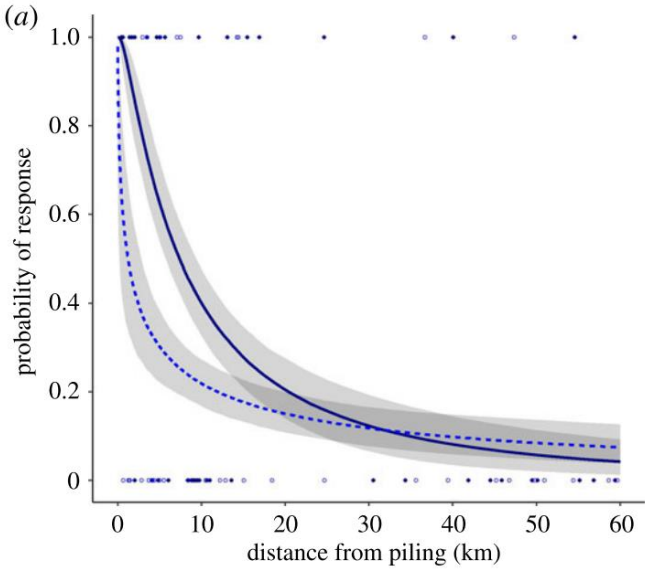
11.12.19 The relative contribution of impact from Rampion 2 is low compared to other developments included in the assessment. For example, in 2024 the total number disturbed by Rampion 2 (452) represents just 1.7% of the total disturbed across all Tier 1-5 developments (27,343). The predictions of the total number of animals disturbed is driven primarily by the developments in the southern North Sea in SCANS III Blocks O, N and L where harbour porpoise densities are much higher than in the English Channel. Additionally, the highest levels of impact are predicted for the seismic surveys which are assumed Tier 5 projects with no known information on timeline or survey methods and so are highly precautionary worst-case assumptions. In comparison to these projects, the number of porpoise disturbed at Rampion 2 is negligible.

11.12.20 There are significant levels of over-precaution built into this CEA which makes the resulting estimates highly precautionary and unrealistic. The main areas of precaution in the assessment include the following.

- The number of developments active at the same time (clearing UXOs, piling or surveying). In order for 27,343 porpoise to be disturbed across all Tier 1-5 projects in 2024, this would require that 13 offshore wind farm developments and 4 seismic surveys are all active at the same time. This is considered to be extremely unrealistic.
- The inclusion of lower tier developments. In reality, the best information in terms of construction timeline is available for Tier 1 projects which have consent and have secured a CfD. If only Tier 1 projects are included in the CEA then the maximum impact overlapping with the Rampion 2 construction period across all Tier 1 projects is disturbance to 9,483 porpoise in total which is 2.75% of the MU (**Table 11-38**). There is less confidence in the timeline for Tier 2 projects as they have consent but have not secured CfD and so the construction timeline is less certain. If only Tier 1 and 2 projects are included in the CEA then the maximum impact overlapping with the Rampion 2 construction period across all Tier 1-2 projects is disturbance to 12,658 porpoise in total which is 3.7% of the MU (**Table 11-38**). By including projects that have no consent, no ES chapter or no submitted information at all (Tiers 3-5) then worst-case scenarios have to be assumed in the absence of other information, making the assessments highly precautionary.
- The assumption that UXO clearance or pile driving can occur at any point throughout the construction window for each development. This results in most projects having UXO and piling activities occurring over multiple consecutive years. For example, the construction window for Hornsea 4 is listed as 2025-2030 (which results in 6 years of impact) however, according to the Hornsea Four PEIR, piling would only occur within a 1 year period within this. Likewise, the information available for Inch Cape was “construction expected from 2021” with no end date provided, so it had to be assumed that construction could occur at any time after 2021. Since the exact timing of the UXO and piling activities within the respective development construction windows is unknown, it had to be assumed that it could occur at any point, thus resulting in piling schedules and subsequent disturbance levels that are far greater than would ever occur in reality.

- The impact area from seismic surveys. This approach was highlighted by BEIS (2020) as being highly precautionary and should be considered as an unrealistic worst-case scenario. This is mainly due to the fact that the approach does not take into consideration time when the seismic airguns are not firing within a survey day. Airguns are required to be turned off at the end of every survey line as the vessel turns, which can take 2-3 hours per turn and several turns can occur each day.
- The assumption that all developments will install pile driven monopile foundations. The project envelope for most of these developments includes options for pin-piles or monopiles. As a worst case assumption monopiles have been assumed, however it is likely that a portion of these projects will use jacket foundations with pin-piles, which have a much lower recommended effective deterrence range (15 km instead of 26 km) (JNCC, 2020), and will therefore disturb far fewer porpoise (e.g. assuming a density of 0.888 porpoise/km^2 a 26 km radius impacts 1,886 porpoise, while a 15 km radius impacts 628 porpoise).
- The assumption that all porpoise within a 26 km range are disturbed. Pile driving activities at other offshore wind farm have shown that this assumption of total displacement within 26 km of pile driving is a significant over-estimate. At Beatrice, there was only a 50% response at 7.4 km and 28% response within 26 km for the first location piled, with decreasing response levels over the construction period to 50% response at only 1.3 km by the final location (**Graphic 11-2**) (Graham et al., 2019). Likewise, pile driving at the first 7 large scale offshore windfarms in the German Bight (including unmitigated piling) found declines in porpoise out to only 17 km (Brandt et al., 2018).

