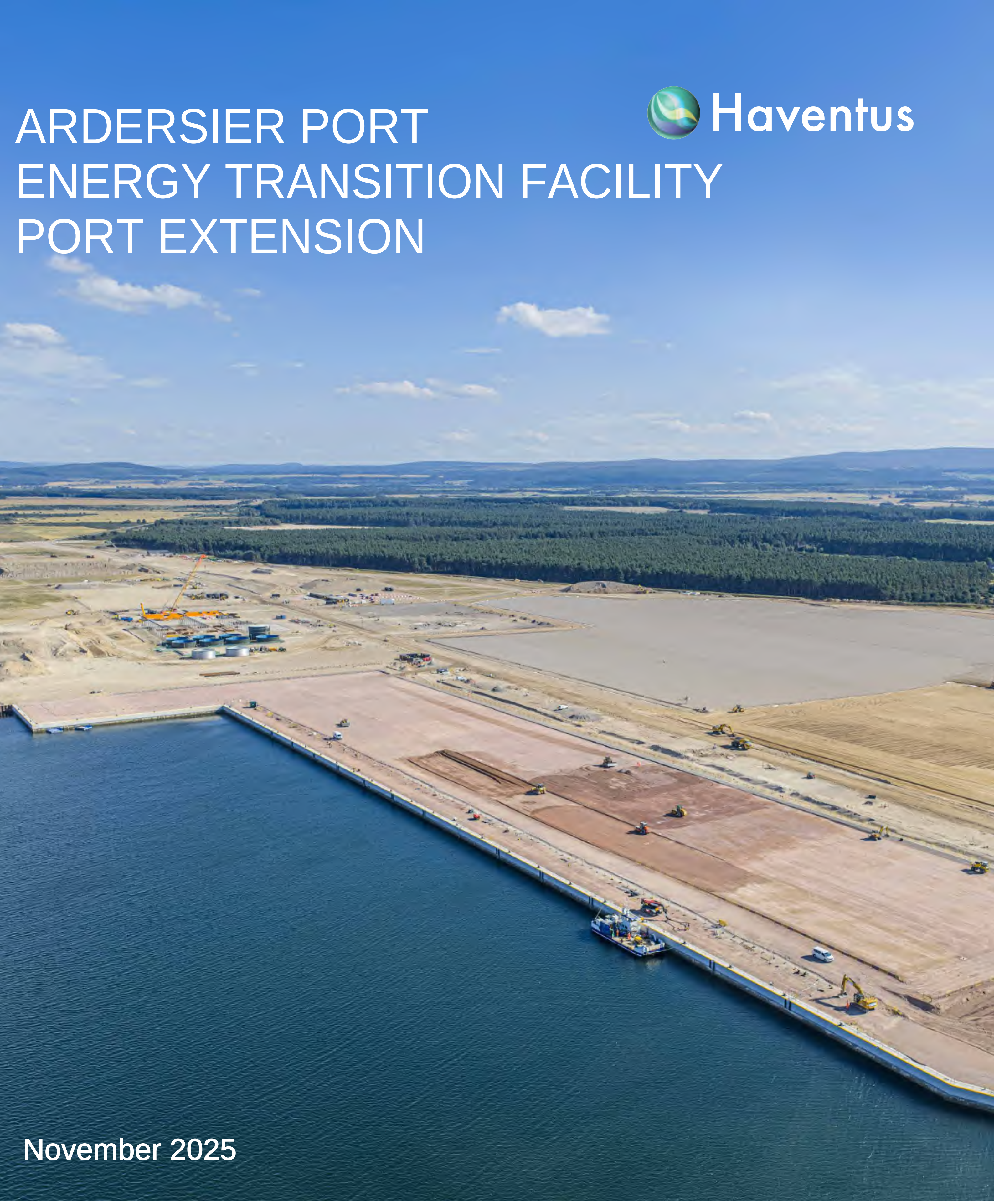
ARDERSIER PORT
ENERGY TRANSITION FACILITY
PORT EXTENSION

Haventus



November 2025

Appendix 11.1: Legislation, Policy and Guidance

SMRU Consulting

understand ♦ assess ♦ mitigate

Ardersier Port Extension

EIAR Appendix 11.1: Legislation, Policy and Guidance

Authors:	Jack Clarkson
Report Code:	SMRUC-POA-2025-011
Date:	Friday, 31 October 2025

THIS REPORT IS TO BE CITED AS: CLARKSON, J (2025). ARDERSIER PORT EXTENSION - EIAR APPENDIX 11.1: LEGISLATION, POLICY AND GUIDANCE. REPORT NUMBER SMRUC-POA-2025-011 PROVIDED TO SWECO & HAVENTUS, SEPTEMBER 2025 (UNPUBLISHED).

Document Control

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Rev.	Date.	Reason for Issue.	Prep.	Chk.	Apr.	Client
1	01/08/2025	First draft	JC	RRS	RRS	HAV

Contents

1 Legislation, Policy and Guidance

The preparation of the Marine Mammals chapter has been informed by the following policy, legislation and guidance.

1.1 Legislation

1.1.1 Habitats Regulations (The Conservation (Natural Habitats &c.) Regulations)

The Habitats Regulations includes a number of legislative items:

- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019;
- The Conservation of Habitats and Species Regulations 2017 (covering inshore waters (<12nm)); and
- The Conservation (Natural Habitats &c.) Regulations 1994.

Under the Habitats Regulations, European Protected Species (EPS) are species listed in Annex IV of the Habitat Directive (and afforded protection under the Habitats Regulations). All cetacean species found in Scottish waters are EPS.

Annex V of the Habitats Directive as transposed into Scottish and UK legislation, defines seals as species of community interest, meaning that any take of these species in the wild is subject to management measures.

The inshore legislation makes it an offence to deliberately or recklessly capture, injure or kill a wild animal of an EPS. It should be noted that with respect to auditory injury, the current advice from NatureScot is that there is no requirement to fully mitigate modelled cumulative auditory injury (PTS) (based on the cumulative Sound Exposure Level (SEL_{cum}) metric) ranges, as it is acknowledged that they are over-precautionary given current modelling methods (see Appendix 11.2). NatureScot thus advise that best practice measures which could reduce the risk of cumulative PTS is welcomed but not required.

Further, it is also an offence to deliberately or recklessly disturb any cetacean (dolphin, porpoise or whale). In terms of the disturbance offence, this is assessed at the individual level. If such an offence is likely to occur, an EPS licence is required.

Should an EPS licence be required, for it to be granted the Habitats Regulations specify three tests which need to be met: (i) there must be a licensable purpose; (ii) there must be no satisfactory alternative; and (iii) the activity must not be detrimental to the maintenance of the population of the species concerned at favourable conservation status in their natural range. It should be noted that only a high-level EPS assessment is undertaken at the EIA stage. A full EPS risk assessment will be undertaken post-consent, as required.

1.1.2 Wildlife and Countryside Act 1981 (WCA)

Under this Act, it is illegal to intentionally or recklessly, disturb or harass dolphins, whales and porpoises (listed under Schedule 5). It is also an offence to deliberately kill, injure or take cetaceans.

1.1.3 Marine (Scotland) Act 2010

The Marine (Scotland) Act 2010 provides the legislative and management framework for the marine environment within Scottish Territorial Waters (from MHWS out to 12 nm). Under Section 21 of the Marine (Scotland) Act 2010, Caledonia North requires a Marine Licence for marine licensable activities below MHWS.

The Act replaces the Conservation of Seals Act 1970 in Scottish waters. The Natural Environment Research Council (NERC) has a duty to provide scientific advice to the Scottish Government on matters related to the management of seal populations. NERC has appointed the Special Committee on Seals (SCOS) to formulate this advice.

1.1.4 Protection of Seals (Designated Sea Haul-out Sites) (Scotland) Order 2014 and Amendment Order 2017

This legislation designates seal haul-outs (coastal locations that seals use to breed, pup, moult and rest). At designated haul-out sites, it is an offence to intentionally or recklessly harass seals, and seals are protected from adverse anthropogenic impacts.

1.1.5 The Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention') (Council of Europe, 1979)

The 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). Cetaceans and seals are listed under Annex II and Annex III.

1.1.6 The Convention on the Conservation of Migratory Species of Wild Animals (the 'Bonn Convention') (United Nations Environment Programme, 1983)

The Convention aims 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 of the Convention). Marine mammal species included in the list and of relevance to this assessment bottlenose dolphin, harbour porpoise, harbour seal, grey seal, and minke whale.

1.2 Policy

1.2.1 The OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention) will be implemented through OSPAR's North-East Atlantic Environment Strategy 2030. The OSPAR Convention contains a series of Annexes with five of them addressing land-based and offshore pollution, marine environment quality and protection of marine ecosystems and biodiversity. There is one marine mammal species listed under the OSPAR Convention that is relevant to this assessment (harbour porpoise).

1.2.2 Department for Environment, Food and Rural Affairs (DEFRA) Policy Paper: Reducing Marine Noise

The UK Government's marine noise policy[1] sets out a strategic approach to reducing human-generated underwater noise and its harmful impacts on marine ecosystems. Central to this strategy is the Marine Noise Registry, which collects data on loud impulsive activities (e.g. pile driving, sonar use, and explosive ordnance clearance) to support marine planning and meet the requirements of the UK Marine Strategy. The policy promotes a risk-based, evidence-led framework, encouraging developers—especially in the offshore wind sector—to adopt low-noise technologies and mitigation techniques as standard practice. Regulatory expectations are tightening, with planned consultations

[1] https://www.gov.uk/government/publications/reducing-marine-noise/reducing-marine-noise

on setting noise limits for offshore piling and an increasing preference for alternatives to high-noise explosive clearance of unexploded ordnance.

The policy is also aligned with broader marine conservation and decarbonisation goals. Strategic compensation measures, such as expanding Marine Protected Areas (MPAs) and establishing a Marine Recovery Fund, are being developed to facilitate responsible offshore wind development while enhancing biodiversity. Cross-sector collaboration is a core theme, involving government, regulators, industry, and NGOs to drive innovation and implement effective noise reduction. Overall, the policy aims to integrate noise management into marine licensing and spatial planning in a way that supports sustainable development and marine environmental protection

1.3 Guidance:

1.3.1 Priority Marine Features (PMFs), as described in NatureScot Commissioned Report 388; Strategy

Cetaceans and pinnipeds are amongst the most regularly occurring marine mammal species within Scottish waters designated as PMFs and are considered to be marine nature conservation priorities in Scottish waters (Tyler-Walters *et al.*, 2016; NatureScot, 2020).

1.3.2 Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects (Southall et al. 2019)

Provides updated marine mammal exposure criteria for auditory injury (PTS).

1.3.3 Scottish Marine Wildlife Watching Code

A code of conduct which aims to minimise disturbance to wildlife, help people enjoy watching marine wildlife, improve chances of seeing wildlife, provide a standard for the wildlife watching industry and help people stay within the law (SNH 2017a, b).

1.3.4 The Protection of Marine European Protected Species from injury and disturbance: Guidance for Inshore Waters (July 2020 Version)

This guidance provides advice for marine users who are planning to carry out an activity in the marine environment which has the potential to kill, injure or disturb a marine EPS. The guidance can also be used by regulators, nature conservation agencies, enforcement authorities and competent authorities when considering whether an activity will cause or has caused death, injury or disturbance to a marine EPS (Marine Scotland 2020).

1.3.5 Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise

This set of mitigation measures offers guidance on reducing risk of injury to marine mammals during pile driving. If followed, risk of injury is likely to be greatly reduced. The guidelines are split by survey planning, mitigation, and reporting, to increase ease of use (JNCC 2010).

1.3.6 Guidance on the Offence of Harassment at Seal Haul-out Sites

Provides guidance on seal harassment and how to avoid an offence (Marine Scotland 2014).

2 Glossary of Terms, Acronyms and Abbreviations

Term	Description
EPS	European Protected Species
EU	European Union
JNCC	Joint Nature Conservation Committee
MHWS	Mean High Water Spring
MPA	Marine Protected Area
NERC	Natural Environment Research Council
NGO	Non-Governmental Organisation
nm	Nautical Miles
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
PMF	Priority Marine Features
PMF	Priority Marine Features
PTS	Permanent Threshold Shift
SCOS	Special Committee on Seals
SEL_{cum}	Cumulative Sound Exposure Level
SNH	Scottish Natural Heritage (now known as 'NatureScot')

3 Literature Cited

JNCC. 2010. Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise.

Marine Scotland. 2014. Guidance on the Offence of Harassment at Seal Haul-out Sites.

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SNH. 2017a. A Guide to Best Practice for Watching Marine Wildlife SMWWC - Part 2. Scottish Natural Heritage.

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Southall, B., J. J. Finneran, C. Reichmuth, P. E. Nachtigall, D. R. Ketten, A. E. Bowles, W. T. Ellison, D. Nowacek, and P. Tyack. 2019. Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals **45**:125-232.

ARDERSIER PORT
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PORT EXTENSION

November 2025

Appendix 11.2: Assessment Methodology

Ardersier Port Extension

EIAR Appendix 11.2: Marine Mammal Assessment Methodology

Authors:	Jack Clarkson, Rachael Sinclair
Report Code:	SMRUC-POA-2025-010
Date:	Friday, 31 October 2025

THIS REPORT IS TO BE CITED AS: CLARKSON, J & SINCLAIR, R. (2025). ARDERSIER PORT EXTENSION - EIAR APPENDIX 11.2: MARINE MAMMAL ASSESSMENT METHODOLOGY. REPORT NUMBER SMRUC-POA-2025-010 PROVIDED TO SWECO & HAVENTUS, SEPTEMBER 2025.

Document Control

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Rev.	Date.	Reason for Issue.	Prep.	Chk.	Apr.	Client
1	01/08/2025	First draft	JC	RRS	RRS	

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1 Introduction

This appendix outlines the approach to the Marine Mammal impact assessment to support the Ardersier Port Extension EIA.

The Ardersier Energy Transition Facility Extension EIA Scoping Report (SCOP-0062) (Haventus 2025) briefly outlined the assessment methodologies required to undertake a robust and complete assessment of the potential impacts to marine mammals which may occur during the construction, and operation and maintenance (O&M) phases of the proposed development.

The following assessment approaches have used in the marine mammal impact assessment for underwater noise:

- Auditory injury (PTS): quantitative assessment using Southall et al. (2019) dual thresholds;
- Disturbance from piling: quantitative assessment using dose-response functions:
  - Harbour porpoise dose-response function (Graham et al. 2017) (also applied to other cetacean species)
  - Harbour seal dose-response function (Whyte et al. 2020) (also applied to grey seals);
- Disturbance from dredging and soil disposal: quantitative assessment for dredging activities through the use of effective deterrence ranges (EDRs), and a qualitative assessment based on literature on vessel activity and the responses of marine mammals for spoil disposal activities.
- Disturbance to seal haul-out sites: qualitative assessment for disturbance to seals at their haul-out sites.
- Vessel collision and disturbance: qualitative assessment based on literature on vessel activity and the responses of marine mammals, particularly within the inner Moray Firth. Where possible, a quantitative impact assessment shall be provided for vessel disturbance.
- Indirect impacts on prey availability: qualitative assessment based on literature on marine mammal prey in the Moray Firth, and the potential risks of pollutant release and/or contamination impacts on marine mammal prey items.
- Cumulative impacts assessment for projects in the Moray Firth: quantitative assessment of the number of animals which may be impacted on any one day of piling, based on reported levels of impacts in published EIARs where available and, where not, on various assumptions relating to impact footprints (e.g., fixed EDRs) and animal densities (Carter et al. 2020, Gilles et al. 2023, Gilles et al. 2025).

Each assessment method is described in detail in Section 2: Assessment Methodology.

2 Assessment Methodology

2.1 Assessment of Auditory Injury (PTS)

The Southall et al. (2019) thresholds were used to assess the risk of auditory injury (PTS) using the dual criteria: cumulative sound exposure level (SEL_{cum}, accumulated sound energy over 24 hours) and peak sound pressure level (SPL_{peak}, sound pressure from a single noise pulse). The SEL_{cum} from multiple pulses was assessed using a fleeing animal model using indicative swim speeds. The SPL_{peak} criterion is for unweighted received sound level. The method used to calculate PTS-onset impact ranges for both 'instantaneous' PTS (SPL_{peak}), and 'cumulative' PTS (SEL_{cum}, over 24 hours) is detailed in EIAR Appendix 11.5.

For cumulative PTS, the calculated impact ranges represent the minimum safe starting distances from the piling location for fleeing animals to avoid a dose higher than the PTS threshold. In calculating the received noise level that animals are likely to receive during the whole piling sequence, constant animal swimming speeds were used:

- For harbour porpoise, NatureScot (Scottish Natural Heritage 2016) recommend that 1.4 m/s is used based on an average descent and ascent speed from tagged porpoise (Westgate et al. 1995).
- The swimming speed for bottlenose dolphins is based on Bailey and Thompson (2006) at 1.52 m/s.
- Scottish Natural Heritage (2016) also recommend a fleeing speed of 2.1 m/s for minke whales based on Williams (2009)
- Scottish Natural Heritage (2016) recommend a swimming speed of 1.8 m/s for harbour and grey seals, based on Thompson (2015) which estimated that typical swimming speeds were in the range of 1.8-2.0 m/s.