Graphic 11-2 The probability of a harbour porpoise response (24 h) in relation to the partial contribution of distance from piling for the first location piled (solid navy line) and the final location piled (dashed blue line) (Graham et al., 2019)



11.12.21 Although the estimate of cumulative impact of disturbance from underwater noise is considered to be highly precautionary (for the reasons listed above), there remains the potential for the cumulative increase in disturbance from construction

activities across these developments to result in individuals experiencing multiple successive days of disturbance. Assuming that disturbance results in a period of zero energy intake, there is the potential for high levels of repeated disturbance to lead to a reduction in calf survival and potentially an effect on adult fertility (see Booth et al., 2019 for further details). The number of animals predicted to be impacted (though acknowledging that this is a vast over-estimate) could potentially result in temporary changes in behaviour and/or distribution of individuals at a scale that would result in potential reductions to lifetime reproductive success to some individuals, although likely not enough to affect the population trajectory over a generational scale. For example, previous population modelling (using iPCoD) of offshore wind farms in eastern English waters has demonstrated low probabilities of population level impacts, even when 16 piling operations were modelled over a 12 year period (disturbing up to a total of 34,396 porpoise per day) (Booth et al., 2017). Similarly the DEPONS model found that the North Sea porpoise population was unlikely to be significantly impacted by construction of 65 wind farms, unless impact ranges were assumed to be significant (exceeding 50 km) (Nabe-Nielsen et al., 2018). Therefore, given that impacts are likely not enough to affect the population trajectory over a generational scale, the magnitude of the cumulative increase in disturbance from construction activities is **Moderate**.

11.12.22 As outlined in **Table 11-30** the sensitivity of harbour porpoise to disturbance from underwater noise such as pile driving is **medium** (for example, reproduction may be affected but animals are expected to be able to recover).

11.12.23 Overall, the sensitivity of harbour porpoise has been assessed as **medium** and the magnitude is predicted to be **moderate**. Therefore, the significance of the effect has been predicted to be of **minor adverse significance** which is **not significant** in EIA terms.

Table 11-37 Harbour porpoise CEA – number of porpoise predicted to be disturbed (per day) by construction activity at each development alongside ongoing seismic surveys in the North Sea

	Rampion 2	Hornsea 2	Neart na Gaoithe	Moray East	Borssele I	Borssele II	Triton Knoll	Dogger Bank A	Dogger Bank B	Dogger Bank C	Sofia	Inch Cape	Seagreen Alpha	Seagreen Bravo	Moray West	East Anglia 3	Hornsea 3	Hornsea 4	Norfolk Vanguard	Norfolk Boreas	East Anglia 1N	East Anglia 2	Seismic 1	Seismic 2	Seismic 3	Seismic 4
Teir		1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	3	3	3	5	5	5	5
Block	C	O	R	S	L	L	O	O	O	N	O	R	R	R	S	L	O	O	L	O	L	L	Average North Sea			
2021		1886	1272	323	1289	1289	1886					1272	1272	1272									2233	2233	2233	2233
2022		1886			1289	1289		1886	1886			1272	1272	1272	323					1886			2233	2233	2233	2233
2023		1886						1886	1886	1778	1886	1272	1272	1272	323	1289				1886	1289	1289	2233	2233	2233	2233
2024	452							1886	1886	1778	1886	1272			323	1289	1886		1289	1886	1289	1289	2233	2233	2233	2233
2025	452									1778	1886	1272				1289	1886	1886	1289	1886	1289	1289	2233	2233	2233	2233
2026	452									1778	1886	1272				1289	1886	1886	1289		1289	1289	2233	2233	2233	2233
2027	452											1272					1886	1886	1289				2233	2233	2233	2233
2028												1272					1886	1886	1289				2233	2233	2233	2233
2029												1272						1886					2233	2233	2233	2233
2030												1272						1886					2233	2233	2233	2233

SCANS III density estimate (porpoise/km^2): Block C = 0.213, Block L = 0.607, Block N = 0.837, Block O = 0.888, Block R = 0.599, Block S = 0.152, Average North Sea = 0.52 (Hammond et al., 2017)
Assumes a 26 km effective deterrence range for both UXO clearance and pile driving (JNCC, 2020)
Assumes a 12 km effective deterrence range for seismic surveys, assuming a survey vessel can travel 199 km in 1 day (JNCC, 2020, BEIS, 2020)

Table 11-38 Harbour porpoise CEA – – total underwater noise disturbance estimates across the Tiers

	Tier 1		Tier 1-2		Tier 1-3		Tier 1-5	
	Total	**% MU**	**Total**	**% MU**	**Total**	**% MU**	**Total**	**% MU**
2021	11,761	3.41%	11,761	3.4%	9,875	2.9%	20,693	6.0%
2022	12,375	3.58%	12,375	3.6%	12,375	3.6%	23,193	6.7%
2023	13,461	3.90%	14,750	4.3%	17,328	5.0%	28,146	8.1%
2024	9,483	2.75%	12,658	3.7%	17,959	5.2%	27,343	7.9%
2025	5,388	1.56%	8,563	2.5%	15,750	4.6%	25,134	7.3%
2026	5,388	1.56%	8,563	2.5%	13,864	4.0%	23,248	6.7%
2027	1,724	0.50%	3,610	1.0%	6,333	1.8%	15,717	4.6%
2028	1,272	0.37%	3,158	0.9%	6,333	1.8%	15,265	4.4%
2029	1,272	0.37%	1,272	0.4%	3,158	0.9%	12,090	3.5%
2030	1,272	0.37%	1,272	0.4%	3,158	0.9%	12,090	3.5%
Min	**1,272**	**0.4%**	**1,272**	**0.4%**	**3,158**	**0.9%**	**12,090**	**3.5%**
Mean	**6,340**	**1.8%**	**7,798**	**2.3%**	**10,613**	**3.1%**	**20,292**	**5.9%**
Max	**13,461**	**3.9%**	**14,750**	**4.3%**	**17,959**	**5.2%**	**28,146**	**8.1%**