2.2 Assessment of Disturbance

2.2.1 Pile Driving

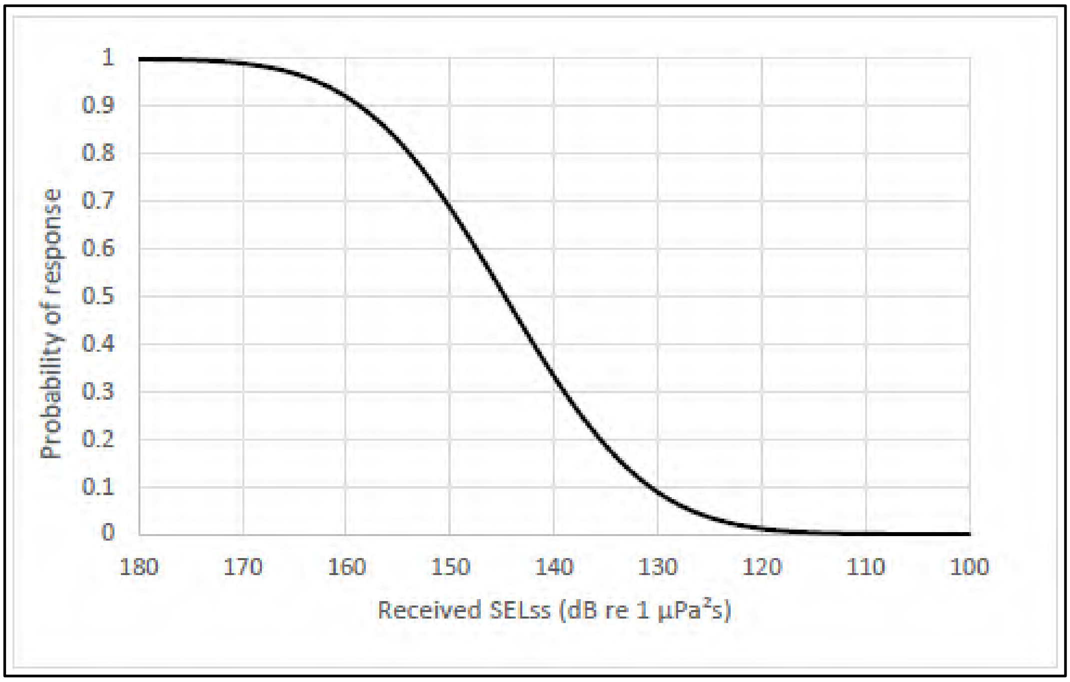
The assessment of disturbance from pile-driven foundations used the current best practice methodology, making use of the best available scientific evidence. This incorporated the application of a dose-response approach.

Noise contours were generated by underwater noise modelling and overlain on species density surfaces to predict the number of animals present within each modelled noise contour. The number of animals present was then multiplied by the proportion of animals that are expected to respond within each contour. The dose-response functions are outlined below.

2.2.1.1 Harbour porpoise dose-response function

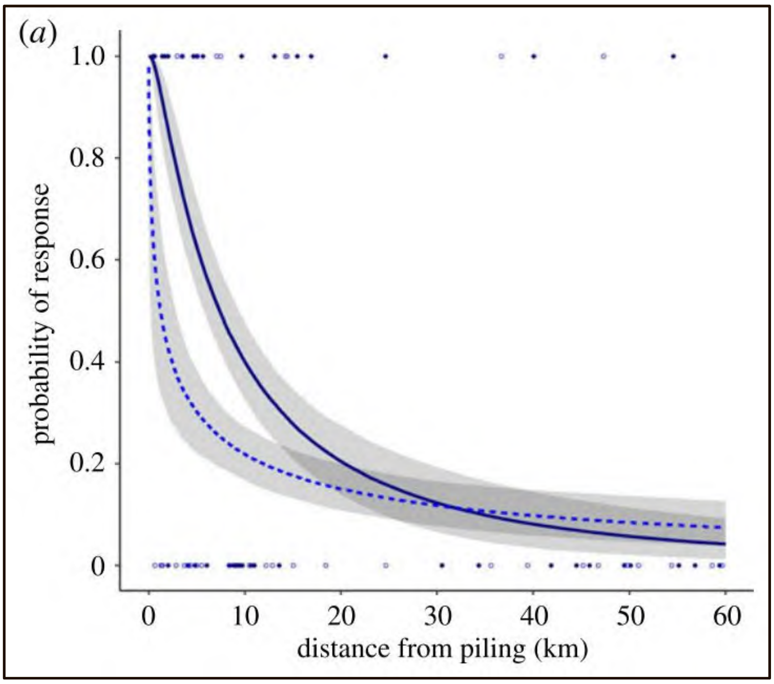
To estimate the number of porpoise predicted to be disturbed as a result of pile driving, the porpoise dose-response function from Graham et al. (2017) was applied.

Figure 1: Relationship between the proportion of porpoise responding and the received single strike SEL (SELss) (Graham et al. 2017)



The Graham et al. (2017) dose-response function was developed using data on harbour porpoise collected during the first six weeks of piling during Phase 1 of the Beatrice Offshore Wind Farm (OWF) monitoring program. Since the initial development of the dose-response function in 2017, additional data from the remaining pile driving events at Beatrice OWF have been processed and are presented in (Graham et al. 2019). The passive acoustic monitoring showed a 50% probability of porpoise response (a significant reduction in detection relative to baseline) within 7.4 km at the first location piled, with decreasing response levels over the construction period (excluding pre-construction surveys) to a 50% probability of response within 1.3 km by the final piling location (Figure 2) (Graham et al. 2019). Using the dose-response function derived from the initial piling events for all piling events in the impact assessment is precautionary, as evidence shows that porpoise response is likely to diminish over the construction period (excluding pre-construction surveys).

Figure 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). Obtained from Graham et al. (2019)



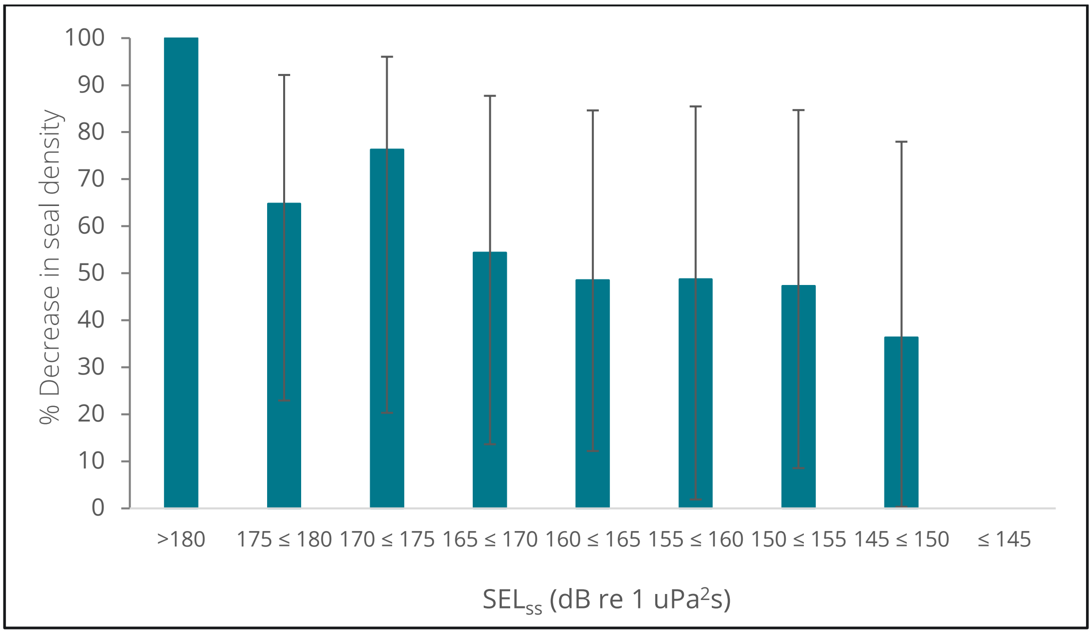
It is noted that Graham et al. (2019) presents an updated dose-response function for harbour porpoise, however this function is audiogram weighted specific to VHF-cetaceans and as such cannot be used as a proxy for other species. Therefore, the assessment uses the Graham et al. (2017) dose-response function as it is more precautionary (predicts higher responses) than the (Graham et al. 2019) dose-response function and can be used across other cetacean species since the curve is not audiogram weighted.

Although the Graham et al. (2017) dose-response function is specific to harbour porpoise, it is proposed that in the absence of species-specific data on dolphin species or minke whales, the Graham et al. (2017) dose-response function was adopted for all cetaceans. However, it should be noted that numerous studies have shown that other cetacean species show comparatively less of a disturbance response from underwater noise compared with harbour porpoise (Kastelein et al. 2006, Culloch et al. 2016, Stone et al. 2017, Fernandez-Betelu et al. 2021), meaning this approach is highly precautionary.

2.2.1.2 Seal dose-response function

For seals, the Whyte et al. (2020) harbour seal dose-response function was used (Figure 3). The Whyte et al. (2020) study used telemetry data from 25 harbour seals tagged in the Wash between 2003 and 2006 and 24 harbour seals tagged in 2012, to assess how seal usage changed in relation to the pile driving activities at the Lincs OWF in 2011-2012.

Figure 3: Predicted decrease in seal density as a function of estimated sound exposure level, error bars show 95% CI (Whyte et al. 2020)



In the Whyte et al. (2020) dose-response function it has been assumed that all seals are displaced at sound exposure levels above 180 dB re 1 µPa^{2}s. This is a conservative assumption since there were no data presented in the study for harbour seal responses at this level. It is also important to note that the percentage decrease in response in the categories 170 ≤ 175 and 175 ≤ 180 dB re 1 µPa^{2}s is slightly anomalous (higher response at a lower sound exposure level) due to the small number of spatial cells included in the analysis for these categories (n = 2 and 3 respectively). Given the large confidence intervals on the data, this assessment presents the mean number of seals predicted to be disturbed alongside the 95% confidence intervals (CI), for context.

There are no corresponding data for grey seals and, as such, the harbour seal dose-response function is applied to the grey seal disturbance assessment. This is considered to be an appropriate proxy for grey seals, since both species are categorised within the same functional hearing group. However, it is likely that this over estimates the grey seal response, since grey seals are considered to be less sensitive to behavioural disturbance than harbour seals and could tolerate more days of disturbance before there is likely to be an effect on vital rates (Booth et al. 2019). Recent studies of tagged grey seals have shown that there is vast individual variation in responses to pile driving, with some animals not showing any evidence of a behavioural response (Aarts et al. 2018). Likewise, if the impacted area is considered to be a high quality foraging patch, it is likely that some grey seals may show no behavioural response at all, given their motivation to remain in the area for foraging (Hastie et al. 2021). Therefore, the adoption of the harbour seal dose-response function for grey seals is considered to be precautionary as it will likely over-estimate the potential for impact on grey seals.

2.2.2 Dredging and Spoil Disposal Activities

There is currently no guidance on the thresholds to be used to assess disturbance of marine mammals from construction activities such as dredging and spoil disposal activities. However, it has been reported harbour porpoise in the Moray Firth show broad-scale responses to construction vessel activities by up to 4 km (Benhemma-Le Gall 2021, Benhemma-Le Gall et al. 2021), whilst McQueen et al. (2020) predicted avoidance of harbour porpoise to dredging vessel up to 5 km. McQueen et al. (2020) also predicted avoidance of seals to dredging vessels between 400 m to 5 km from the dredging site. Further, Pirotta et al. (2015) have assumed that dredging activities exclude dolphins from a 1 km radius of the dredging site, based on a study undertaken at Aberdeen Harbour.

Based on the literature reviewed, the Project impact assessment for dredging activities provides a quantitative assessment on the number of individuals, and percentage of the MU, for each marine mammal receptor which may experience behavioural disturbance. For harbour porpoise and seals, a 5 km EDR is applied, whilst for bottlenose dolphins, a 1 km EDR is applied. As no studies have focussed specifically on the expected disturbance ranges on minke whales from dredging activities, a 5 km EDR is applied.

For spoil disposal (i.e., dredge material dumping activities) the assessment is qualitative and focusses on the impacts of vessel presence/activity (see Section 2.2.3).

2.2.3 Disturbance and Collision Risks from Vessel Activity

There is currently no guidance on the thresholds to be used to assess disturbance of marine mammals from vessel activity. Where possible, literature on vessel activity and the responses of marine mammals, particularly within the Moray Firth (e.g., Onoufriou et al. (2016), Jones et al. (2017), Benhemma-Le Gall et al. (2021)) were used to inform the assessment. In the absence of Moray Firth specific studies on the interactions of marine mammals with vessels, other studies were used to inform the assessment (e.g., Young et al. (2014), Cates and Acevedo-Gutierrez (2017), Sullivan and Torres (2018), Clarkson et al. (2020), Puszka et al. (2021)).

2.2.4 Disturbance to Seal Haul-Out Sites

There is currently no guidance on the thresholds to be used to assess disturbance of seals at their haul-out sites. Therefore, this impact assessment provides a qualitative assessment for disturbance to seals at their haul-out sites, using studies which focus on the reactions of seals at their haul-out sites to human activities (e.g., Henry and Hammill (2001), Bankhead et al. (2023)).

2.2.5 Indirect impacts on Marine Mammal Prey Availability

There is currently no guidance on the assessment methodologies to be undertaken for this impact pathway. Thus, this impact assessment provides a qualitative assessment for indirect impacts on prey availability, using studies which focus on marine mammal prey items in the Moray Firth, and the potential risks of pollutant release and/or contamination impacts on marine mammal prey items.

2.3 Cumulative Effects Assessment (CEA)

The approach to CEA shall follow the process outlined Section 5: Cumulative Effects of Appendix 11.4.

The most significant cumulative impact on marine mammal species is likely to be underwater noise associated with construction activities, and vessel disturbance during operations and maintenance. For marine mammals, the approach to CEA is holistic and combines all potential sources of underwater noise including unexploded ordnance (UXO) clearance and pile driving at other wind farms together with disturbance from vessels, seismic surveys and any other marine construction developments that are planned within the Moray Firth.

For each relevant project, an assessment will be made of the number of animals which may be impacted on any one day, based on reported levels of impacts in published EIARs where available and, where not, on various assumptions relating to impact footprints (e.g., fixed EDRs) and animal densities (Carter et al. 2020, Carter et al. 2022, Gilles et al. 2023, Carter et al. 2025). The quantitative approach to the CEA shall only consider projects located within the Moray Firth (e.g. OWFs, Nigg port, Invergordon/Cromarty port). Where there is a potential for temporal overlap with construction at the proposed development and other developments, the assessment will assume that there is a potential for projects to be piling within the same timeframe. As definitive timescales for which piling shall occur at the proposed development are unknown, assumptions shall be made on the likely piling year within the proposed development construction timeline to allow for a quantitative CEA to take place against years for which other projects within the Moray Firth may also be piling. The maximum cumulative number of animals impacted on any one day will be presented as a proportion of the relevant MU. The contribution of the proposed development to this proportion shall also be calculated and provided.

The CEA for marine mammals will consider the maximum design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 2 (Methodology) of the EIAR. The impacts of fishing will not be considered in the CEA, since these activities will have occurred throughout the baseline and are therefore already accounted for in the existing marine mammal baseline characterisation abundance and density estimates. Where no EIA is available yet, indicative numbers of animals disturbed will be estimated (e.g. assuming a fixed EDR and using the most relevant density estimate (e.g., SCANS IV)).

As, once operational, the proposed development shall give rise to a significant increase in the number of vessel movements throughout the Inner Moray Firth, increased shipping traffic shall also be considered in this CEA. However, it is challenging 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 and thus, this assessment shall be qualitative.

3 Data Limitations & Assumptions

There are uncertainties relating to the underwater noise modelling and impact assessment for the proposed development. Broadly, these relate to predicting exposure of animals to underwater noise, predicting the response of animals to underwater noise.

3.1 PTS-onset Assumptions

There are no empirical data on the threshold for auditory injury in the form of Permanent Threshold Shift (PTS) -onset for marine mammals, as to test this would be inhumane. Therefore, PTS-onset thresholds are estimated based on extrapolating from Temporary Threshold Shift (TTS) -onset thresholds. For pulsed noise, such as piling, NOAA have set the onset of TTS at the lowest level that exceeds natural recorded variation in hearing sensitivity (6 dB), and assumes that PTS occurs from exposures resulting in 40 dB or more of TTS measured approximately four minutes after exposure (NMFS 2018). This assumption is used in the Southall et al. (2019) thresholds for PTS which are used in this assessment.

3.1.1 Instantaneous PTS

The predictions for instantaneous PTS-onset assume that all animals within the PTS-onset range are impacted, which is likely to overestimate the true number of impacted animals.

3.2 Density Assumptions

There are uncertainties relating to the ability to predict the responses of animals to underwater noise and the number of animals potentially exposed to levels of noise that may cause an impact is uncertain. Given the high spatial and temporal variation in marine mammal abundance and distribution in any particular area of the sea, it is difficult to predict how many animals may be present within the range of noise impacts. All methods for determining at sea abundance and distribution suffer from a range of biases and uncertainties. The density estimates selected for the quantitative impact assessment for the proposed development are the most recent and most robust density estimates available for each species, as detailed in EIAR Appendix 11.3.

3.3 Disturbance Assumptions

3.3.1 Dose-response function

In the absence of species-specific data on dolphin species or minke whales, the Graham et al. (2017) dose-response function has been adopted for all cetaceans. However, it should be noted that various studies have shown that other cetacean species show comparatively less of a disturbance response from underwater noise compared with harbour porpoise, meaning this approach is highly precautionary. Porpoise are considered to be particularly responsive to anthropogenic disturbance, with playback experiments showing avoidance reactions to very low levels of sound (Tyack 2009), and multiple studies showing that porpoise respond (avoidance and reduced vocalisation) to a variety of anthropogenic noise sources to distances of multiple kilometres (e.g. Brandt et al. 2013, Thompson et al. 2013, Tougaard et al. 2013, Brandt et al. 2018, Sarnocinska et al. 2019, Thompson et al. 2020, Benhemma-Le Gall et al. 2021).

Evidence suggests that dolphin species are less sensitive to disturbance compared to harbour porpoise. A literature review of recent (post Southall et al. 2007) behavioural responses by harbour porpoises and bottlenose dolphins to noise was conducted by Moray Offshore Renewables Limited (2012). Several studies have reported a moderate to high level of behavioural response at a wide range of received SPLs (100 and 180 dB re 1µPa) (Lucke et al. 2009, Tougaard et al. 2009, Brandt et al. 2011). Conversely, a study by Niu et al. (2012) reported moderate level responses to non-pulsed noise by bottlenose dolphins at received SPLs of 140 dB re 1µPa. Another high frequency cetacean, Risso's dolphin, reported no behavioural response at received SPLs of 135 dB re 1µPa (Southall et al. 2010). Whilst both species showed a high degree of variability in responses and a general positive trend with higher responses at higher received levels, moderate level responses were observed above 80 dB re 1µPa in harbour porpoise and above 140 dB re 1µPa in bottlenose dolphins (Natural Power and SMRU Ltd 2012), indicating that moderate level responses by bottlenose dolphins will be exhibited at a higher received SPL and, therefore, they are likely to show a lesser response to disturbance. Likewise, other high-frequency cetacean species, such as striped and common dolphins, have been shown to display less of a response to underwater noise signals and construction-related activities compared with harbour porpoise (e.g. Kastelein et al. 2006, Culloch et al. 2016).