Minke whale

11.12.24 All developments included in the CEA are located within the North Sea and so are considered as relevant to the cumulative effects assessment on the Celtic and Greater North Sea MU for minke whales. Across all years considered in the CEA (2021-2030 inclusive) (**Table 11-39**), the year with the highest expected level of disturbance impact to minke whales is 2023 which is the year prior to the start of construction work at Rampion 2, and therefore Rampion 2 is not contributing to this disturbance level. During the four years when construction activity could occur at Rampion 2 (2024-2027 inclusive) the maximum number of minke whales predicted to be disturbed across all Tier 1-2 projects is between 108 and 234 (0.03% and 0.07% MU) and across all Tier 1-5 projects is between 385 and 511 (0.11% and 0.15% MU) (**Table 11-40**).

11.12.25 The relative contribution of impact from Rampion 2 is low compared to other developments included in the assessment. For example, in 2024 the total number

disturbed at Rampion 2 (4) represents just 0.8% of the total disturbed across all Tier 1-5 developments (511). The predictions of the total number of animals disturbed is driven primarily by the developments in the mid-northern North Sea in SCANS III Blocks O, N, R and S where minke whale densities are much higher than in the English Channel. Additionally, high levels of impact are predicted for the seismic surveys which are assumed Tier 5 projects with no known information on timeline or survey methods and so are highly precautionary worst-case assumptions. In comparison to these projects, the number of whales disturbed at Rampion 2 is negligible.

11.12.26 As per the harbour porpoise CEA assessment, there are significant levels of over-precaution built into this CEA which makes the resulting estimates highly precautionary and unrealistic. These precautions are stated above for harbour porpoise and similarly apply for minke whales. In addition to the precautions listed above for harbour porpoise, there is uncertainty for minke whales since there is no suggested EDR for UXO, pile driving or seismic surveys for this species as empirical data on their responses is lacking. Additionally, it is important to note that minke whales are not expected to be present year round in the English Channel or the North Sea and therefore activities occurring outside of the summer months are expected to have no effect on the minke whale population as they are not likely to be present.

11.12.27 Although the estimate of cumulative impact of disturbance from underwater noise is considered to be highly precautionary (for the reasons listed above), there is the potential for the cumulative increase in disturbance from construction activities across these developments to result in individuals experiencing multiple successive days of disturbance. However, since minke whales are not expected to be present outside of the summer season, their exposure to disturbance impacts is limited and therefore it is expected that the level of impact they are potentially exposed to during the summer season is likely not enough to affect the population trajectory. Therefore, the magnitude of the cumulative increase in disturbance from construction activities is **moderate**.

11.12.28 As outlined in **Table 11-30** the sensitivity of minke whales to disturbance from underwater noise such as pile driving is **medium** (for example, reproduction may be affected but animals are expected to be able to recover).

11.12.29 Overall, the sensitivity of minke whales has been assessed as **medium** and the magnitude is predicted to be **moderate**. Therefore, the significance of the effect has been predicted to be of **minor adverse significance** which is **not significant** in EIA terms.

Table 11-39 Minke whale CEA – number of whales predicted to be disturbed (per day) by construction activity at each development alongside ongoing seismic surveys in the North Sea.

	Rampion 2	Hornsea 2	Neart na Gaoithe	Moray East	Borssele I	Borssele II	Triton Knoll	Dogger Bank A	Dogger Bank B	Dogger Bank C	Sofia	Inch Cape	Seagreen Alpha	Seagreen Bravo	Moray West	East Anglia 3	Hornsea 3	Hornsea 4	Norfolk [illegible]	Norfolk Boreas	East Anglia 1N	East Anglia 2	Seismic 1	Seismic 2	Seismic 3	Seismic 4
Teir		1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	3	3	3	5	5	5	5
Block	C	O	R	S	L	L	O	O	O	N	O	R	R	R	S	L	O	O	L	O	L	L	Average North Sea			
2021		21	83	21	0	0	21					83	83	83									64	64	64	64
2022		21			0	0		21	21			83	83	83	21					21			64	64	64	64
2023		21						21	21	42	21	83	83	83	21	0				21	0	0	64	64	64	64
2024	4							21	21	42	21	83			21	0	21		0	21	0	0	64	64	64	64
2025	4									42	21	83				0	21	21	0	21	0	0	64	64	64	64
2026	4									42	21	83				0	21	21	0		0	0	64	64	64	64
2027	4											83					21	21	0				64	64	64	64
2028												83					21	21	0				64	64	64	64
2029												83						21					64	64	64	64

	Rampion 2	Hornsea 2	Neart na Gaoithe	Moray East	Borssele I	Borssele II	Triton Knoll	Dogger Bank A	Dogger Bank B	Dogger Bank C	Sofia	Inch Cape	Seagreen Alpha	Seagreen Bravo	Moray West	East Anglia 3	Hornsea 3	Hornsea 4	Norfolk [illegible]	Norfolk Boreas	East Anglia 1N	East Anglia 2	Seismic 1	Seismic 2	Seismic 3	Seismic 4
2030												83						21					64	64	64	64

SCANS III density estimate (whales/km^2): Block C = 0.002, Block L = 0.000, Block N = 0.020, Block O = 0.010, Block R = 0.039, Block S = 0.010, Average North Sea = 0.015 (Hammond et al., 2017)
Assumes a 26 km effective deterrence range for both UXO clearance and pile driving (JNCC, 2020)
Assumes a 12 km effective deterrence range for seismic surveys, assuming a survey vessel can travel 199 km in 1 day (JNCC, 2020, BEIS, 2020)

Table 11-40 Minke whale CEA – total underwater noise disturbance estimates across the Tiers

	Tier 1		Tier 1-2		Tier 1-3		Tier 1-5	
	Total	**% MU**	**Total**	**% MU**	**Total**	**% MU**	**Total**	**% MU**
2021	395	0.11%	395	0.11%	374	0.11%	651	0.19%
2022	333	0.10%	333	0.10%	333	0.10%	610	0.19%
2023	396	0.11%	396	0.11%	396	0.11%	673	0.19%
2024	213	0.06%	234	0.07%	251	0.07%	511	0.15%
2025	150	0.04%	171	0.05%	209	0.06%	469	0.14%
2026	150	0.04%	171	0.05%	188	0.05%	448	0.13%
2027	87	0.03%	108	0.03%	125	0.04%	385	0.11%
2028	83	0.02%	104	0.03%	125	0.04%	381	0.11%
2029	83	0.02%	83	0.02%	104	0.03%	360	0.10%
2030	83	0.02%	83	0.02%	104	0.03%	360	0.10%
Min	**83**	**0.02%**	**83**	**0.02%**	**104**	**0.03%**	**360**	**0.10%**
Mean	**197**	**0.06%**	**208**	**0.06%**	**221**	**0.06%**	**485**	**0.14%**
Max	**396**	**0.11%**	**396**	**0.11%**	**396**	**0.11%**	**673**	**0.19%**

Bottlenose dolphin

11.12.30 All developments included in the CEA are located within the North Sea and so are not considered as relevant to the cumulative effects assessment on the Offshore Channel and SW England MU for bottlenose dolphins.

Common dolphin

11.12.31 All developments included in the CEA are located within the North Sea and so are considered as relevant to the cumulative effects assessment on the Celtic and Greater North Sea MU for common dolphins. However, common dolphins are considered to be rare in the North Sea, no common dolphins are expected to be present in the relevant SCANS III survey blocks of the developments considered in this CEA and none of the developments included common dolphins in their impact

assessments. Therefore no further consideration of cumulative effects of disturbance from underwater noise on common dolphins is required.

Cumulative increase in vessel disturbance

11.12.32 There is a potential risk of other projects within the marine mammal ZOI to increase the total number of vessels within the vicinity, greater than that caused by construction activities on the Proposed Development alone. This cumulative assessment considers the increased potential for disturbance to marine mammals due to the potential increase in vessel movements from the construction of the proposed development with other planned or existing projects, plans and activities. Projects were screened out of the assessment where they were already active or operational as they were considered to be part of the baseline.

11.12.33 Harbour porpoise, common dolphin and minke whale: The list of projects screened into the assessment were all located in the North Sea and, therefore, were located within the harbour porpoise MU (North Sea) and the relevant MUs for common dolphins and minke whales (Celtic and Greater North Seas) (**Table 11-41**).

11.12.34 Bottlenose dolphin: Only the Aquind interconnector is within the MU for bottlenose dolphins (**Table 11-41**).

11.12.35 **Table 11-42** presents the quantitative information that is available for all projects screened into the CEA for vessel disturbance, covering the construction and/or operation and maintenance phase vessel numbers and movements expected for each project.

11.12.36 In general, it is extremely difficult to reliably quantify the level of increased disturbance to marine mammals resulting from increased vessel activity on a cumulative basis given the large degree of temporal and spatial variation in vessel movements between projects and regions, coupled with the spatial and temporal variation in marine mammal movements across the region. Vessel routes to and from offshore windfarms and other projects will use existing vessel routes for pre-existing vessel traffic which marine mammals will be accustomed to. They may also have become habituated to the volume of regular vessel movements and therefore the additional risk is confined predominantly to construction sites. Vessel movements within construction areas for both offshore wind farms and interconnector cables are likely to be limited and relatively slow, resulting in less risk to marine mammal receptors. In addition, most projects are likely to adopt vessel management plans in order to minimise any potential effects on marine mammals. Therefore, increases in disturbance from vessels from offshore energy projects are likely to be small in relation to current and ongoing levels of shipping.

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

11.12.38 Overall, the sensitivity of all marine mammals to vessel disturbance has been assessed as **low** (see **Section 11.9.70**) and the magnitude of the cumulative increase in vessel disturbance is predicted to be **minor.** Therefore, the effect is of **minor adverse significance**, which is **not significant** in EIA terms.