3.3.2 Exposure to noise

There are uncertainties relating to the ability to predict the exposure of animals to underwater noise, as well as in predicting the response to that exposure. These uncertainties relate to a number of factors: the ability to predict the level of noise that animals are exposed to, particularly over long periods of time; the ability to predict the numbers of animals affected, and the ability to predict the individual and ultimately population consequences of exposure to noise. These are explored in further detail in the paragraphs below.

The propagation of underwater noise is relatively well understood and modelled using standard methods. However, there are uncertainties regarding the amount of noise actually produced by each pulse at source and how the pulse characteristics change with range from the source. There are also uncertainties regarding the position of receptors in relation to received levels of noise, particularly over time, and understanding how position in the water column may affect received levels. Noise monitoring is not always carried out at distances relevant to the ranges predicted for effects on marine mammals, so effects at greater distances remain un-validated in terms of actual received levels. The extent to which ambient noise and other anthropogenic sources of noise may mask signals from the Project construction are not specifically addressed. The dose-response functions for porpoise include behavioural responses at noise levels down to 120 dB SEL_{ss} which may be indistinguishable from ambient noise at the ranges these levels are predicted.

3.3.3 Predicted Response

There are limited empirical data available to inform predictions of the extent to which animals may experience auditory damage or display responses to noise. The current methods for prediction of behavioural responses are based on received sound levels, but it is likely that factors other than noise levels alone will also influence the probability of response and the strength of response (e.g. previous experience, behavioural and physiological context, proximity to activities, characteristics of the sound other than level, such as duty cycle and pulse characteristics). However, at present, it is impossible to adequately take these factors into account in a predictive sense. This assessment makes use of the monitoring work that has been carried out during the construction of the Beatrice OWF and, therefore, uses the most recent and site-specific information on disturbance to harbour porpoise as a result of pile driving noise.

There is also a lack of information on how observed effects (e.g. short-term displacement around impact piling activities) manifest themselves in terms of effects on individual fitness, and ultimately population dynamics to attempt to quantify the amount of disturbance required before vital rates are impacted.

3.3.4 Duration of Impact

The duration of disturbance is another uncertainty. Studies at Horns Rev 2 demonstrated that porpoises returned to the area between one and three days (Brandt et al. 2011) and monitoring at the Dan Tysk Wind Farm as part of the Disturbance Effects on the Harbour Porpoise Population in the North Sea (DEPONS) project found return times of around 12 hours (van Beest et al. 2015). Two studies at Alpha Ventus demonstrated, using aerial surveys, that the return of porpoises was about 18 hours after piling (Dähne et al. 2013). A recent study of porpoise response at the Gemini wind farm in the Netherlands, also part of the DEPONS project, found that local population densities recovered between two and six hours after piling (Nabe-Nielsen et al. 2018). An analysis of data collected at the first seven OWFs in Germany has shown that harbour porpoise detections were reduced between one and two days after piling (Brandt et al. 2018).

Analysis of data from monitoring of marine mammal activity during piling of jacket pile foundations at Beatrice OWF (Graham et al. 2017, Graham et al. 2019) provides evidence that harbour porpoise were displaced during pile driving but return after cessation of piling, with a reduced extent of disturbance over the duration of the construction period. This suggests that the assumptions adopted in the current assessment are precautionary as animals are predicted to remain disturbed at the same level for the entire duration of the pile driving phase of construction.

4 Glossary of Terms, Acronyms and Abbreviations

Term	Description
µPa	Micropascals
CEA	Cumulative Effects Assessment

Term	Description
CI	Confidence Intervals
dB	Decibels
DEPONS	Disturbance Effects on the Harbour Porpoise Population in the North Sea
EDR	Effective Deterrence Ranges
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ETF	Energy Transition Facility
HF	High Frequency
km	Kilometres
LF	Low Frequency
m	Metres
m/s	Metres per second
MU	Management Units
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
OWF	Offshore Wind Farm
PTS	Permanent Threshold Shifts
RaDIN	Range Dependent nature of Impulsive Noise
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SEL_{cum}	Cumulative Sound Exposure Level
SEL_{ss}	Sound Exposure Level (Single Strike)
SPL_{peak}	Peak Sound Pressure Level
TTS	Temporary Threshold Shift
UXO	Unexploded Ordnance
VHF	Very High Frequency

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Haventus

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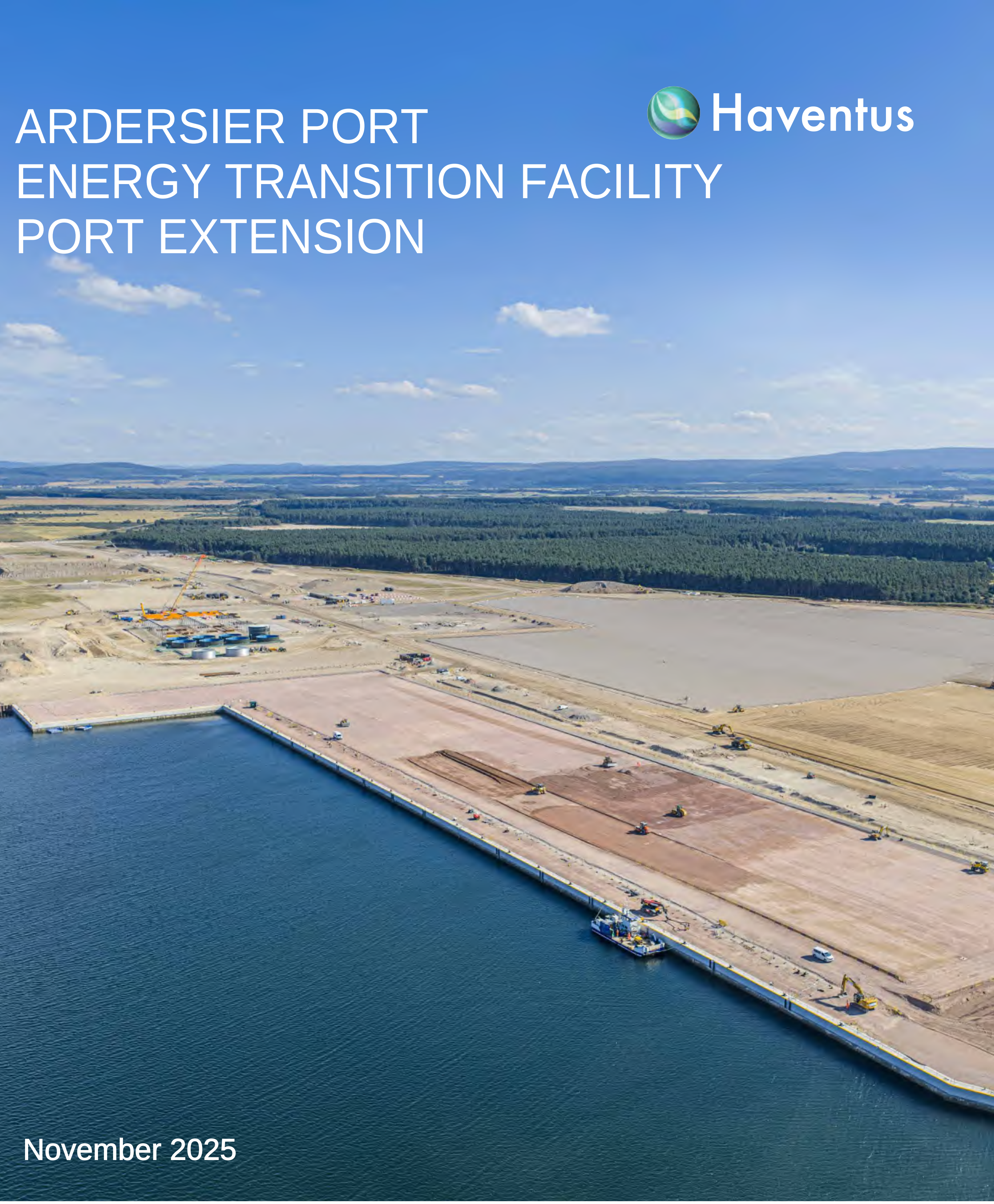

November 2025

Appendix 11.4: Ardersier ETF Expansion

Technical Marine Mammal Impact Assessment

SMRU Consulting

understand • assess • mitigate

Ardersier Port Extension

EIAR Appendix 11.4: Marine Mammal Impact Assessment

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Report Code:	SMRUC-POA-2025-012
Date:	Friday, 31 October 2025

This report is to be cited as: Gregory, E; Charish, R; Clarkson, J & Sinclair, R. (2025). Ardersier Port Extension - EIAR Appendix 11.4: Marine Mammal Impact Assessment. Report number SMRUC-PoA-2025-012 provided to SWECO & Haventus, September 2025 (unpublished).

Document Control

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Rev.	Date.	Reason for Issue.	Prep.	Chk.	Apr.	Client
1	01/08/2025	First draft	EG, RC, JC	RRS	RRS	HAV
2	03/09/2025	Second draft – revised vessel numbers	JC	RRS	HAV	HAV
3	29/09/2025	Final draft – revised timelines	JC	RRS	SWECO	HAV

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1 Introduction

This Appendix, the Marine Mammal Impact Assessment, assesses the level and significance of the residual effects of the proposed development on marine mammal receptors during both construction and operation. This Appendix is supported by the following EIAR documents:

- EIAR Chapter 11: Marine Mammals;
- EIAR Appendix 11.1: Legislation, Policy and Guidance;
- EIAR Appendix 11.2: Marine Mammal Assessment Methodology;
- EIAR Appendix 11.3: Marine Mammal Baseline Characterisation;
- EIAR Appendix 11.5: Underwater Noise Modelling;
- EIAR Appendix 11.6: Report to Inform the Appropriate Assessment (RIAA) - Marine Mammals; and
- EIAR Appendix 11.7: Marine Mammal Mitigation Plan (MMMP).

The list of impacts proposed to be scoped into the EIAR Chapter 11 (Marine Mammals), and approach to the assessment, follows the approach set out in the EIA Scoping Report (SCOP-0062). The overarching legislation, policy and guidance relating to Marine Mammals in Scotland, and relevant to this assessment of the proposed development are presented in Appendix 11.1. The methodology used in the impact assessment is presented in Appendix 11.2 which includes the assumptions and limitations of the assessment. Appendix 11.3 includes the marine mammal study area and key data sources used in the marine mammal assessment, and EIAR Chapter 3 (Project Description) contains a detailed description of the proposed development for which impacts are assessed against.

A detailed description of the baseline marine mammal environment is provided in Appendix 11.3. The marine mammal species scoped into the assessment of impacts, and thus included in this appendix, are as follows:

- Harbour porpoise;
- Bottlenose dolphin;
- Minke whale;
- Harbour seal; and
- Grey seal.

There are a range of density estimates available from various surveys and data sources, as outlined in Appendix 11.3. The most robust and relevant density estimates are outlined in Table 1 and were taken forward to the quantitative impact assessment.

Table 1: Species, MU size and density estimate recommended for use in the quantitative impact assessment for the proposed development.

Species	MU	MU size (# of individuals)	UK MU Size (# of individuals)	MU Ref	Density (#/km^2)	Density Ref
Bottlenose dolphin	Coastal East Scotland	234		Arso Civil et al. (2025)	Density surface scaled from Thompson et al. (2015).	
Harbour seal	Moray Firth	1,365		SCOS (2024)	Grid cell specific	Carter et al. (2025)
Grey seal	Moray Firth	5,384		SCOS (2024)	Grid cell specific	Carter et al. (2025)
Harbour porpoise	North Sea	346,601	159,632	IAMMWG (2023)	0.2813	SCANS IV block CS-K (Gilles et al. 2023)
					0.186	Grid cell closest to the port (Gilles et al. 2025)
Minke whale	Celtic and Greater North Sea	20,118	10,288	IAMMWG (2023)	0.0116	SCANS IV block CS-K (Gilles et al. 2023)
					0.008	Grid cell closest to the port (Gilles et al. 2025)

For each of the scoped-in marine mammal receptors, the following impacts have been assessed within this appendix:

- Construction Phase:
  - Auditory injury (PTS) associated with piling (vibro and impact) for installation of mooring dolphins;
  - Auditory injury (PTS) associated with dredging and spoil disposal activities;
  - Disturbance associated with piling (vibro and impact) for installation of mooring dolphins;
  - Disturbance associated with dredging and spoil disposal activities;
  - Disturbance associated with increased vessel traffic;
  - Collision risks associated with increased vessel traffic; and

  - Indirect impacts on prey availability.
- O&M Phase:
  - Collision risk impacts associated with increased vessel traffic;
  - Disturbance impacts associated with increased vessel traffic (including disturbance to seal haul-outs);
  - Indirect impacts on prey availability; and
  - Long term habitat changes, displacement and/or barrier effects.

The construction impacts scoped into this assessment are described in Section 3: Construction Phase, whilst operational impacts scoped into this assessment are described in Section 4: Operation & Maintenance Phase. The Cumulative Effects Assessment (CEA) for marine mammals is included in Section 5.

2 Assessment Methodology

Although full details on the assessment methodology employed for marine mammal impacts are described in Appendix 11.2, this section provides a summary of the assessment criteria used to determine the significance of impacts for marine mammals.

The criteria for determining the significance of effects is a two-stage process which 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 to the magnitude of potential impacts.

2.1 Sensitivity

The criteria for defining sensitivity for Marine Mammals receptors are provided below in Please note, the value of the receptor is not included in the definition of sensitivity as all marine mammals are considered to have a high value. It is considered that since marine mammals are either listed under Annex IV of the Habitats Directive as EPS of Community Interest and are in need of strict protection and/or are listed in the under Annex II of the Habitats Directive as species of Community Interest, the value of the receptor is inherently considered through various legislation. In addition to the EIA process, there is legislation and regulatory mechanisms (Habitat Regulations Appraisal (HRA)/European Protected Species (EPS) Licence) to ensure additional and comprehensive assessment to specific species because of their value/importance. Further, the sensitivity of marine mammal receptors should be defined by their potential vulnerability to an impact from the proposed development, their recoverability and their tolerance. This ensures that the potential risks to individuals and populations are based around evidence on the behavioural adaptability of marine mammals, and the likelihood of changes to vital, reproduction and survival rates of these species from specific impacts.Please note, the value of the receptor is not included in the definition of sensitivity as all marine mammals are considered to have a high value. It is considered that since marine mammals are either listed under Annex IV of the Habitats Directive as EPS of Community Interest and are in need of strict protection and/or are listed in the under Annex II of the Habitats Directive as species of Community Interest, the value of the receptor is inherently considered through various legislation. In addition to the EIA process, there is legislation and regulatory mechanisms (Habitat Regulations Appraisal (HRA)/European Protected Species (EPS) Licence) to ensure additional and comprehensive assessment to specific species because of their value/importance. Further, the sensitivity of marine mammal receptors should be defined by their potential vulnerability to an impact from the proposed development, their recoverability and their tolerance. This ensures that the potential risks to individuals and populations are based around evidence on the behavioural adaptability of marine mammals, and the likelihood of changes to vital, reproduction and survival rates of these species from specific impacts.

Table 2: Definition of Terms Relating to Receptor Sensitivity.

Sensitivity	Definition Used in this Chapter
High	Adaptability: No ability to avoid or adapt to an impact so that individual survival and reproduction rates are affected. Tolerance: No tolerance – Effect will cause a change in both individual reproduction and survival rates. Recoverability: No ability for the animal to recover from any impact on vital rates (reproduction and survival rates).
Medium	Adaptability: Limited ability to avoid or adapt to an impact so that individual survival and reproduction rates may be affected. Tolerance: Limited tolerance – Effect may cause a change in both individual reproduction and survival of individuals. Recoverability: Limited ability for the animal to recover from any impact on vital rates (reproduction and survival rates).
Low	Adaptability: Reasonable ability to avoid or adapt to an impact so that individual reproduction rates may be affected but survival rates not likely to be affected. Tolerance: Some tolerance – Effect unlikely to cause a change in both individual reproduction and survival rates. Recoverability: Ability for the animal to recover from any impact on vital rates (reproduction and survival rates).
Negligible	Adaptability: Receptor is able to avoid or adapt to an impact so that individual survival and reproduction rates are not affected. Tolerance: Receptor is able to tolerate the effect without any impact on individual reproduction and survival rates. Recoverability: Receptor is able to return to previous behavioural states/activities once the impact has ceased.

2.2 Magnitude

The magnitude of an impact is based on its duration and spatial extent. Data sources, feedback received from consultation, and expert judgement are used to inform the assessment of magnitude for impacts to Marine Mammal receptors. The criteria for defining magnitude are defined in Table 3.

Table 3: Definition of Terms Relating to Magnitude of an Impact.

Magnitude	Definition Used in this Chapter
High	Extent/Duration: The impact occurs over a large spatial extent and over long-term duration, with the potential to affect a large proportion of a receptor population. Probability/frequency: The effect is highly likely to occur and/or will occur at a high frequency. Consequence: The effect could affect a large enough proportion of the population to alter the long-term trajectory of the population in the long term.
Medium	Extent/Duration: The impact occurs over a medium spatial extent and over medium-term duration, with potential affect a moderate proportion of a receptor population. Probability/frequency: The effect is likely to occur and/or will occur at a moderate frequency. Consequence: The effect could affect a moderate proportion of the population although not large enough to alter the population trajectory in the long term.
Low	Extent/Duration: The impact is localised and temporary or short-term, with potential to result in a noticeable effect on a small proportion of a receptor population. Probability/frequency: The effect may occur but at low frequency. Consequence: The effect could affect a small proportion of the population, and the population trajectory would not be altered.
Negligible	Extent/Duration: The impact is highly localised and short-term, with potential to result in very slight or imperceptible changes to a receptor population. Probability/frequency: The effect is very unlikely to occur; if it does, it will occur at a very low frequency. Consequence: The effect will not alter the population trajectory.