Table 11-41 Projects considered within the marine mammal CEA for disturbance from vessel activity

	Rampion 2	Hornsea 2	Neart na Gaoithe	Moray East	Borssele I	Borssele II	Triton Knoll	Dogger Bank A	Dogger Bank B	Dogger Bank C	Sofia	Inch Cape	Seagreen Alpha	Seagreen Bravo	Moray West	East Anglia 3	Hornsea 3	Hornsea 4	Norfolk Vanguard	Norfolk Boreas	East Anglia 1N	East Anglia 2	Aquind
Teir		1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	3	3	3	3
2024	C	O	O	O	O	O	O	C	C	C	C	C	O	O	C	C	C		C	C	C	C	C
2025								O	O						O			C					O
2026																				O			
2027										O	O					O					O	O	
HP	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
MW	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
BD	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
CD	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

C = Construction phase vessels screened in, O = operation and maintenance phase vessels screened in
HP = harbour porpoise, MW = minke whale, BD = bottlenose dolphin and CD = common dolphin
Y = within MU, N = not in MU

Table 11-42 Level of vessel activity anticipated for each project included in the marine mammal CEA (NS = information not stated in project species impact assessment)

Project	Construction Vessels		operation and maintenance Vessels		Notes
	# vessels	# round trips	# vessels	# round trips/year	
Hornsea Project Two	Construction screened out – completed before Rampion 2 construction commences – no overlap		22	2,817	NA
Neart na Gaoithe			NS	NS	Number of vessels and trips during operation and maintenance not available.
Moray East			NS	NS	Number of vessels and trips during operation and maintenance is still to be confirmed but will be less than during construction.
Borssele I			NS	NS	Number of vessels and trips during operation and maintenance not available.
Borssele II			NS	NS	Number of vessels and trips during operation and maintenance not available.
Triton Knoll			NS	18,440	Number of vessels during operation and maintenance not available.
Dogger Bank A	264 (66 per 4 concurrent projects)	3,460	NS	683	Max 66 vessels offshore per project during construction (peak in year 2). Max 28 vessels offshore per project during operation and maintenance.

Project	Construction Vessels		operation and maintenance Vessels		Notes
	# vessels	# round trips	# vessels	# round trips/year	
Dogger Bank B	264 (66 per 4 concurrent projects)	3,460	NS	683	Dogger Bank A and B may be constructed in isolation, sequentially or concurrently. Therefore operation and maintenance may occur in isolation or concurrently depending on construction.
Dogger Bank C	396 (66 per 6 concurrent projects)	5,810	26	730	Max 66 vessels offshore per project during construction. Dogger Bank C and Sofia may be constructed in isolation, sequentially or concurrently. Therefore operation and maintenance may occur in isolation or concurrently depending on construction.
Sofia	396 (66 per 6 concurrent projects)	5,810	26	730	
East Anglia Three	45	5,700	13	4,067	Estimated 2 service vessels offshore per day.
Inch Cape	NS	3,500	Operation and maintenance screened out		Number of vessels during construction not available.
Seagreen Alpha	Construction screened out – completed before Rampion 2 construction commences – no overlap		NS	NS	Up to 2 vessels on site at a time. May operate in isolation of concurrently with Seagreen Bravo, depending on construction schedule. Number of vessels and trips during operation and maintenance not available.

Project	Construction Vessels		operation and maintenance Vessels		Notes
	# vessels	# round trips	# vessels	# round trips/year	
Seagreen Bravo			NS	NS	Up to 2 vessels on site at a time. May operate in isolation of concurrently with Seagreen Alpha, depending on construction schedule. Number of vessels and trips during operation and maintenance not available.
Hornsea Three	126	10,774	operation and maintenance screened out as constructing at same time as Rampion 2		Up to 8 vessels in 5 km^2 area at any one time.
Hornsea Four	176	4054			NA
Norfolk Vanguard	NS	1,180			Construction may occur in single phase or in two phases with 2 x 590 round trips.
Moray West	25	NS	NS	150 - 200	Up to 25 vessels offshore during construction. Number of vessels during construction and operation and maintenance and round trips during construction not available.
Norfolk Boreas	NS	1,296	NS	445 (support vessels only)	Max 57 vessels offshore during construction. Approx 36 vessels per month during the 36 month construction period for single phase development or approximately 33 vessels per month during 39 month construction period for two phase development. Number of vessels during construction and operation and maintenance not available.

Project	Construction Vessels		operation and maintenance Vessels		Notes
	# vessels	# round trips	# vessels	# round trips/year	
East Anglia One North	NS	3,335	NS	647 (support vessels only)	Max 74 vessels offshore during construction (including max 3 IAC vessel and 5 EC vessels). Number of vessels during construction and operation and maintenance not available.
East Anglia Two	NS	3,672	NS	687 (support vessels only)	Max 74 vessels offshore during construction (including max 3 IAC vessel and 5 EC vessels). Number of vessels during construction and operation and maintenance not available.
Aquind (UK to France)	NS	NS	NS	NS	Number of vessels and round trips during construction and operation and maintenance not available.

11.13 Transboundary effects

11.13.1 Transboundary effects arise when impacts from a development within one European Economic Area (EEA) states affects the environment of another EEA state(s). A screening of transboundary effects has been carried out and is presented in Appendix B of the Scoping Report (RED, 2020).

11.13.2 The transboundary screening report identified that due to the nature of the primary direct impact to marine mammals (noise generated from piling during construction), the proposed development could affect EEA states with marine mammals as Qualifying Features at European Sites.

11.13.3 Full consideration of connectivity of European Sites (SACs) is provided through the HRA process, which covers matters associated with European designations in detail and which will also be consulted upon with SNCBs as part of the Application process. As presented in the **Draft Report to Inform Appropriate Assessment (RIAA)**, it has been concluded that there will be no adverse effect on the integrity of any European designated site from the construction of the Proposed Development. As such, it can be concluded that there will be no significant transboundary effects from the Proposed Development.

11.14 Inter-related effects

11.14.1 The inter-related effects assessment considers likely significant effects from multiple impacts and activities from the construction, operation and decommissioning of the Proposed Development on the same receptors identified in **Section 11.6**.

11.14.2 The potential inter-related effects include:

- Project lifetime effects: i.e., those arising throughout more than one phase of the project (construction, operation, and decommissioning) to interact to potentially create a more significant effect on a receptor than if just one phase were assessed in isolation; and
- Receptor led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor (or group). Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

11.14.3 The potential inter-related effects that could arise in relation to marine mammals are presented in **Table 11-43**. A description of the process to identify and assess these effects is presented in **Chapter 5**.

Table 11-43 Inter-related effects assessment for marine mammals

Project phase(s)	Nature of inter-related effect	Assessment alone	Inter-related effects assessment
Proposed Development - lifetime effects			

Project phase(s)	Nature of inter-related effect	Assessment alone	Inter-related effects assessment
Construction and decommissioning	Disturbance from underwater noise	Both PTS and disturbance from piling in the construction phase was assessed as not significant in EIA terms, and similar (or lesser) effects are expected for decommissioning.	Disturbance to marine mammals will be mainly caused by underwater noise from piling and UXO in the construction phase and removal of structures in the decommissioning phase. The construction and decommissioning phases are significantly temporally separate such that there will be no interaction between the two. Disturbance from underwater noise was assessed as Not Significant in EIA terms. Therefore, across the Proposed Development lifetime, the effects on marine mammal receptors 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 phase.
Construction, operation and decommissioning	Collisions and disturbance from vessels	Both collisions and disturbance from vessels were assessed as having no significant effect across all three project phases.	The potential for disturbance and/or collision effects will arise at all stages of the Proposed Development, resulting in a potential lifetime effect. However, it is not predicted that the significance of any potential effects will increase due to the interaction of this impact across all Proposed Development stages, rather be maintained at the same level throughout the project. With the proposed implementation of a VMP (C-51, **Table 11-11**), impacts from vessel activity is assessed as minor and therefore not significant across all three phases. Therefore,

Project phase(s)	Nature of inter-related effect	Assessment alone	Inter-related effects assessment
			across the Proposed Development lifetime, the effects on marine mammals 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 phase.
Receptor-led effects			
Inter-related effect from the combination of disturbance from underwater noise, the presence of vessels and loss of prey resources on marine mammals.		The greatest potential for spatial and temporal interactions is likely to occur with underwater construction noise impacts (i.e. during the construction phase). The individual impacts were assigned a significance of negligible to minor. It is noted that some of these interactions are mutually exclusive (i.e. disturbance/displacement resulting from underwater noise will mean reduced potential for vessel interactions). It is therefore not anticipated that any inter-related effects will be produced that are of greater significance than the assessments presented for each individual phase.	
Inter-related effects from the interaction of increased SSC and smothering, and underwater noise.		With respect to the interaction with increased SSC and smothering, and underwater noise, these impacts were assigned a significance of minor adverse significance for all fish and shellfish receptors apart from black bream which was moderate. Therefore the effect on mammals (via the impact on prey species) can also be considered as minor significance at most (as the potential for effect is indirect). Although potential inter-related impacts may arise, it is important to recognise that some of the activities are mutually exclusive. Furthermore, underwater noise from piling which is predicted to result in displacement of organisms which will in turn mean that these species will not be exposed to the greatest predicted increases in SCC from smothering and drilling in the array area. Therefore, effects of greater significance than the individual impacts in isolation are not predicted.	

Project phase(s)	Nature of inter-related effect	Assessment alone	Inter-related effects assessment
Inter-related effects from the interaction of increased SSC and smothering, and habitat loss/disturbance		The greatest potential for inter-related effects is predicted to occur through the interaction of both temporary and permanent habitat loss/disturbance from foundation installation/jack-up vessels/anchor placement/scour, indirect habitat disturbance due to sediment deposition and indirect effects of changes in physical processes due the presence of infrastructure in the operational offshore wind farm. With respect to this interaction, these impacts were assigned a significance of minor adverse significance for all fish and shellfish receptors apart from black bream which was moderate. Therefore the effect on mammals (via the impact on prey species) can also be considered as minor significance at most (as the potential for effect is indirect). In addition, any effects due to changes in the physical processes are likely to be limited, both in extent and in magnitude, with receptors having low sensitivity to the scale of changes predicted. As such, these interactions are predicted to be no greater in significance than that for the individual effects assessed in isolation.	

11.15 Summary of residual effects

11.15.1 **Table 11-44** presents a summary of the preliminary assessment of significant impacts, any relevant embedded environmental measures and residual effects on marine mammal receptors.

Table 11-44 Summary of preliminary assessment of residual effects

Activity and impact	Magnitude of impact	Receptor and sensitivity or value	Embedded environmental measures	Preliminary assessment of residual effect (significance)
Construction				

Activity and impact	Magnitude of impact	Receptor and sensitivity or value	Embedded environmental measures	Preliminary assessment of residual effect (significance)
Construction noise impacts (PTS) (piling and UXO clearance)	Negligible (piling) Minor (UXO clearance)	Medium (cetacean species) and Very low (seal species)	C-52, C-102	**Minor adverse (no significant ecological effect)**
Construction noise impacts (Disturbance)	Piling: Moderate (bottlenose and common dolphins) Minor (harbour porpoise and minke whale) Negligible (seal species) UXO clearance: Minor	Medium (cetacean species and harbour seal) and very low (grey seal)	C-52	**Minor adverse (no significant ecological effect)**
Non-piling noise – Underwater noise from seabed preparation, rock dumping and cable installation	Negligible	Medium (cetacean species and harbour seal) and Very low (grey seal)	C-52	**Minor adverse (no significant ecological effect)**
Vessel collision risk	Mino	High to very high	C-51	**Minor adverse (no significant ecological effect)**