2.3 Significance

The significance of the effect upon Marine Mammal receptors is determined by combining the sensitivity of the receptor and the magnitude of the impact. On this basis potential impacts as assessed as either negligible, minor, moderate or major significance. For the purposes of this assessment, any effects with a significance level of major and/or moderate are considered significant in EIA terms, while those of minor and/or negligible are deemed non-significant.

Where the potential for significant effects is identified, additional secondary mitigation measures are proposed and an assessment of residual effects carried out. It should be noted that significant residual effects need not be unacceptable or irreversible.

Table 4: Matrix Used for Assessment of the Significance of the Effect.

Significance of Effect		**Sensitivity of Receptor**			
		Negligible	*Low*	*Medium*	*High*
Magnitude of Effect	*Negligible*	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Minor	**Moderate**
	Medium	Negligible	Minor	**Modertate**	**Major**
	High	Negligible	**Moderate**	**Major**	**Major**

2.4 Proposed Development Design Parameters

Table 5 details the key Proposed Development Design Parameters of relevance to the assessment for marine mammal receptors.

Table 5: Proposed Development Design Parameters used to inform the impact assessment for marine mammal receptors.

Impact	**Project details**	**Timeline**
Construction		
Auditory injury and disturbance from pile driving of mooring dolphins	**Impact pile driving for 3 mooring dolphins:** • Pile diameter: 1.2 meters • Maximum hammer energy: 294 kJ • Total number of piles: 12 • Total number of piling days: 12 • Number of piles installed per day: 1 • Duration of each pile installation: 10 hours • Duration of soft start: 20 minutes • Initial soft start strike rate: 6 strikes per minute (spm) (20% of max) • Maximum strike rate: 30 spm	12 piling days between 2026 and 2028
Auditory injury and disturbance from dredging and soil disposal	• Cutter Suction Dredge (CSD) modelled and assessed under worst-case scenario for auditory injury • Disturbance assessment has considered CSD, Trailer-Suction Hopper Dredgers (TSHD) and Split Hopper Barges (SHB) • Expected soil disposal sites: Inverness, Sutors or Burghead	Dredging and soil disposal is expected to be taking place over a 10 week period between March and September (sometime between 2027 – 2029)
Vessel disturbance and collision	**Peak vessel activity:** • During spoil disposal operations (between Ardersier and Inverness, Sutors or Burghead) • Up to 13–23 barge movements per day may be required to transport dredged material offshore • Maximum of ~450 additional vessel movements within the Inner Moray Firth over a 10 week period when considering material delivery by barge, and spoil disposal operations	Construction activities are planned to take place between 2026 and 2028, with dredging activities (licensed separately) set to take place between 2027 – 2029

Operation		
Vessel disturbance and collision	• **Vessel movements:** Vessel traffic during the operational phase is anticipated to be 400 vessel calls per year as a maximum worst-case scenario (Haventus 2025). • **Vessel speed:** While some of the vessels expected to operate are capable of reaching speeds up to 13 knots, most are expected to transit at typical speeds around 10 knots. • **Vessel types primarily large vessels servicing offshore industries, including**: Heavy Load Carriers (>150 m): 7 different vessel types arriving on-site, in total, per year, Heavy Lift Vessels (>100 m): 4 different vessel types arriving on-site, in total, per year, Jack-up Barges (>80 m): 7 different vessel types in total, General Cargo Vessels (>140 m): 2 different vessel types arriving on-site, in total, per year, Bulk Carrier (150 m): 1 vessel type arriving on-site, in total, per year, Semi-submersible (137 m): 1 vessel type arriving on-site, in total, per year.	Vessel activity levels will be sustained over a long-term duration (50 years)

2.5 Primary Mitigation Measures

The primary mitigation measures relevant to marine mammals include:

- Piling MMMP (Marine Mammal Mitigation Protocol);
- Dredging MMMP;
- Port Environmental Management Plans (POEMP) and
- Navigational Safety Risk Assessment (NRA) for vessels.

3 Construction Phase

3.1 Auditory injury (PTS) from piling

Pile driving activity involves the installation of 12 piles over a 19-day period. One pile shall be installed per day. There shall be 12 days within the 19 day period, within which piling shall take place. It shall take ~10 hours to install each pile. The pile driving will be conducted using an impact hammer with a maximum energy of 294 kJ. The pile diameter is 1.2 meters. A soft-start procedure is implemented to minimise underwater noise impacts with the soft-start beginning at 20% of the maximum strike rate (6 strikes per minute) for the first 20 minutes, gradually increasing to the maximum rate of 30 strikes per minute thereafter. Table 6 provides a summary of the piling parameters used in underwater noise modelling.

As impact piling shall only be utilised for the installation of mooring dolphins, the representative location used in underwater noise modelling was the most seaward pile (i.e., the pile located furthest from the inner harbour area). This represents the worst-case scenario.

Table 6: Summary of piling parameters

Parameter	Value
Pile diameter	1.2 meters
Maximum hammer energy	294 kJ
Total number of piles	12
Total number of piling days	12
Number of piles installed per day	1
Duration of each pile installation	10 hours
Duration of soft start	20 minutes
Initial soft start strike rate	6 strikes per minute (spm) (20% of max)
Maximum strike rate	30 spm

3.1.1 Sensitivity

The ecological consequences of PTS for marine mammals are uncertain. At an expert elicitation workshop for the iPCoD framework several general discussion points were raised, including that PTS did not mean animals were deaf, that the limitations of the ambient noise environment should be considered and that the magnitude and frequency band in which PTS occurs are critical to assessing the effect on vital rates (Booth and Heinis 2018).

For piling noise, most energy is between approximately 30 – 500 Hz, with a peak usually between 100 – 300 Hz and energy extending above 2 kHz (Kastelein et al. 2015, Kastelein et al. 2016). Studies have shown that exposure to impulsive pile driving noise induces threshold shift in a relatively narrow frequency band (i.e. a ‘notch’) in marine mammals (reviewed in Finneran (2015)), with statistically significant threshold shift occurring at 4 and 8 kHz (Kastelein et al. 2016) and centred at 4 kHz (Kastelein et al. 2012a, Kastelein et al. 2012b, Kastelein et al. 2013, Kastelein et al. 2017). Therefore, it is expected that any threshold shifts that occur as a result of pile driving would manifest themselves somewhere between 2 to 10 kHz (Kastelein et al. 2017). This is considered to apply to all marine mammals. The expert elicitation found that a PTS ‘notch’ of 6 to 18 dB in a narrow frequency band in the 2 to 10 kHz region is highly unlikely to significantly affect the fitness of individuals (ability to survive and reproduce) of the species assessed (harbour porpoise, bottlenose dolphins and seals).

The frequency where the PTS is expected is below the region of greatest sensitivity for VHF cetaceans, including harbour porpoise (12 to 140 kHz). There is a small overlap with the 2 to 10 kHz range and region of greatest sensitivity for HF cetaceans such as bottlenose dolphin (8.8 to 110 kHz). Whilst there is a potential for overlap with the region of greatest hearing sensitivity for PCW species (1.9 to 30 kHz), expert elicitation process concluded that auditory injury (PTS) is unlikely to have a large impact on survival or fertility of both seal species (Booth and Heinis 2018).

Whilst PTS is a permanent effect which cannot be recovered from, the evidence does not suggest that PTS from piling will cause a material impact on either survival or reproductive rates for species included in the expert elicitation process (harbour porpoise, bottlenose dolphin, harbour seal, grey seal). As such, harbour porpoise, bottlenose dolphin, harbour seal and grey seal are assessed as having a **Low** sensitivity to auditory injury (PTS-onset) from piling.

There is an overlap with frequency at which PTS due to piling is expected to occur and the region of greatest sensitivity for LF cetaceans, including minke whale and humpback whale (200 Hz to 19 kHz) Although animals are not at risk of loss of hearing across the entire hearing band, they may have limited ability to adapt their behaviour and tolerance to the effect. As such, minke whale are assessed as having a **Medium** sensitivity to auditory injury (PTS-onset) from piling.

3.1.2 Magnitude

The following section provides the quantitative assessment of the impact of auditory injury (PTS) from pile driving on marine mammal species. The impact area and maximum impact ranges for each marine mammal hearing group are presented in Table 7 for instantaneous PTS (SPL_{peak}) and in Table 8 for cumulative PTS (SEL_{cum}) for impact piling, and Table 9 for cumulative PTS (SEL_{cum}) for vibropiling.

Impact ranges for cumulative PTS (SEL_{cum}) are calculated based on the effect over time of a moving receptor, and the maximum impact ranges were produced following bearings of transects which were not constrained by landmass or structures nearby to the noise source.

3.1.2.1 Instantaneous PTS

Using SPL_{peak} noise PTS-onset thresholds, the maximum estimated impact ranges were <10 m for minke whale, bottlenose dolphin, harbour seal and grey seal. Within this range, no animals are expected to be impacted by instantaneous PTS (SPL_{peak}). For harbour porpoise, the maximum estimated impact range was 60 m. Based on this worst-case impact range (corresponding to an area of 0.0013 km^2) and considering the worst-case harbour porpoise density estimate of 0.281 animals/$km^{2,}$ the estimated number of harbour porpoise impacted by instantaneous PTS will be <1 animal.

The extent of auditory injury from instantaneous PTS (SPL_{peak}) is expected to be extremely localised (maximum of 60 m). In addition, the project will adhere to a MMMP (see Appendix 11.7) outlining specific mitigation measures in accordance with the current guidance on minimising the risk of injury to marine mammals from piling noise. These measures include, but are not limited to, pre-piling marine mammal monitoring through the use of an marine mammal observer (MMO) or passive acoustic monitoring (PAM) equipment. As a result, it is anticipated that no animals will experience auditory injury. Therefore, the magnitude of instantaneous PTS from piling for marine mammals has been assessed as **Negligible**.

Table 7: Predicted auditory injury instantaneous PTS impact ranges for impact piling, using the Southall et al. (2019) SELpeak PTS criteria in marine mammals.

Hearing group	Species	Southall *et al.* (2019) criteria (PTS) (SEL_{peak})	Maximum estimated impact range (m)
LF Cetaceans	Minke whale	219 dB	<10
HF Cetaceans	Bottlenose dolphin	230 dB	No predicted exceedance
VHF Cetaceans	Harbour porpoise	202 dB	60

PCW Pinnipeds	Harbour seal Grey seal	218 dB	<10

3.1.2.2 Cumulative PTS

Using SEL_{cum} PTS-onset thresholds for impact piling (Table 8) and vibropiling (Table 9), the maximum estimated impact ranges were <10 m for all hearing groups. The extent of auditory injury from cumulative PTS (SEL_{cum}) is therefore expected to be extremely localised and as a result, no animals are expected to be impacted by cumulative PTS (SEL_{cum}) during impact piling or vibropiling. In addition, the project will adhere to a MMMP (see Appendix 11.7), which outlines specific mitigation measures in accordance with the current guidance on minimising the risk of injury to marine mammals from piling noise. These measures include, but are not limited to, pre-piling marine mammal monitoring through the use of MMOs and/or PAM. As a result, it is anticipated that no animals will experience auditory injury. Therefore, the magnitude of cumulative PTS from piling for marine mammals has been assessed as **Negligible**.

Table 8: Worst case scenario auditory injury cumulative PTS impact ranges for impact piling, using the Southall et al. (2019) SELcum PTS criteria in marine mammals, assuming a fleeing receptor

Hearing group	Species	Southall *et al*. (2019) criteria (PTS) (SEL_{cum})	Maximum estimated impact range (m)
LF Cetaceans	Minke whale	183 dB	<10
HF Cetaceans	Bottlenose dolphin	185 dB	<10
VHF Cetaceans	Harbour porpoise	155 dB	<10
PCW Pinnipeds	Harbour seal Grey seal	185 dB	<10

Table 9: Worst case scenario auditory injury cumulative PTS impact ranges for vibropiling, using the Southall et al. (2019) SELcum PTS criteria in marine mammals, assuming a fleeing receptor

Hearing group	Species	Southall *et al*. (2019) criteria (PTS) (SEL_{cum})	Maximum estimated impact range (m)
LF Cetaceans	Minke whale	199 dB	<10
HF Cetaceans	Bottlenose dolphin	198 dB	<10
VHF Cetaceans	Harbour porpoise	173 dB	<10
PCW Pinnipeds	Harbour seal Grey seal	201 dB	<10

3.1.3 Significance of Effect

For both instantaneous PTS (SPL_{peak}), and cumulative PTS (SEL_{cum}), the magnitude of the impact is deemed to be **Negligible** for all marine mammals. The sensitivity is deemed to be **Low** for porpoise, dolphins and seals and **Medium** for minke whales. The effect will therefore be of **Negligible** significance, which is not significant in EIA terms (Table 10).

Table 10: Summary of the impact assessment for auditory injury (PTS) from pile driving

Species	Magnitude	Sensitivity	Significance
Harbour porpoise	Negligible	Low	Negligible (not significant)
Bottlenose dolphin	Negligible	Low	Negligible (not significant)
Harbour seal	Negligible	Low	Negligible (not significant)
Grey seal	Negligible	Low	Negligible (not significant)
Minke whale	Negligible	Medium	Negligible (not significant)

3.1.4 Secondary Mitigation

The embedded primary mitigation includes an MMMP.

No additional marine mammal mitigation is considered necessary because the likely effect is not significant in EIA terms.

3.1.5 Residual Effect

As no additional mitigation commitments are required, the residual effect remains **Non-Significant** in EIA terms.

3.2 Auditory injury (PTS) associated with dredging and spoil disposal activities

3.2.1 Sensitivity

Dredging is described as a continuous broadband sound source, with the main energy below 1 kHz. However, the frequency and sound pressure level can vary considerably depending on the equipment, activity, and environmental characteristics (Todd et al. 2015). The source level of dredging has been described to vary between SPL 172-190 dB re 1 µPa @ 1 m with a frequency range of 45 Hz to 7 kHz (Evans 1990, Thompson et al. 2009, Verboom 2014). This is in line with estimated source levels for dredging activities at the proposed development (181.4 dB RMS re 1 µPa) (see Appendix 11.5), where data was obtained from Subacoustech's measurement library and calculated directly from the recordings of Taurus II dredge vessel. It is expected that the underwater noise generated by dredging will be below the PTS-onset threshold (Todd et al. 2015) and thus the risk of injury is unlikely. For harbour porpoise, bottlenose dolphins and seals, the hearing sensitivity below 1 kHz is relatively poor and thus it is expected that a PTS at this frequency would result in little impact to vital rates. Therefore, the sensitivity of harbour porpoise, dolphins and seals to PTS from dredging is assessed as **Low.**

The low frequency noise produced during dredging may be more likely to overlap with the hearing range of low frequency cetacean species such as minke whale. Minke whale communication signals have been demonstrated to be below 2 kHz (Edds-Walton 2000, Mellinger et al. 2000, Gedamke et al. 2001, Risch et al. 2013, Risch et al. 2014). Tubelli et al. (2012) estimated the most sensitive hearing range (the region with thresholds within 40 dB of best sensitivity) to extend from 30 to 100 Hz up to 7.5 to 25 kHz, depending on the specific model used. Therefore, the sensitivity of minke whales to PTS from dredging is precautionarily assessed as **Medium.**

3.2.2 Magnitude

The maximum impact ranges for each hearing group are presented in Table 11 for cumulative PTS (SEL_{cum}) for CSD as a worst-case scenario.

Using SEL_{cum} PTS-onset thresholds for CSD (Table 11) the maximum estimated impact ranges were <10 m for all hearing groups. The extent of auditory injury from cumulative PTS (SEL_{cum}) is therefore expected to be extremely localised and as a result, no animals are expected to be impacted by cumulative PTS (SEL_{cum}) during CSD.

In addition, the project will adhere to a MMMP (see Appendix 11.7), which outlines specific mitigation measures in accordance with the current guidance on minimising the risk of injury to marine mammals from dredging noise. These measures include, but are not limited to, pre-dredging marine mammal monitoring and the implementation of a soft-start procedure. As a result, it is anticipated that no animals will experience auditory injury. Therefore, the magnitude of cumulative PTS from CSD for marine mammals has been assessed as **Negligible**.

Table 11: Worst case scenario auditory injury cumulative PTS impact ranges for cutter suction dredging, using the Southall et al. (2019) SELcum PTS criteria in marine mammals, assuming a fleeing receptor

Hearing group	Species	Southall *et al*. (2019) criteria (PTS) (SEL_{cum})	Maximum estimated impact range (m)
LF Cetaceans	Minke whale	199 dB	<10
HF Cetaceans	Bottlenose dolphin	198 dB	<10
VHF Cetaceans	Harbour porpoise	173 dB	<10
PCW Pinnipeds	Harbour seal Grey seal	201 dB	<10

3.2.3 Significance of Effect

For cumulative PTS (SEL_{cum}), the magnitude of the impact is deemed to be **Negligible** for all marine mammals. The sensitivity is deemed to be **Low** for porpoise, dolphins and seals and **Medium** for minke whales. The effect will therefore be of **Negligible** significance, which is not significant in EIA terms (Table 12).

Table 12: Summary of the impact assessment for auditory injury (PTS) from dredging

Species	Magnitude	Sensitivity	Significance
Harbour porpoise	Negligible	Low	Negligible (not significant)
Bottlenose dolphin	Negligible	Low	Negligible (not significant)

Harbour seal	Negligible	Low	Negligible (not significant)
Grey seal	Negligible	Low	Negligible (not significant)
Minke whale	Negligible	Medium	Negligible (not significant)

3.2.4 Secondary Mitigation

The embedded primary mitigation includes an MMMP and a NRA.

No additional marine mammal mitigation is considered necessary because the likely effect is not significant in EIA terms.

3.2.5 Residual Effect

As no additional mitigation commitments are required, the residual effect remains **Non-Significant** in EIA terms.

3.3 Disturbance from piling

The assessment of disturbance from pile-driven foundations was based on the current best practice methodology, making use of the best available scientific evidence. Results for all species are presented using dose-response functions (Graham et al. 2017a, Whyte et al. 2020).