Activity and impact	Magnitude of impact	Receptor and sensitivity or value	Embedded environmental measures	Preliminary assessment of residual effect (significance)
Vessel disturbance	Minor	Low	C-51	**Minor adverse (no significant ecological effect)**
Change to prey availability	Negligible	Medium	C-52	**Minor adverse (no significant ecological effect)**
Disturbance to seal haul out sites at landfall	Negligible	Medium for harbour seals and Low for grey seals	C-52, C-102	**Minor adverse (no significant ecological effect)**
Operation and maintenance				
Operational noise	Minor	Low	N/A	**Minor adverse (no significant ecological effect)**
Vessel collision risk	Minor	High to very high	C-51	**Minor adverse (no significant ecological effect)**
Vessel disturbance	Minor	Low	C-51	**Minor adverse (no significant ecological effect)**
Changes to prey availability	Negligible	Low	C-52	**Minor adverse (no**

Activity and impact	Magnitude of impact	Receptor and sensitivity or value	Embedded environmental measures	Preliminary assessment of residual effect (significance)
				significant ecological effect)
Decommissioning				
Decommissioning noise impacts (PTS)	The potential impacts during the decommissioning phase are anticipated to be similar or less than during construction. Therefore, the significance of effect from decommissioning noise (PTS) impacts on marine mammals has been assessed as being of **minor adverse significance**, which is **not Significant** in EIA terms.			
Decommissioning noise impacts (disturbance)	The potential impacts during the decommissioning phase are anticipated to be similar or less than during construction. Therefore, the significance of effect from decommissioning noise (disturbance) impacts on marine mammals has been assessed as being of **minor adverse significance**, which is **not Significant** in EIA terms.			
Vessel collision risk	The potential impacts during the decommissioning phase are anticipated to be similar or less than during construction. Therefore, the significance of effect from vessel collision risk has been assessed as being of **minor adverse significance**, which is **not Significant** in EIA terms.			
Vessel disturbance	The potential impacts during the decommissioning phase are anticipated to be similar or less than during construction. Therefore, the significance of effect from vessel disturbance on marine mammals has been assessed as being of **minor adverse significance**, which is **not Significant** in EIA terms.			
Changes in prey availability	The potential impacts during the decommissioning phase are anticipated to be similar or less than during construction. Therefore, the significance of effect from changes in prey availability on marine mammals has been assessed as being of **minor adverse significance**, which is **not Significant** in EIA terms			

Activity and impact	Magnitude of impact	Receptor and sensitivity or value	Embedded environmental measures	Preliminary assessment of residual effect (significance)
Disturbance to seal haul out sites at landfall	The potential impacts during the decommissioning phase are anticipated to be similar or less than during construction. Therefore, the significance of effect from disturbance to seal haul out sites has been assessed as being of **minor adverse significance**, which is **not Significant** in EIA terms.			

11.16 Further work to be undertaken for ES

Introduction

11.16.1 Further work that will be undertaken to support the marine mammal assessment and presented within the ES is set out below.

Baseline

11.16.2 Upon receiving the additional four months of analysed data which was unavailable for the PEIR, the baseline characterisation presented within this chapter will be updated for the ES.

11.16.3 Additionally, the cetacean MUs considered in the assessment will be updated if required following the release of the IAMMWG 2021 report (currently in review).

Assessment

11.16.4 If the baseline characterisation is changed significantly upon receiving the additional nine months of analysed data which was unavailable for the PEIR, the assessments presented here may also require updating accordingly.

Consultation and engagement

11.16.5 Further consultation and engagement that will be undertaken to inform the marine mammal assessment and presented within the ES is set out in **Table 11-45.**

Table 11-45 Further consultation and engagement

Consultee	Issues to be addressed	Relevance to assessment
Marine mammal ETG members (including the Cefas, MMO, Natural	Section 42 comments	As appropriate

Consultee	Issues to be addressed	Relevance to assessment
England, TSWT, TWT and WDC)		

Environmental measures

11.16.6 No further environmental measures are considered to be required.

11.17 Glossary of terms and abbreviations

Table 11-46 Glossary of terms and abbreviations

Term (acronym)	Definition
ADD	Acoustic Deterrent Devices
BAP	Biodiversity Action Plan
Baseline	Refers to existing conditions as represented by latest available survey and other data which is used as a benchmark for making comparisons to assess the impact of development.
Baseline conditions	The environment as it appears (or would appear) immediately prior to the implementation of the Proposed Development together with any known or foreseeable future changes that will take place before completion of the Proposed Development.
BEIS	Department for Business, Energy, and Industrial Strategy
CEA	Cumulative Effects Assessment
Construction effects	Used to describe both temporary effects that arise during the construction phases as well as permanent existence effects that arise from the physical existence of development (for example new buildings).
CTV	Crew Transfer Vessel
Cumulative effects	Additional changes caused by a Proposed Development in conjunction with other similar developments or as a combined effect of a set of developments.
Cumulative Effects Assessment (CEA)	Assessment of impacts as a result of the incremental changes caused by other past, present and reasonably foreseeable human activities and natural processes together with the Proposed Development.