In addition to the piling works for new mooring dolphins, the project will also involve extraction of old quay piles using vibro methods. These works will take place approximately 800 m to 1.8 km inside the harbour. In some locations, a temporary bund within the water may be required, while in others works will proceed without such a bund. Given the location of these activities within the enclosed harbour environment, and the very low likelihood of marine mammals—particularly cetaceans—occurring in this area, no specific impact assessment for vibro-extraction is presented.

The potential underwater noise effects of piling for the new mooring dolphins have been modelled. Both vibro piling and impact piling were considered, with impact piling representing the worst-case scenario. Accordingly, only the potential impacts associated with impact piling are assessed in this section. Piling activities shall only take place during daylight hours.

3.3.1 Sensitivity

3.3.1.1 Harbour porpoise

A study on harbour porpoise behavioural responses to the construction of the Nigg Energy Park port in the Cromarty Firth found that porpoises were not excluded from monitoring sites in the vicinity of either impact or vibration piling (Graham et al. 2017). However, there was a slight reduction in the probability of porpoise presence on days in which vibration piling occurred. Further, monitoring of harbour porpoise activity at the Beatrice Offshore Wind Farm within the Moray Firth during piling has indicated that harbour porpoises were displaced from the immediate vicinity of the pile driving activity with diminishing response over the construction period (Graham et al. 2019). In addition, the study indicated that harbour porpoise activity recovered between pile driving days. Benhemma-Le Gall et al. (2021) studied harbour porpoise response to pile driving at two OWFs within the Moray Firth and found that harbour porpoise were not completely displaced from the piling site: detections of clicks (echolocation) and buzzing (associated with prey capture) in the short-range (2 km) did not cease in response to pile driving. Detections of both clicks (echolocation) and buzzing (associated with prey capture) increased above baseline levels with increasing distance from the pile, which suggests that those harbour porpoise that are displaced from the near-field resume foraging at a greater distance from the modelling location. Therefore, harbour porpoise that experience displacement are expected to be able to compensate for the lost foraging opportunities.

The findings of the expert elicitation workshop suggest that first year calf survival (post-weaning) and fertility were the most likely vital rates to be affected by disturbance, but that juvenile and adult survival were unlikely to be significantly affected as these life-stages were considered to be more robust (Booth et al., 2019). Experts agreed that the final third of the year was the most critical for harbour porpoises as they reach the end of the current lactation period and the start of new pregnancies, therefore it was thought that significant impacts on fertility would only occur when animals received repeated exposure throughout the whole year. It was also concluded that it would likely take high levels of repeated disturbance to an individual before there was any effect on that individual's fertility, and that it was very unlikely an animal would terminate a pregnancy early. The experts agreed that calf survival could be reduced by only a few days of repeated disturbance to a mother/calf pair during early lactation; 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 (Booth et al., 2019).

The observed responsiveness to piling and expected ability to compensate for lost foraging opportunities suggest that harbour porpoise have the ability go adapt behaviour in response to stressor. As such, harbour porpoises are anticipated to be able to recover from any impact on vital rates and have been assessed as having a **Low** sensitivity to disturbance from piling.

3.3.1.2 Bottlenose dolphin

There is evidence in published literature that bottlenose dolphins may be displaced from an area as a result of the noise produced by offshore construction activities; for example, avoidance behaviour in bottlenose dolphins has been shown in relation to dredging activities, piling and seismic surveys (Pirotta et al. 2013, Graham et al. 2017b, Fernandez-Betelu et al. 2021). However, a study on bottlenose dolphin during the construction of the Nigg Energy Park in the Cromarty Firth showed that dolphins were not excluded from the vicinity of the piling activities (Graham et al. 2017b). The vibration pile driving resulted in a slight reduction of encounter durations (though only by a few minutes) for dolphins within the Cromarty Firth. These data highlight a small spatial and temporal scale disturbance to bottlenose dolphins as a result of impact piling activities.

Furthermore, the relatively dynamic social structure of bottlenose dolphins (Connor et al. 2001) and the fact that they have no significant predation threats and do not appear to face excessive competition for food with other marine mammal species, have potentially resulted in a higher tolerance (compared to porpoise) to perceived threats or disturbances in their environment, which may make them less sensitive to disturbance. According to the opinions of the experts, disturbance would be most likely to affect bottlenose dolphin calf survival if "*it exceeded 30-50 days, because it could result in mothers becoming separated from their calves and this could affect the amount of milk transferred from the mother to her calf*" (Harwood et al. 2014). Note, bottlenose dolphins were not included in the second (most recent) expert elicitation in 2018.

Given that the Moray Firth has been identified as important area with calves being recorded throughout the Moray Firth SAC[1], there is the potential for behavioural disturbance and displacement to result in disruption in foraging and resting activities and an increase in travel and energetic costs. However, a study on bottlenose dolphins within the Moray Firth suggests that bottlenose dolphins have the ability to compensate for behavioural responses as a result of increased commercial vessel activity, where longer term overall activity time budget remained the same despite the immediate behavioural response to disturbance (New et al. 2013). Therefore, while there remains the potential for disturbance and displacement to affect individual behaviour, it is not expected that this would result in an overall change in individual energy budget since animals have been shown to compensate for time lost due to disturbance. Therefore, bottlenose dolphins are considered to have a **Low** sensitivity to disturbance from piling.

3.3.1.3 Seals

3.3.1.3.1 Harbour seals

A study of tagged harbour seals in the Wash has shown that they are displaced from the vicinity of piles during impact piling activities in the short-term, and that seals returned to non-piling distributions within two hours after the end of a piling event (Russell et al. 2016). Harbour seals store energy in a thick layer of blubber, which means that they are tolerant of periods of fasting when hauled out and resting between foraging trips, and when hauled out during the breeding and moulting periods. Therefore, they are unlikely to be particularly sensitive to short-term displacement from foraging grounds during periods of active piling.

At the expert elicitation workshop (Booth et al., 2019), experts agreed that harbour seals were considered to have a reasonable ability to compensate for lost foraging opportunities due to their generalist diet, mobility, life history and adequate fat stores. The survival of 'weaned of the year' animals and fertility were determined to be the most sensitive life history parameters to disturbance (i.e., leading to reduced energy intake). Juvenile harbour seals are typically considered to be coastal foragers (Booth et al., 2019) and so less likely to be exposed to disturbances and similarly pups were thought to be unlikely to be exposed to disturbance due to their proximity to land. There was no DEB model available to simulate the effects of disturbance on seal energy intake and reserves; therefore, the opinions of the experts were less certain. Experts considered that the location of the disturbance would influence the effect of the disturbance, with a greater effect if animals were disturbed at a foraging ground as opposed to when animals were transiting through an area (note: the modelling does not show impacts to high density foraging areas). The experts agreed that for an animal in bad condition, moderate levels of repeated disturbance might be sufficient to reduce fertility; however, there was a large amount of uncertainty in this estimate.

Two controlled playback experiments further quantified harbour seal responses to impulsive pile-driving sounds recorded in the North Sea and played back in a quiet pool. Behavioural responses were observed at SEL_{ss} levels of 131–137 dB re 1 μPa²s and were pronounced at ≥143 dB re 1 μPa²s. The strongest responses were elicited by high-frequency components, highlighting the value of frequency-weighted SEL_{ss} in predicting disturbance effects and informing mitigation measures (Kastelein et al. 2025).

1 Although it should be noted that studies show that bottlenose dolphin from the Moray Firth SAC extended their distributional range southwards along the east coast of Scotland and into northeast England (Arso Civil et al., 2019; Cheney et al., 2024).

Due to their observed responsiveness to piling the sensitivity of harbour seals within the Moray Firth SMU has been assessed as **Low**.

3.3.1.3.2 Grey seals

There are still limited data on grey seal behavioural responses to pile driving. The key dataset on this topic is presented in Aarts et al. (2018) where 20 grey seals were tagged in the Wadden Sea to record their responses to pile driving at two OWFs: Luchterduinen in 2014 and Gemini in 2015. The grey seals showed varying responses to the pile driving, including no response, altered surfacing and diving behaviour, and changes in swimming direction. The most common reaction was a decline in descent speed and a reduction in bottom time, which suggests a change in behaviour from foraging to horizontal movement. The distances at which seals responded varied significantly; in one instance a grey seal showed responses at 45 km from the pile location, while other grey seals showed no response when within 12 km. Differences in responses could be attributed to differences in hearing sensitivity between individuals and in sound transmission with environmental conditions or the behaviour and motivation for the seal to be in the area. The telemetry data also showed that seals returned to the pile driving area after pile driving ceased. While this evidence base is from studies of grey seals tagged in the Wadden Sea, it is expected that grey seals in waters east of Scotland would respond in a similar way, and therefore the data are considered to be applicable. Hastie et al. (2021) found that grey seal avoidance rates in response to pile driving sounds were dependent on the quality of the prey patch, with grey seals continuing to forage at high density prey patches when exposed to pile driving sounds but showing reduced foraging success at low density prey patches when exposed to pile driving sounds. Additionally, the seals showed an initial aversive response to the pile driving playbacks (lower proportion of dives spent foraging) but this diminished during each trial. Therefore, the likelihood of grey seal response is expected to be linked to the quality of the prey patch and their previous exposure history.

Based on the expert elicitation workshop, Booth et al. (2019) concluded that grey seals were considered to have a reasonable ability to compensate for lost foraging opportunities due to their generalist diet, mobility, life history and adequate fat stores and that the survival of 'weaned of the year' animals and fertility were determined to be the most sensitive parameters to disturbance (i.e., reduced energy intake). However, in general, experts agreed that grey seals would be much more robust than harbour seals to the effects of disturbance due to their larger energy stores and more generalist and adaptable foraging strategies. It was agreed that grey seals would require moderate-high levels of repeated disturbance before there was any effect on fertility rates. The 'weaned of the year' were considered to be most vulnerable following the post-weaning fast, and that during this time it might take ~60 days of repeated disturbance before there was expected to be any effect on weaned-of-the-year survival, however there was a lot of uncertainty surrounding this estimate.

Grey seals are capital breeders and store energy in a thick layer of blubber, which means that, in combination with their large body size, they are tolerant of periods of fasting as part of their normal life history. Grey seals are also highly adaptable to a changing environment and are capable of adjusting their metabolic rate and foraging tactics, to compensate for different periods of energy demand and supply (Beck et al. 2003, Sparling et al. 2006). Grey seals are also very wide ranging and are capable of moving large distances between different haul out and foraging regions (Russell et al. 2013). Therefore, they are unlikely to be particularly sensitive to displacement from foraging grounds during periods of active piling.

The observed responsiveness to piling suggest that grey seal have the ability to adapt behaviour in response to a stressor and their life-history implies that they have a high tolerance to the stressor. Grey seals are expected to be able to return to previous behavioural activities once the impact has ceased and therefore and have been assessed as having a **Negligible** sensitivity to disturbance from piling.

3.3.1.4 Minke whale

There is little information available on the behavioural responses of minke whales to underwater noise, specifically, piling noise. Minke whales have been shown to change their diving patterns and behavioural state in response to disturbance from whale watching vessels; and it was suggested that a reduction in foraging activity at feeding grounds could result in reduced reproductive success in this capital breeding species (Christiansen et al. 2013). Sivle et al. (2016) reported minke whale reactions to sonar signals with behavioural response severity scores above 4 (the stage at which avoidance to a sound source first occurs) for a received SPL of 146 dB re 1 µPa (score 72)[2] and a received SPL of 158 dB re 1 µPa (score 83)[3]. There is a study detailing minke whale responses to a Lofitech Acoustic Deterrent Device (ADD) which has a source level of 204 dB re 1 µPa @ 1m, which showed minke whales within 500 m and 1,000 m of the source exhibiting a behavioural response. The estimated received level at 1,000 m was 136.1 dB re 1 µPa (McGarry et al. 2017). Durbach et al. (2021) showed that minke whale's movements became faster and more directed during sonar exposure than in baseline phases and that the mean direction of movement differed during sonar exposure. However, not all whales changed their movement patterns. Whales remaining in a slow movement state during sonar exposure were more likely to stop calling than in other exposure phases (Durbach et al., 2021). There are no equivalent such studies of responses to piling noise.

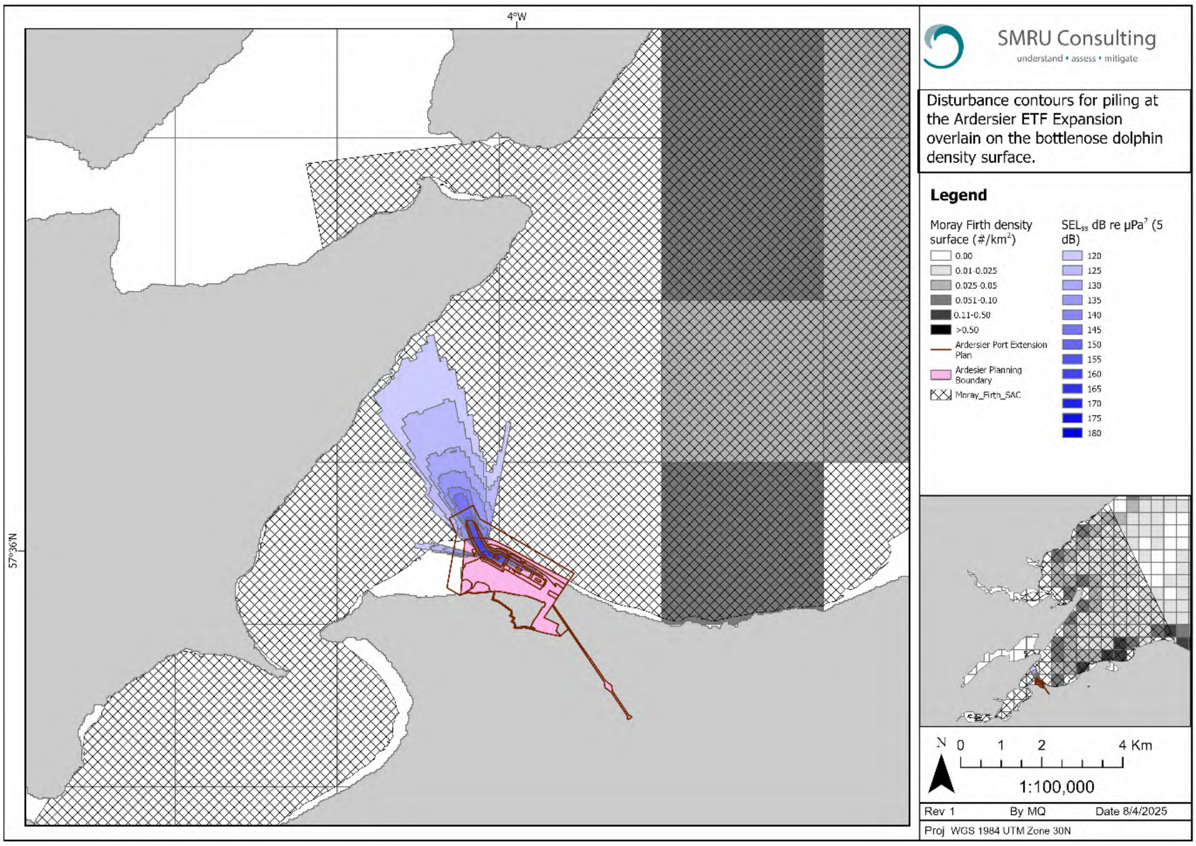
Since minke whales are known to forage in UK waters in the summer months, there is the potential for displacement to impact on reproductive rates. However, due to their large size and capacity for energy storage, it is expected that minke whales will be able to tolerate temporary displacement from foraging areas much better than harbour porpoise and individuals are expected to be able to recover from any impact on vital rates. Therefore, minke whales have been assessed as having a **Low** sensitivity to disturbance from pile driving.

3.3.2 Magnitude

The number of marine mammals predicted to be disturbed by piling activities has been estimated using species-specific density data and dose-response functions. The results are summarised in Table 13. Figure 1: Disturbance contours for piling of mooring dolphins at the proposed development , overlain on the scaled Thompson et al. (2015) bottlenose dolphin density surface

2 Defined in Sivle et al. (2015) as: Prolonged avoidance – The animal increased speed and swam directly away from the sound source throughout the rest of the exposure. Opportunistic visual observations of skim feeding at the surface before the start of the sonar exposure indicated that this response might also have involved a cessation of feeding.

3 Defined in Sivle et al. (2015) as: Obvious progressive aversion (and sensitization) – The animal continued to increase its speed as the exposure progressed, swimming at such a high speed that the distance to the source ship remained constant. About halfway through the exposure, the dive pattern changed to shallower diving, which may be a way to move more effectively away from the source.



Error! Reference source not found. show the disturbance contours for bottlenose dolphins (Figure 1) and seals (Figure 2 & Figure 3) respectively, overlain on grid cell density surfaces where applicable. The extent of the disturbance contours for bottlenose dolphins are the same as those for harbour porpoise and minke whales.