Term (acronym)	Definition
DCO Application	An application for consent to undertake a Nationally Significant Infrastructure Project made to the Planning Inspectorate who will consider the application and make a recommendation to the Secretary of State, who will decide on whether development consent should be granted for the Proposed Development.
Decommissioning	The period during which a development and its associated processes are removed from active operation.
DEPONS	The Disturbance Effects of noise on the harbour Porpoise population in the North Sea
Development Consent Order (DCO)	This is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects, under the Planning Act 2008.
DML	Deemed Marine License
ECC	Export Cable Corridor
EDR	Effective Deterrent Range
Embedded environmental measures	Equate to 'primary environmental measures' as defined by Institute of Environmental Management and Assessment (2016). They are measures to avoid or reduce environmental effects that are directly incorporated into the preferred masterplan for the Proposed Development.
EMF	Electro-Magnetic Frequency
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed project or development over and above the existing circumstances (or 'baseline').
Environmental Statement (ES)	The written output presenting the full findings of the Environmental Impact Assessment.
EPS	European Protected Species
ETG	Expert Topic Group
Evidence Plan Process (EPP)	A voluntary consultation process with specialist stakeholders to agree the approach and the information required to support the EIA and HRA for certain aspects.
Future baseline	Refers to the situation in future years without the Proposed Development.

Term (acronym)	Definition
HDD	Horizontal Directional Drilling
HRA	Habitat Regulations Assessment
Impact	The changes resulting from an action.
Indirect effects	Effects that result indirectly from the Proposed Development as a consequence of the direct effects, often occurring away from the site, or as a result of a sequence of interrelationships or a complex pathway. They may be separated by distance or in time from the source of the effects. Often used to describe effects on landscape character that are not directly impacted by the Proposed Development such as effects on perceptual characteristics and qualities of the landscape.
JUV	Jack-Up Vessel
Likely Significant Effects	It is a requirement of Environmental Impact Assessment Regulations to determine the likely significant effects of the Proposed Development on the environment which should relate to the level of an effect and the type of effect.
LSE	Likely Significant Effect
Magnitude (of change)	A term that combines judgements about the size and scale of the effect, the extent of the area over which it occurs, whether it is reversible or irreversible and whether it is short term or long term in duration'. Also known as the 'degree' or 'nature' of change.
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MLS	Most Likely Scenario
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MP	Monopile
MPCP	Marine Pollution Contingency Plan
MSFD	Marine Strategy Framework Directive

Term (acronym)	Definition
MU	Management Unit
MWWC	Marine Wildlife Watching Code
Nationally Significant Infrastructure Project (NSIP)	Nationally Significant Infrastructure Projects are major infrastructure developments in England and Wales which are consented by DCO. These include proposals for renewable energy projects with an installed capacity greater than 100MW.
NPS	National Policy Statement
PDV	Phocine Distemper Virus
PEIR	Preliminary Environmental Information Report
PEIR Assessment Boundary	The PEIR Assessment Boundary combines the search areas for the offshore and onshore infrastructure associated with the Proposed Development. It is defined as the area within which the Proposed Development and associated infrastructure will be located, including the temporary and permanent construction and operational work areas.
PEMMP	Project Environmental Monitoring and Management Plan
PINS	Planning Inspectorate
Planning Inspectorate	The Planning Inspectorate deals with planning appeals, national infrastructure planning applications, examinations of local plans and other planning-related and specialist casework in England and Wales.
PP	Pinpile
Preliminary Environmental Information Report (PEIR)	The written output of the Environmental Impact Assessment undertaken to date for the Proposed Development. It is developed to support formal consultation and presents the preliminary findings of the assessment to allow an informed view to be developed of the Proposed Development, the assessment approach that has been undertaken, and the preliminary conclusions on the likely significant effects of the Proposed Development and environmental measures proposed.
Proposed Development	The development that is subject to the application for development consent, as described in **Chapter 4**.
PTS	Permanent Threshold Shift

Term (acronym)	Definition
Rampion 2	Rampion 2 Offshore Wind Farm
Receptor	These are as defined in Regulation 5(2) of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 and include population and human health, biodiversity, land, soil, water, air, climate, material assets, cultural heritage and landscape that may be at risk from exposure to pollutants which could potentially arise as a result of the Proposed Development.
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
Scoping Opinion	A Scoping Opinion is adopted by the Secretary of State for a Proposed Development.
Scoping Report	A report that presents the findings of an initial stage in the Environmental Impact Assessment process.
Secretary of State	The body who makes the decision to grant development consent.
Sensitivity	A term applied to specific receptors, combining judgements of the susceptibility of the receptor to the specific type of change or development proposed and the value associated to that receptor.
Significance	A measure of the importance of the environmental effect, defined by criteria specific to the environmental aspect.
Significant effects	It is a requirement of the EIA Regulations to determine the likely significant effects of the development on the environment which should relate to the level of an effect and the type of effect. Where possible significant effects should be mitigated.
SNCB	Statutory Nature Conservation Bodies
SOV	Service Operation Vessels
SPA	Special Protection Area
Temporal Scope	The temporal scope covers the time period over which changes to the environment and the resultant effects are predicted to occur and are typically defined as either being temporary or permanent.

Term (acronym)	Definition
Temporary or permanent effects	Effects may be considered as temporary or permanent. In the case of wind energy development the application is for a 30 year period after which the assessment assumes that decommissioning will occur and that the site will be restored. For these reasons the development is referred to as long term and reversible.
The Applicant	Rampion Extension Development Limited (RED)
TTS	Temporary Threshold Shift
UXO	Unexploded Ordnance
UXO	Unexploded Ordnance
VMP	Vessel Management Plan
WTG	Wind Turbine Generator
Zone of Influence (ZOI)	The area surrounding the Proposed Development which could result in likely significant effects.

11.18 References

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