Table 13: Predicted Number of Marine Mammals Disturbed by Piling Activities

Species	Density source	Number of Individuals Impacted	% MU	% UK MU
Harbour porpoise	0.2813/km² (SCANS IV Block CS-K)(Gilles et al. 2023)	<1	<0.001	<0.001
	0.186/km² (Grid cell closest to port (Gilles et al. 2025))	<1	<0.001	<0.001

Bottlenose dolphin	Moray Firth density surface (scaled from Thompson et al. 2015)	<1	<0.001	N/A
	Data on presence and group size (Benhemma-Le Gall and Cheney 2025)	Mean group size: 8 Max group size: 56	Mean group size: 3.4% Max group size: 24%	N/A
Harbour seal	Grid cell specific (Carter et al. 2025)	<1	<0.001	N/A
Grey seal	Grid cell specific (Carter et al. 2025)	<1	<0.001	N/A
Minke whale	0.0116/km^2 (SCANS IV Block CS-K) (Gilles et al. 2023)	<1	<0.001	<0.001
	0.008/km^2 (Grid cell closest to port (Gilles et al. 2025))	<1	<0.001	<0.001

Figure 1: Disturbance contours for piling of mooring dolphins at the proposed development , overlain on the scaled Thompson et al. (2015) bottlenose dolphin density surface

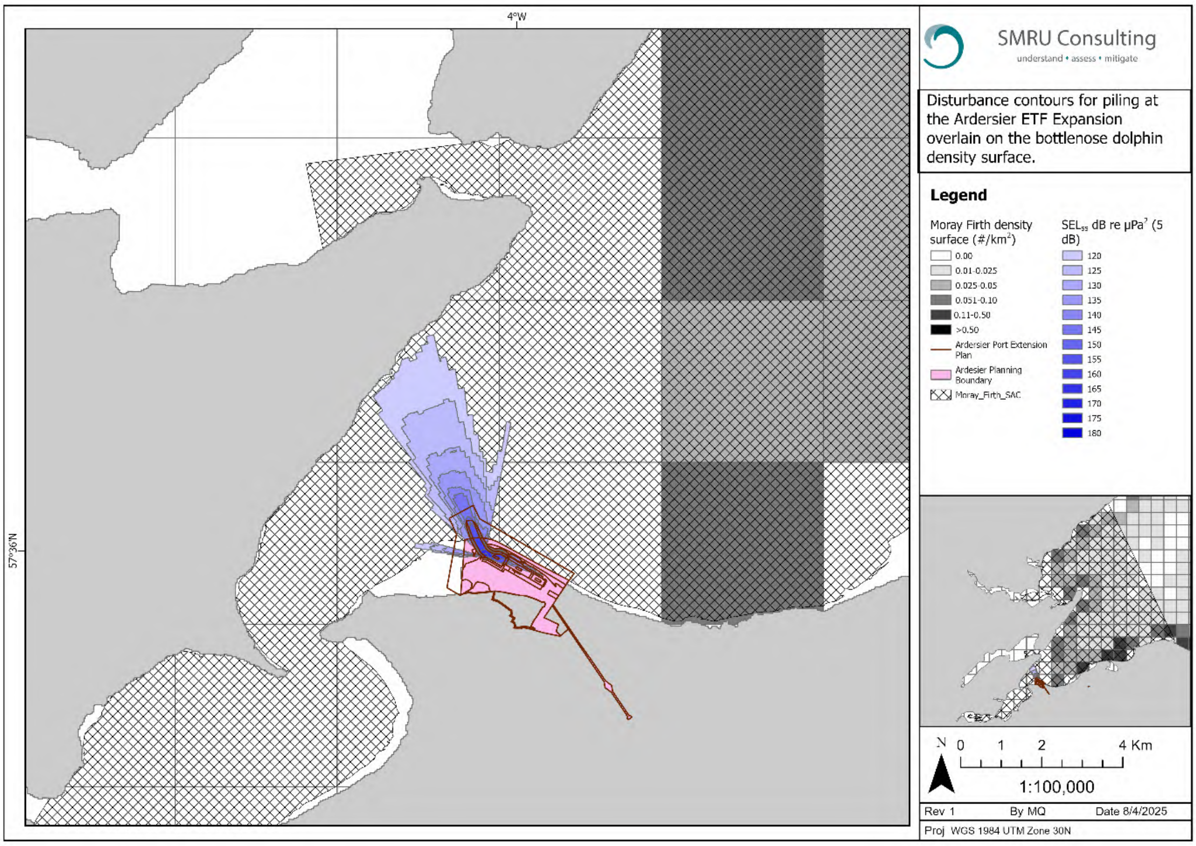


Figure 2: Disturbance contours for piling of mooring dolphins at the proposed development, overlain on the Carter et al. (2025) harbour seal density surface

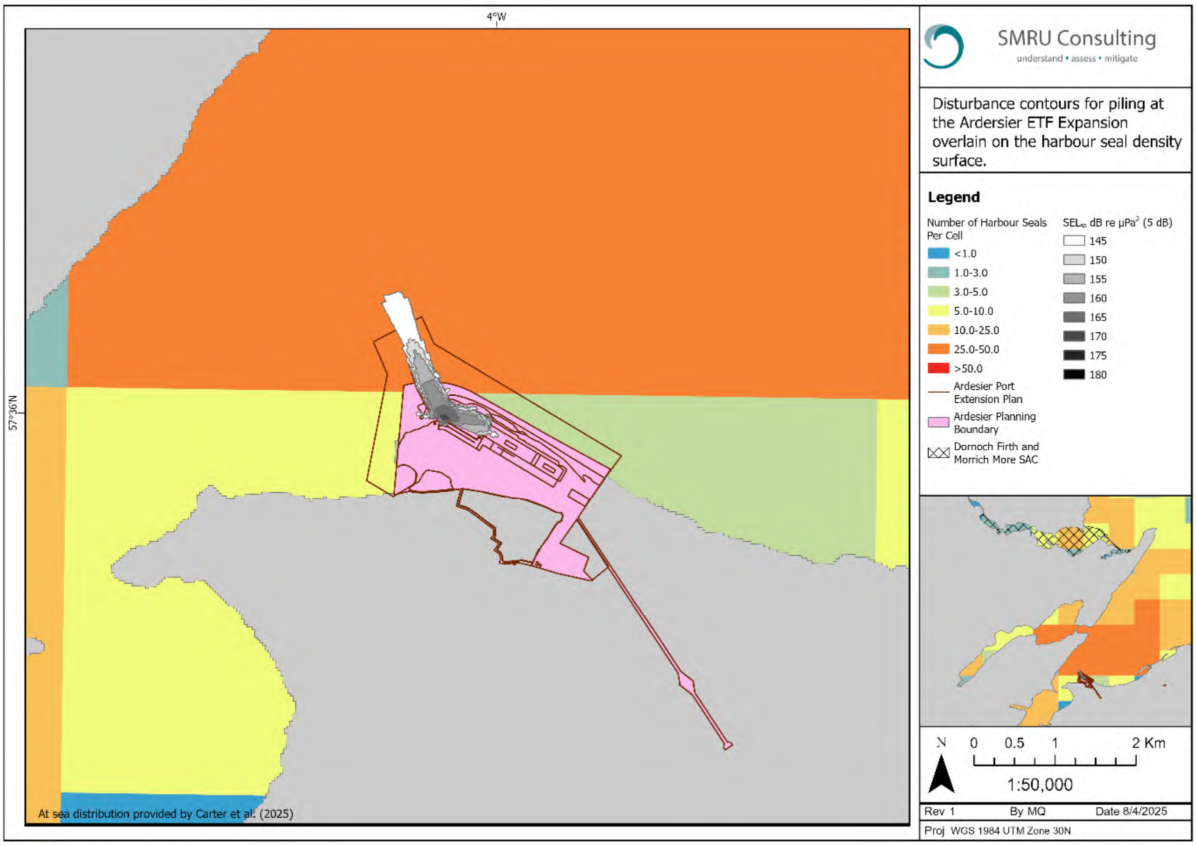
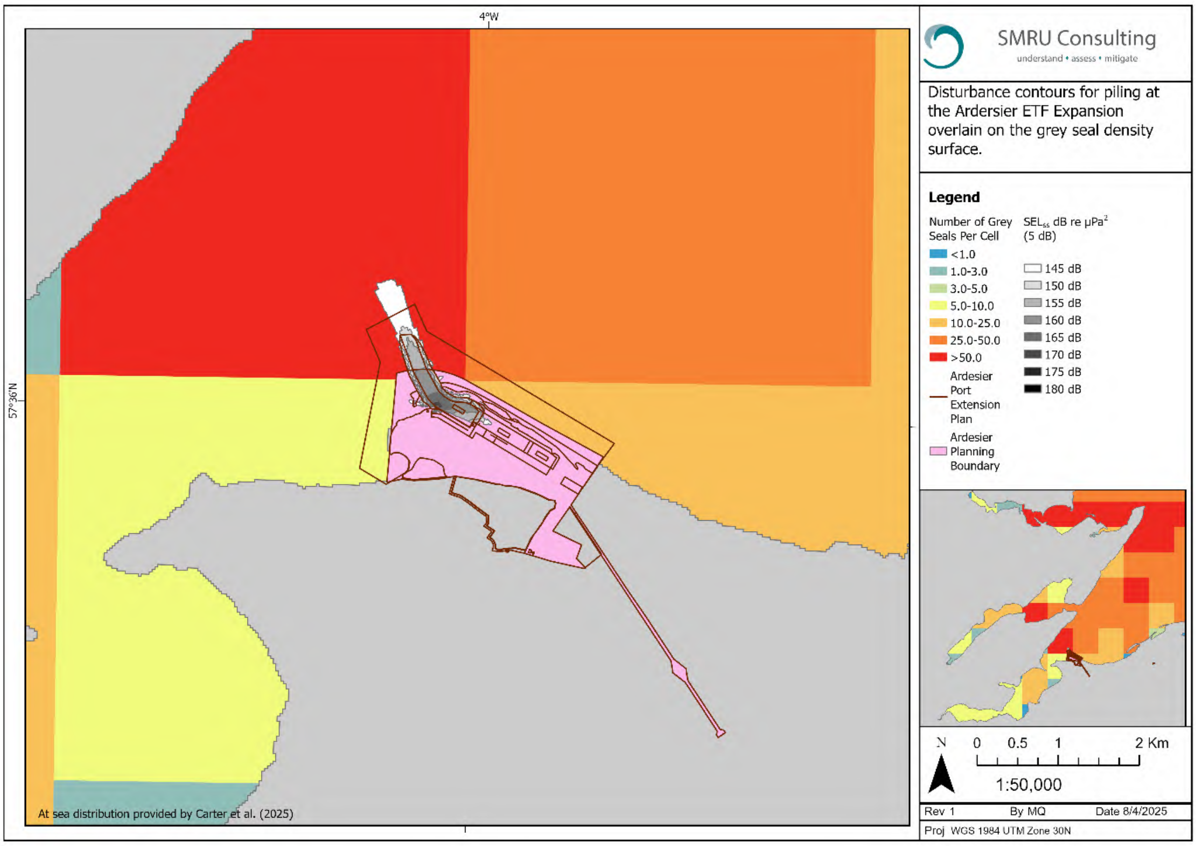


Figure 3: Disturbance contours for piling of mooring dolphins at the proposed development , overlain on the Carter et al. (2025) grey seal density surface



For all marine mammal species assessed, except for bottlenose dolphins, the predicted number of individuals exposed to noise levels sufficient to cause disturbance is <1. This translates to less than <0.001% of the MU population and, where applicable, the UK MU population. For bottlenose dolphins, 8 – 56 individuals could be impacted by pile driving events at the proposed development, translating to 3.4 – 24.0% of the MU, based on presence and group size data Benhemma-Le Gall and Cheney (2025).

In the case of harbour porpoise and minke whale, both broad-scale (SCANS IV) and fine-scale (grid cell-specific) density estimates were used to reflect potential variation in distribution. The SCANS IV data provide a conservative, spatially uniform estimate across offshore waters, while the grid-cell densities offer insight into potential nearshore habitat use near the Port of Ardersier. Though SCANS IV data are limited to summer and may be conservative, they are considered robust for regional assessments. The use of localised density values ensures that the analysis captures both offshore and inshore habitat use.

While acoustic and visual data on bottlenose dolphins and harbour porpoise in the Moray Firth, as provided by the University of Aberdeen (Benhemma-Le Gall and Cheney 2025), have not been directly incorporated into the quantitative modelling, they provide important context suggesting that both species may use the area with moderate regularity during the piling window. Given that bottlenose dolphins were detected for a median of 3.5 (year-round) DPH per day around the Port of Ardersier, and harbour porpoise were detected for a median of 0.000 (July, September, November) – 4.008 (May) DPH per day (Benhemma-Le Gall and Cheney 2025), they imply a non-zero probability that individual harbour porpoises or bottlenose dolphins could be present during piling activities.

Thus, with respect to bottlenose dolphins, there is a high likelihood that bottlenose dolphins will be present on piling days due to their year-round presence at the Port of Ardersier. This, coupled with the fact that during boat based surveys, the mean dolphin group size at Ardersier was 8 individuals (maximum group size was 56) leads to the possibility that bottlenose dolphins could be disturbed by piling events. For harbour porpoise, DPH per day fluctuates throughout the year. This variability suggests that while there is a non-zero probability of harbour porpoise presence during piling activities, their occurrence is likely to be intermittent. As such, piling events may coincide with periods of higher porpoise activity, but may also occur during periods when the species is largely absent from the area. Therefore, while there is some potential for disturbance, the likelihood and frequency of harbour porpoise exposure to piling noise is considerably lower and less predictable compared to bottlenose dolphins.

However, even when considering this potential for presence, the likelihood of individuals being exposed to disturbance levels sufficient to elicit a behavioural response remains low. This is due to the fact that there is limited spatial footprint of the piling operations and a short duration of the works (12 piles installed over 12 non-consecutive days, with a maximum of 10 hours of activity per pile).

Taken together, these factors suggest that while marine mammal individuals may occasionally be present near the piling location, the probability of any one individual being within the disturbance range during active piling is extremely low. Overall, the duration of the piling events are far below the number of days expected before population level effects may occur (e.g., 60 days for grey seals, and 30 – 50 days for harbour porpoise). Based on the limited spatial and temporal extent of piling activity and the very low number or proportion of individuals predicted to be exposed, the magnitude of impact is assessed as **Negligible** for all marine mammal species except bottlenose dolphins, for which the impact is considered **Low** due to the higher likelihood of presence, larger group sizes, and greater proportion of the Management Unit potentially affected.

3.3.3 Significance of Effect

The sensitivity of marine mammals to disturbance from piling has been assessed as Low for all species except grey seals, which were assessed as having Negligible sensitivity. The magnitude of impact is assessed as Negligible for all species considered except for bottlenose dolphins, which were assessed as Low. The effect will therefore be of **Negligible** significance for all marine mammals, which is **Not Significant** in EIA terms.

Table 14: Summary of the impact assessment for disturbance from piling

Species	Magnitude	Sensitivity	Significance
Harbour porpoise	Negligible	Low	Negligible (not significant)
Bottlenose dolphin	Low	Low	Negligible (not significant)
Harbour seal	Negligible	Low	Negligible (not significant)
Grey seal	Negligible	Negligible	Negligible (not significant)
Minke whale	Negligible	Low	Negligible (not significant)

3.3.4 Secondary Mitigation

The embedded primary mitigation includes an MMMP.

No additional marine mammal mitigation is considered necessary because the likely effect is not significant in EIA terms.

3.3.5 Residual Effect

As no additional mitigation commitments are required, the residual effect remains **Not Significant** in EIA terms.

3.4 Disturbance associated with dredging and spoil disposal activities

3.4.1 Sensitivity

3.4.1.1 Harbour porpoise

Source levels for dredging activities at the proposed development are estimated to be 181.4 dB RMS re 1 µPa (see Appendix 11.5). Dredging at a source level of 184 dB re 1 µPa at 1 m resulted in harbour porpoise avoidance up to 5 km from the dredging site (Verboom 2014). Conversely, Diederichs et al. (2010) found much more localised impacts; using Passive Acoustic Monitoring there was short term avoidance (~3 hours) at distances of up to 600 m from the dredging vessel, but no significant long-term effects. Modelling potential impacts of dredging using a case study of the Maasvlatke port expansion (assuming maximum source levels of 192 dB re 1 µPa) predicted a disturbance range of 400 m, while a more conservative approach predicted avoidance of harbour porpoise up to 5 km (McQueen et al. 2020).

NOTE: Awaiting full UWN modelling report to see what source level was modelled to incorporate into this section Based on the literature reviewed, harbour porpoise sensitivity to dredging activities is assessed as **Low.**

3.4.1.2 Bottlenose dolphins

Increased dredging activity at Aberdeen Harbour was associated with a reduction in bottlenose dolphin presence and, during the initial dredge operations, bottlenose dolphins were absent for five weeks (Pirotta et al. 2013). Based on the results of this study, Pirotta et al. (2015a) have assumed that dredging activities exclude dolphins from a 1 km radius of the dredging site. However, a study on bottlenose dolphin during the construction of the Nigg Energy Park in the Cromarty Firth showed that dolphins were not excluded from the vicinity of the piling activities (Graham et al. 2017b), which demonstrates the potential tolerance of bottlenose dolphins in the Moray Firth to noisy activities. Based on the literature examined, it is concluded that localised, temporary avoidance of dredging activities by bottlenose dolphins could take place.

Bottlenose dolphin sensitivity to dredging activities is therefore assessed as **Low.**

3.4.1.3 Seals

Source levels for dredging activities at the proposed development are estimated to be 181.4 dB RMS re 1 µPa. Based on the generic threshold of behavioural avoidance of pinnipeds (140 dB re 1 µPa SPL) (Southall et al. 2007), acoustic modelling of dredging demonstrated that disturbance could be caused to individuals between 400 m to 5 km from site (McQueen et al. 2020).

Based on the literature reviewed, harbour and grey seal sensitivity to dredging activities is assessed as **Low.**

3.4.1.4 Seal haul-out sites

Due to proximity of the proposed dredge area to the Ardersier designated seal haul-out site, the sensitivity of hauled-out seals to dredging activities is also considered.

The results of a study where Bankhead et al. (2023) compared harbour seal responses to in-air noise at two haul-out sites with different levels of human activities showed that seals may become tolerant to in-air noise levels at sites where human activities are high. It corroborated the findings of Cates and Acevedo-Gutiérrez (2017) who found that harbour seals at haul-out sites with low vessel activity flush more readily in response to boats than those at high-activity sites. Although vessel disturbance could be most detrimental during pupping season, there is evidence that seals are more reluctant to enter the water during the annual moult (Henry and Hammill 2001).

It should be noted that potential impacts of seals may be different depending on type of the year. Harbour seal breeding season occurs in June and July, followed by the moulting period in August During these periods, there is typically a greater number of harbour seals hauled-out during low tide periods than at other times of year. Grey seal breeding season occurs from August to December, followed by the annual moult occurs between December and April. During the breeding and moulting season, they will spend longer hauled-out compared to other times of year.

The sensitivity of grey seals to disturbance to haul-outs, is classified as **Low** outside of the breeding season and **Medium** during the breeding season. Due to declines in several regional harbour seal populations, this species is considered more vulnerable to pressures, including physical disturbance (SCOS 2022). Therefore, the sensitivity of harbour seal to disturbance during and outside the breeding and moult seasons at haul-outs has been assessed as **Medium**.

3.4.1.5 Minke whale

In northwest Ireland, construction-related activity (including dredging) has been linked to reduced minke whale presence (Culloch et al. 2016). Minke whale distance to construction site increased and relative abundance decreased during dredging activities in Newfoundland (Borggaard et al. 1999). No studies have focussed specifically on the expected disturbance ranges of dredging activity on minke whales, however.

Based on the literature reviewed, minke whale sensitivity to dredging activities is assessed as **Low.**

3.4.2 Magnitude

Although the presence of vessels and associated noise in the vicinity of the proposed development is not a novel impact for marine mammals in the area, additional vessel movements and the duration for which vessels are active during the dredging and spoil disposal phase could introduce additional disturbance events to marine mammals above existing baseline levels.

A combination of hydraulic and mechanical dredging will be carried out during the construction phase of the proposed development . The primary dredging activity will be conducted using a cutter suction dredger (CSD), supported by a combination of self-propelled split hopper barges (SHB) and trailer suction hopper dredgers (TSHD), which will transit between the dredge area and disposal sites. Up to six dredging and spoil disposal vessels may be present on site at one time; however, these vessels are expected to operate in continuous rotation, each transiting between the port and the disposal sites. Once operational, the CSD is expected to run with minimal interruptions or shut-down events, enabling efficient and near-continuous dredging to ensure timely completion. As a result, the repetition of disturbance events is expected to be short-term and infrequent, as the limited number of pauses in activity reduces opportunities for animals to move into active areas and subsequently be disturbed upon resuming operations.

Under the most likely scenario, spoil disposal operations are projected to take place over a ten-week period between March and September (sometime between 2027 – 2029). During this phase, up to 13 – 23 barge movements may be required per day to transport dredged material offshore. Assuming each barge has the capacity to transport on average ~4,500m^3 of material, this results in approximately 450 additional vessel movements taking place within the inner Moray Firth over the ten-week period.

The intensity of movement is short-term but represents a significant temporary increase in marine traffic local to the Ardersier site and spoil disposal areas, as well as along the transit routes between these. The anticipated increase in vessel movements for dredging and spoil disposal may lead to short-term localised impacts, particularly relating to underwater noise, and a higher risk of disturbance to marine mammals.

This assessment presents results for the following behavioural disturbance thresholds:

- 1 km effective deterrence range (EDR): Bottlenose dolphin; and
- 5 km EDR: Harbour porpoise, minke whale, harbour seal and grey seal.

It is important to note that all EDRs were created around a point that represents the most seaward extent of all dredging activity proposed to take place. However, this location is very close to landmass (i.e., Whiteness Point) which will likely create a strong barrier effect for any noise propagation and thus, estimates of impacts may be highly conservative.

Table 15: Summary of the densities, number of individuals and the proportion of the respective MUs impacted based on the impact ranges for dredging and spoil disposal using a 5 km and 1 km EDR.

<table>
<tr><th>Species</th><th>Density source</th><th>Impact</th><th>5 km EDR</th><th>1 km EDR</th></tr>
<tr><td rowspan="6">Harbour porpoise</td><td rowspan="3">0.2813/km^2 (SCANS IV Block CS-K) (Gilles et al. 2023)</td><td># animals</td><td>22</td><td>-</td></tr>
<tr><td>% NS MU</td><td>< 0.01</td><td>-</td></tr>
<tr><td>% UK MU</td><td>0.01</td><td>-</td></tr>
<tr><td rowspan="3">0.186/km^2 (Grid cell closest to port (Gilles et al. 2025))</td><td># animals</td><td>15</td><td>-</td></tr>
<tr><td>% NS MU</td><td>< 0.01</td><td>-</td></tr>
<tr><td>% UK MU</td><td>0.01</td><td>-</td></tr>
<tr><td rowspan="2">Bottlenose dolphin</td><td rowspan="2">Moray Firth density surface (scaled from Thompson et al. 2015)</td><td># animals</td><td>-</td><td>0.00</td></tr>
<tr><td>% CES MU</td><td>-</td><td>0.00</td></tr>
</table>

	Data on presence and group size (Benhemma-Le Gall and Cheney 2025)	# animals	Mean group size: 8 Max group size: 56	
		% CES MU	Mean group size: 3% Max group size: 24%	
Harbour seal	Grid cell specific (Carter et al. 2025)	# animals	23	-
		% MF SMU	1.71	-
Grey seal	Grid cell specific (Carter et al. 2025)	# animals	37	-
		% MF SMU	0.69	-
Minke whale	0.0116/km^2 (SCANS IV Block CS-K) (Gilles et al. 2023)	# animals	<1	-
		% CGNS MU	<0.001	-
		% UK MU	<0.001	-
	0.008/km^2 (Grid cell closest to port (Gilles et al. 2025))	# animals	<1	-
		% CGNS MU	<0.001	-
		% UK MU	<0.001	-

3.4.2.1 Harbour porpoise

Based on literature discussed in 3.4.1, it has been shown that harbour porpoises are predicted to exhibit avoidance of dredging vessels up to 5 km. As such, a 5 km EDR (methodology discussed in Appendix 11.2) has been used to determine the magnitude of impact from dredging vessels (Table 15).

Predicted numbers of individuals disturbed were calculated using both the SCANS IV uniform density estimate and the density estimate for the cell closest to the port. While limited to summer months and likely overly conservative, the SCANS IV uniform estimate provides a robust absolute density estimate that is more representative of harbour porpoise in offshore waters. Density cell estimates from the cell closest to the port are used to ensure the consideration of species habitat use in coastal environments.

Using the 5 km EDR, up to 22 (SCANS IV) and 15 (closest grid cell) harbour porpoise individuals are anticipated to be disturbed by dredging vessels, which equates to <0.01% of the NS MU and/or 0.01% UK MU. While the associated disturbance from dredging vessel presence and movement is expected to be short-term, it represents a temporary but notable increase in marine traffic in the vicinity of the proposed development and disposal sites and routes. While the number of interactions between spoil disposal vessel movements and harbour porpoise in the waters, acoustic data from Benhemma-Le Gall and Cheney (2025) indicate that harbour porpoise presence, measured by DPH per day varies significantly by month—ranging from 0.0 DPH in July and September, to a peak of 4.008 DPH in May, with intermediate levels in April (1.992), June (1.992), and August (1.008). Spoil disposal is scheduled to occur over a 10-week period between March and September, with approximately 13–23 barge movements per day, resulting in a total of around 450 vessel movements across this period. Due to the uncertainty in the exact timing of disposal operations, vessel activity may coincide with months of higher porpoise activity or with periods of near absence. Assuming continuous spoil disposal operations (24 hours/day for 70 days), and using an average daily presence estimate of 1.5 DPH across the March–September period, this equates to approximately 105 hours of porpoise presence during the 1,680-hour operational window (70 days × 24 hours). This represents ~6.3% of the total spoil disposal timeframe. Applying this to the estimated 450 vessel movements suggests that roughly 28 movements (450 × 0.063) may occur during periods when harbour porpoises are present.

Given that porpoise detections tend to reflect solitary or small-group behaviour, the number of individuals potentially disturbed per interaction is expected to be low. Further, the very small proportion of the population predicted to be impacted indicates that disturbance effects will be biologically insignificant at the population level. Further, embedded mitigation measures including a MMMP covering both dredging and spoil disposal activities, and a NRA will be in place for all construction-phase vessel operations. These protocols are coordinated to minimise disturbance, reduce overlap in vessel activity and avoid unnecessary transits.

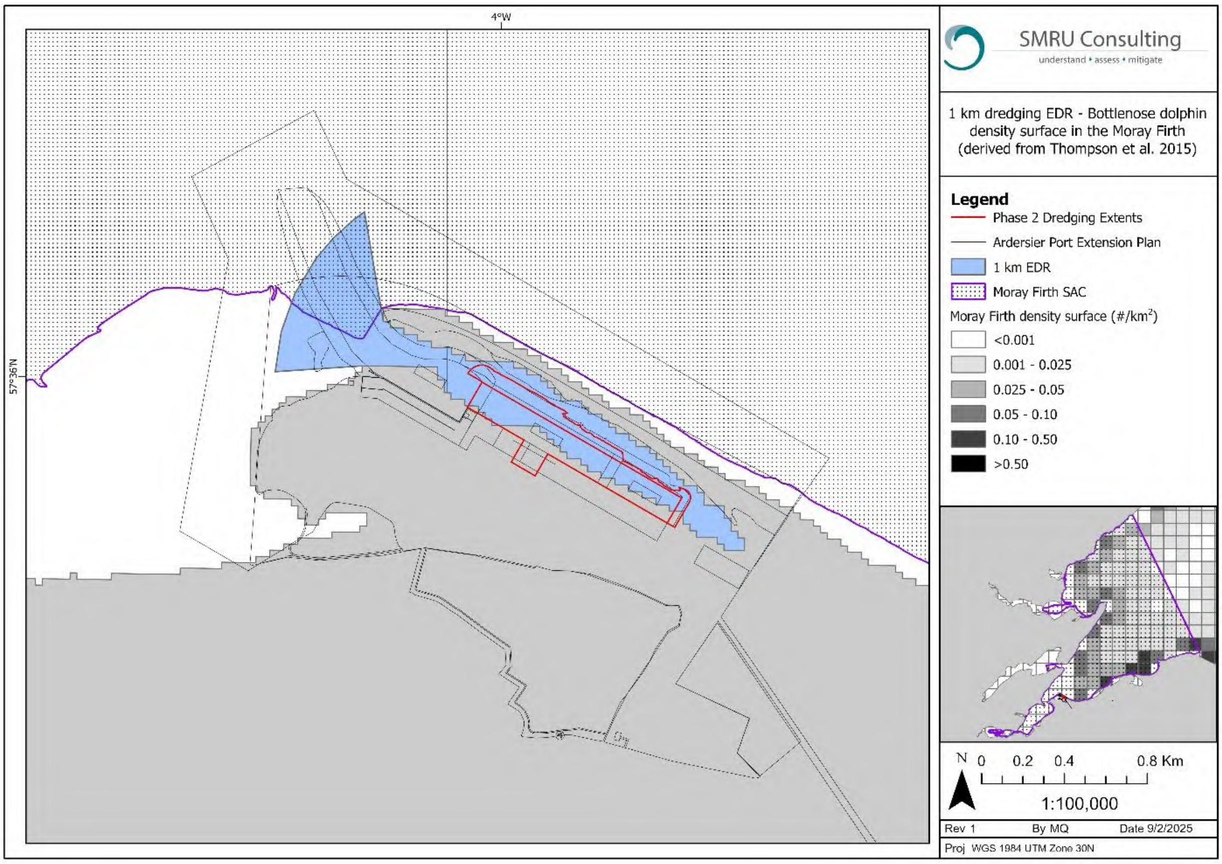
As such, the magnitude of disturbance from dredging vessel activity from the proposed development can be assessed as **Negligible**.

3.4.2.2 Bottlenose dolphin

As discussed in Section 3.4.1, Pirotta et al. (2015a) assumed a 1 km exclusion distance radius (EDR) around dredging operations for bottlenose dolphins, based on observational data from Aberdeen Harbour. Accordingly, a 1 km EDR has been applied in this assessment to evaluate potential disturbance from dredging vessels (refer to Appendix 11.2; and Table 15The EDR has been clipped to account for barrier effects from land masses, preventing propagation of underwater noise from dredging activities.

Under a worst-case scenario, the potential disturbance to bottlenose dolphins during dredging is at the most seaward location of the dredge footprint (see Figure 4). Predicted numbers of individuals disturbed were calculated using the Moray Firth density surface scaled from predicted probabilities of bottlenose dolphin occurrence Thompson et al. (2015). Based on this and using a 1 km EDR, no bottlenose dolphins were predicted to be disturbed by dredging vessel activity within this range (Table 15). The activity will also be short-term (few days to one week) as it will involve the removal of only small volumes of material to create the dredge channel slope.

Figure 4: Bottlenose dolphin density surface for the Moray Firth derived from Thompson et al. (2015). Blue polygon represents a 1 km EDR for disturbance associated with dredging activity from the most seaward dredging location. The EDR has been clipped to account for barrier effects from land masses, preventing propagation of underwater noise from dredging activities.



However, reliable density estimates for bottlenose dolphins within the CES MU and Moray Firth SAC are absent and thus, the application of a 1 km EDR and the Moray Firth density surface may not realistically predict the number of bottlenose dolphin individuals, and the probability of bottlenose dolphins, from being disturbed by dredging activities.

The University of Aberdeen LHFS identified the waters adjacent to the Port of Ardersier as a hotspot for bottlenose dolphin activity within the Moray Firth SAC. Over the 2006 to 2024 monitoring period, 161 individual dolphins (56.3% of the total identified within the Moray Firth SAC) were recorded around the Port of Ardersier, and encounter rates around the Port of Ardersier regularly reached ~1 encounter per hour (of survey effort). During boat based surveys, the mean dolphin group size at Ardersier was 8 individuals (maximum group size was 56), whilst using acoustic survey methods, bottlenose dolphins were detected for a median of 3.5 DPH per day around the Port of Ardersier (Benhemma-Le Gall and Cheney 2025).

The number of interactions between the dredging vessel itself and bottlenose dolphin groups utilising waters surrounding the Port of Ardersier shall be minimal, as dredging activity shall largely take place, over the medium-term (~6 months), deeper within the inner harbour away from where encounter rates are highest around the Port of Ardersier. However, when considering spoil disposal events, up to 13 – 23 barge movements may be required per day to transport dredged material offshore (to the Inverness, Sutors or Burghead disposal sites), resulting in approximately 450 additional vessel movements within the inner Moray Firth (medium extent) over the ten-week period. To estimate the number of individual bottlenose dolphin exposures to vessel movements during the 70-day spoil disposal period, a conservative approach was adopted based on the temporal overlap between vessel activity and dolphin presence. A total of 450 vessel movements are expected over the 70-day period, equating to 1,680 operational hours (70 days × 24 hours) assuming spoil disposals shall take place 24 hours a day, 7 days a week. Bottlenose dolphin presence in the area is estimated at an average of 3.5 hours per day, resulting in 245 hours of dolphin activity across the same period. This represents approximately 14.6% of the total operational time. Applying this proportion to the total number of vessel movements, an estimated 66 movements are likely to coincide with periods when dolphins are present (450 × 0.146). Using a mean group size of 8 individuals (Benhemma-Le Gall and Cheney, 2025), there is expected to be disturbance to an average of 8 individuals (maximum 56) over each of these 66 vessel movements.

Overall, the dredging works will be medium-term but spatially restricted to the inner harbour, where overlap with high dolphin use is limited. While spoil disposal activities are expected to involve a higher frequency of vessel movements (approximately 450 over 10 weeks), these will be temporary and transient in nature. It is expected (based on data on dolphin presence and group size) that there will be disturbance to an average of 8 individuals (maximum 56) over 66 vessel movements. Consequently, risk of repeated behavioural disturbance to a small portion of the local population is high but is unlikely to alter its long-term trajectory. The impact will occur over a medium spatial extent, but for a short-term duration. Further, embedded mitigation measures including a MMMP for dredging and spoil disposal activities. These plans will ensure that vessel routes, speeds, and scheduling are coordinated to minimise disturbance, minimise overlap in vessel activity and reduce unnecessary transits. Therefore, magnitude of impact for both dredging and spoil disposal activities combined is considered to be **Medium**.

3.4.2.3 Seals

Based on literature discussed in 3.4.1, it has been shown that seals are predicted to exhibit avoidance of dredging vessels between 400 m to 5 km (McQueen et al. 2020). As such, and to remain conservative, a 5 km EDR (methodology discussed in Appendix 11.2) has been used to determine the magnitude of impact from dredging vessels (Table 15). The EDR has been clipped to account for barrier effects from land masses, preventing propagation of underwater noise from dredging activities.

Predicted numbers of individuals disturbed were calculated using grid-cell specific density estimates from the Carter et al. (2025) habitat preference maps. Using the 5 km EDR, up to 23 harbour seal individuals (Figure 5) (1.71% of the MF SMU) and 37 grey seal individuals (Figure 6) (0.69% of the MF SMU) are anticipated to be disturbed by dredging vessels (Table 15). While the associated disturbance from dredging vessel presence and movement is expected to be short-term, it represents a temporary but notable increase in marine traffic in the vicinity of the proposed development and disposal sites and routes. However, the small proportion of the population predicted to be impacted indicates that disturbance effects will be biologically insignificant at the population level. Further, embedded mitigation measures including a MMMP covering both dredging and spoil disposal activities, and a NRA will be in place for all construction-phase vessel operations. These protocols are coordinated to minimise disturbance, reduce overlap in vessel activity and avoid unnecessary transits.

As such, the magnitude of disturbance from dredging vessel activity from the proposed development can be assessed as **Negligible**.

Figure 5: Harbour seal distribution during autumn-winter-spring from haul out sites in Scotland only. Data from Carter et al. (2025). Blue outline represents a 5 km EDR for disturbance associated with dredging activity from the most seaward dredging location. The EDR has been clipped to account for barrier effects from land masses, preventing propagation of underwater noise from dredging activities.

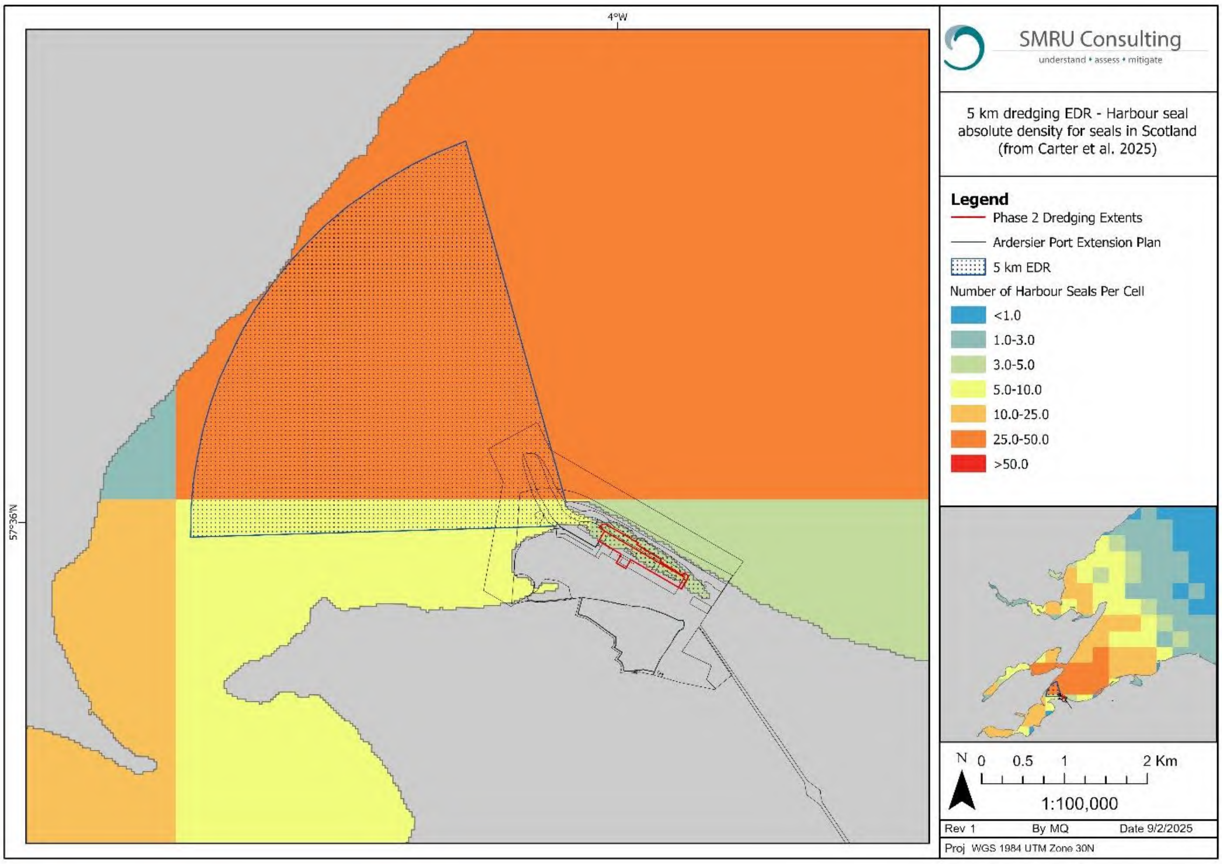
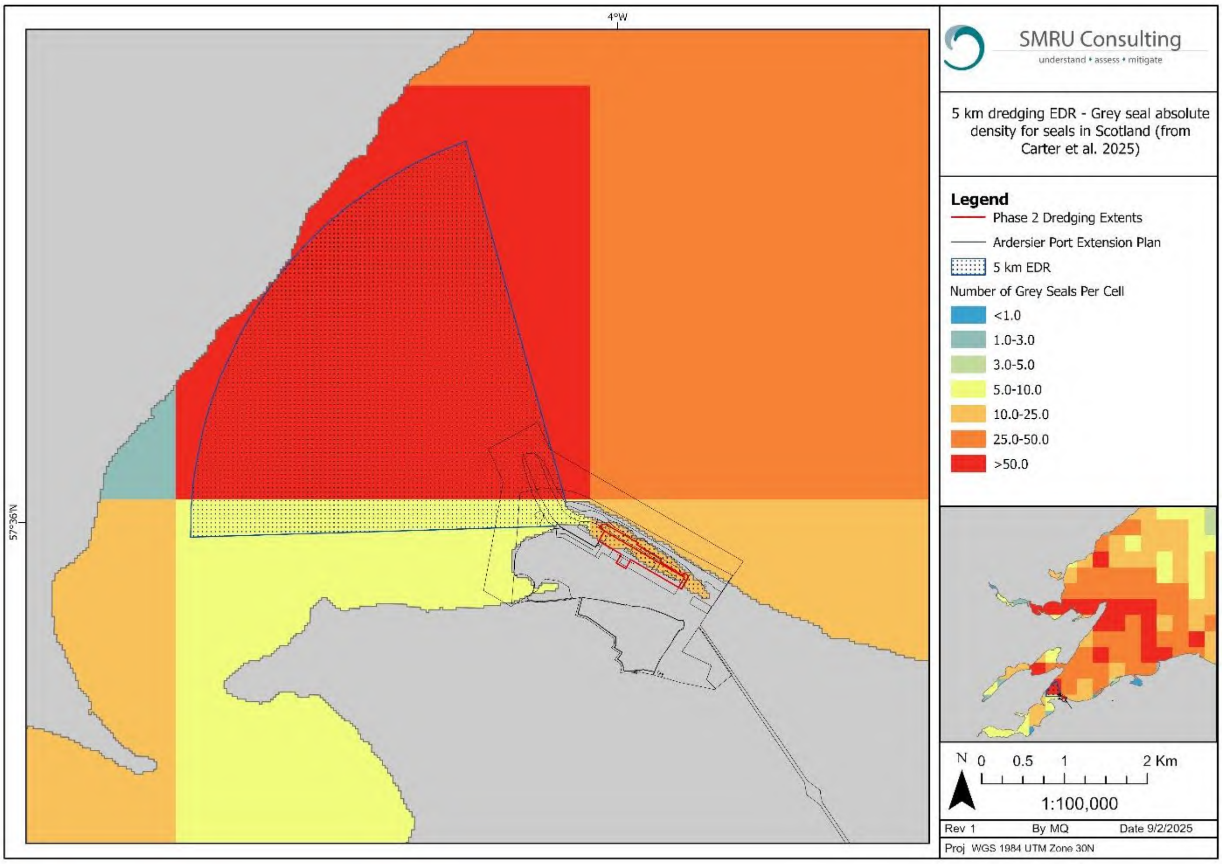


Figure 6: Grey seal at-sea habitat preference map in Summer (May – August). Data from Carter et al. (2025). Blue outline represents a 5 km EDR for disturbance associated with dredging activity from the most seaward dredging location. The EDR has been clipped to account for barrier effects from land masses, preventing propagation of underwater noise from dredging activities.



3.4.2.4 Seal haul-outs

Under a worst-case scenario, the potential disturbance to seals hauled-out involves dredging at the most seaward location of the dredge footprint. This will be short-term (few days to one week) and will involve the removal of only small volumes of material to create the dredge channel slope. Most dredging activity will take place deeper within the inner harbour, where extensive port infrastructure - including harbour walls and built structures - provides substantial acoustic masking of vessel activity, thereby minimising the risk of flushing seals into the water.

As such, the magnitude of disturbance to seal haul-outs from dredging vessel activity from the proposed development can be assessed as **Negligible**.

3.4.2.5 Minke whale

As discussed in 3.4.1, there are no studies that have focussed specifically on the expected disturbance ranges on minke whales. As such, to remain conservative, a 5 km EDR (methodology discussed in Appendix 11.2) has been used to determine the magnitude of impact from dredging vessels (Table 15

Predicted numbers of individuals disturbed were calculated using both the SCANS IV uniform density estimate and the density estimate for the cell closest to the port. While limited to summer months and likely overly conservative, the SCANS IV uniform estimate provides a robust absolute density estimate that is more representative of harbour porpoise in offshore waters. Density cell estimates from the cell closest to the port are used to ensure the consideration of species habitat use in coastal environments.

Using the 5 km EDR, 0.058 (SCANS IV) and 0.040 (closest grid cell) minke whale individuals are anticipated to be disturbed by dredging vessels, which equates to <0.001% of the CGNS MU and/or <0.001% UK MU. While the associated disturbance from dredging vessel presence and movement is expected to be short-term, it represents a temporary but notable increase in marine traffic in the vicinity of the proposed development and disposal sites and routes. However, the very small proportion of the population predicted to be impacted indicates that disturbance effects will be biologically insignificant at the population level. Further, embedded mitigation measures including a MMMP covering both dredging and spoil disposal activities, and a NRA will be in place for all construction-phase vessel operations. These protocols are coordinated to minimise disturbance, reduce overlap in vessel activity and avoid unnecessary transits.

As such, the magnitude of disturbance from dredging vessel activity from the proposed development can be assessed as **Negligible**.

3.4.3 Significance of Effect

The sensitivity of the receptor is **Low** for all marine mammals, including seals at-sea. For seals at their haul-out sites, grey seal sensitivity is classified as Low outside of the breeding/moult seasons and Medium during the breeding/moult seasons. For hauled-out harbour seals, sensitivity is classified as Medium year-round.

The magnitude of impact is deemed Medium for bottlenose dolphins. For all other marine mammals including seals at their haul-out sites, the magnitude of impact is deemed to be Negligible.

The significance of effect is therefore assessed as **Negligible** and **Not Significant** for all marine mammals except for bottlenose dolphins, where the significance of effect is assessed as **Minor** and **Not Significant** (Table 16).

Table 16: Summary of the impact assessment for disturbance from dredging and soil disposal

Species	Magnitude	Sensitivity	Significance
Harbour porpoise	Negligible	Low	Negligible (not significant)
Bottlenose dolphin	Medium	Low	Minor (not significant)
Seals at-sea	Negligible	Low	Negligible (not significant)
Seals hauled-out	Negligible	Medium (Harbour seals) Low (Grey seals, non-breeding) Medium (Grey seals, breeding)	Negligible (not significant)
Minke whale	Negligible	Low	Negligible (not significant)

3.4.4 Secondary Mitigation

The embedded primary mitigation includes and MMMP and a NRA.

No additional marine mammal mitigation is considered necessary because the likely effect in not significant in EIA terms.

3.4.5 Residual Effect

No additional mitigation commitments are required; the residual effect remains **Non-Significant** in EIA terms.

3.5 Disturbance associated with increased vessel traffic

Disturbance to marine mammals by vessels will be driven by a combination of underwater noise and the physical presence of the vessel itself (e.g. Pirotta et al. 2015b, Pirotta et al. 2015c). It is not simple to disentangle these drivers and thus disturbance from vessels is assessed here in general terms, covering disturbance driven by both vessel presence and underwater noise.

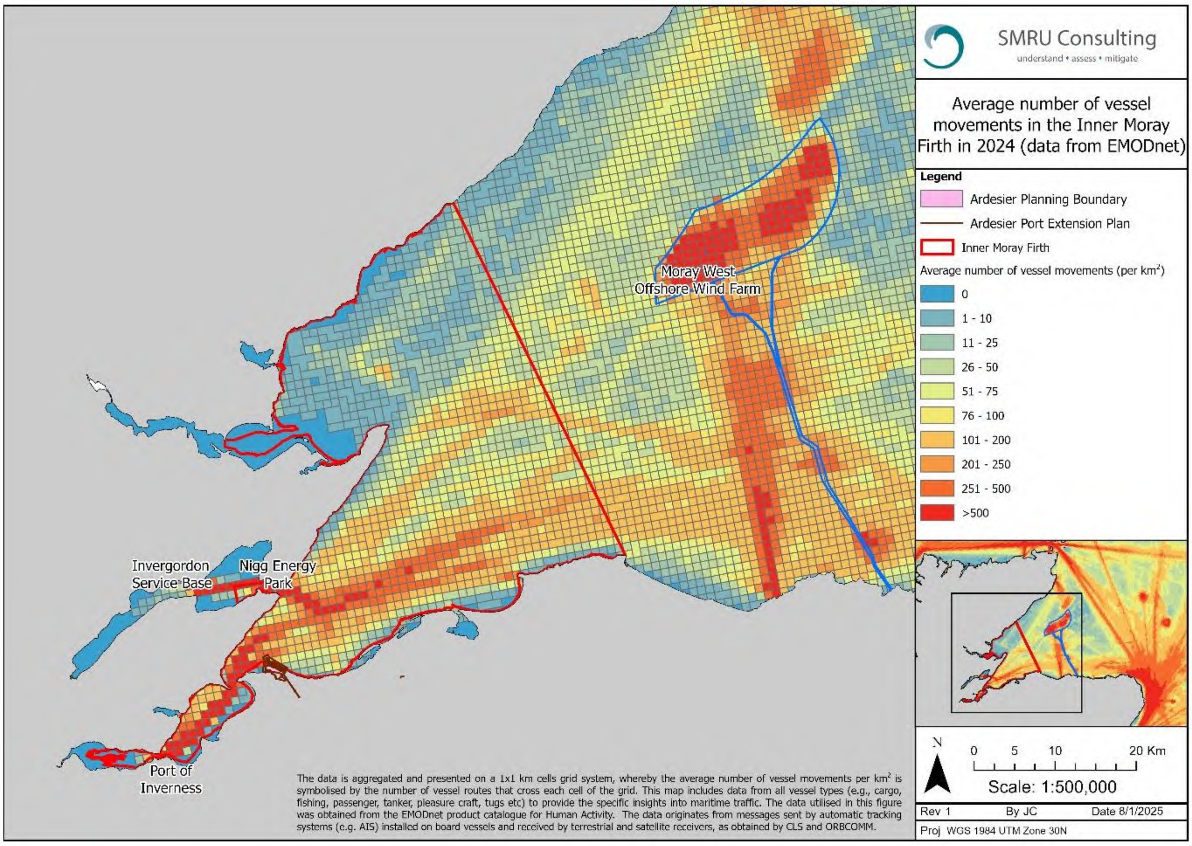
Noise levels from construction vessels will result in an increase in non-impulsive, continuous sound in the vicinity of the proposed development , typically in the range of 10 to 100 Hz (although higher frequencies will also be produced) (Erbe et al. 2019) with an estimated L_p source level of ~161 and ~168 dB re 1 µPa@1m for medium and large construction vessels respectively, travelling at a speed of 10 knots. Vessel noise is continuous, and is dominated by sounds from propellers, thrusters and various rotating machinery (e.g., power generation, pumps) (OSPAR 2009). In general, small boats and ships are expected to have broadband source levels in the range 160 to 180 dB re 1µPa (rms), with the majority of energy below 1 kHz (OSPAR 2009). Large commercial vessels (>100 m) produce relatively loud and predominately low frequency sounds, with the strongest energy concentrated below 200 Hz (Gotz et al. 2009, OSPAR 2009).

3.5.1 Baseline vessel activities

Data obtained from the European Marine Observation and Data Network (EMODnet) provides a baseline characterisation of existing vessel traffic within the Inner Moray Firth in 2024. Both vessel movement data and vessel 'density' data show the distribution and movement patterns of vessels within the Inner Moray Firth. These data, created by EMODnet, use a grid system of 1x1 km cells to represent vessel density. The data is derived from Automatic Identification System (AIS) data, which tracks vessel positions and includes data from various vessel types (fishing, service, dredging or underwater ops, sailing, pleasure craft, high speed craft, tug and towing, passenger, cargo, tanker, military and law enforcement, and unknown and other) to provide the specific insights into maritime traffic.

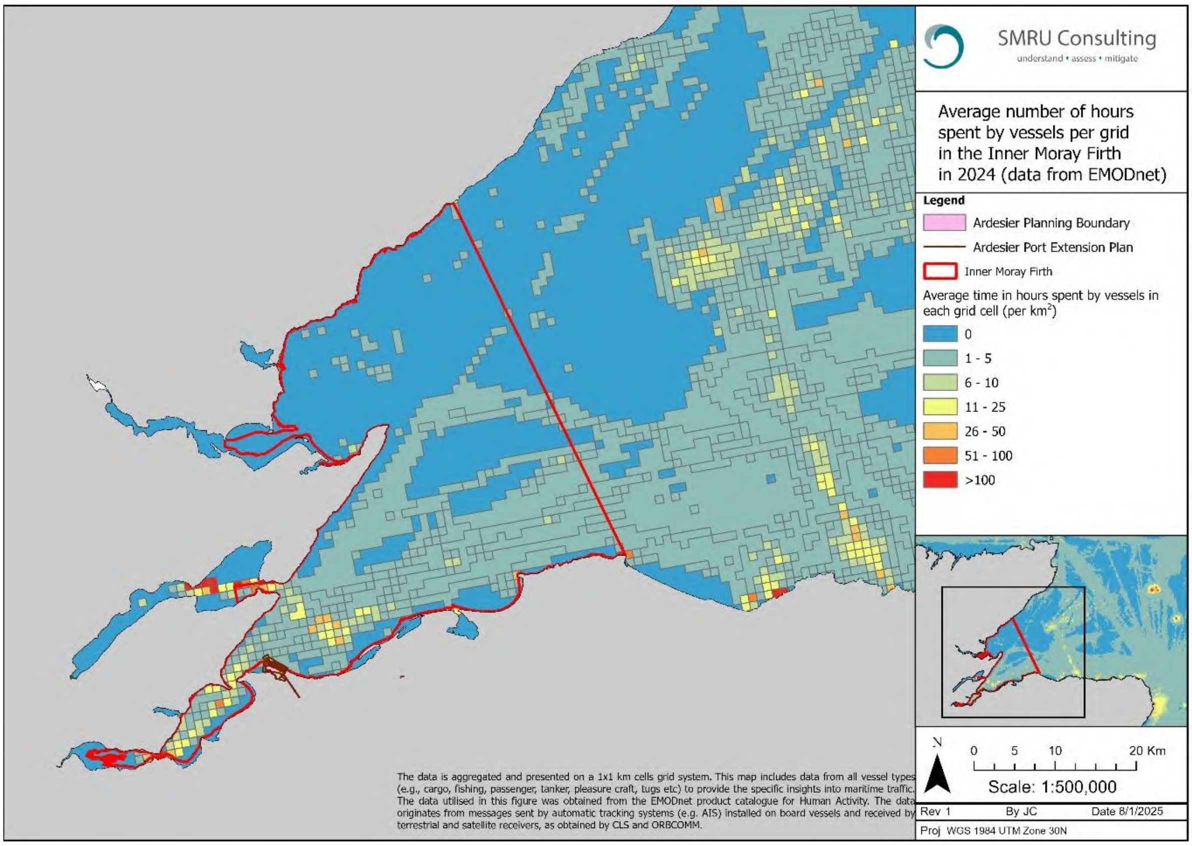
The highest concentrations of vessel movements, exceeding 500 movements/km² throughout 2024, are primarily located in and around the Ardersier Port and along the main southern (Inverness and Beauly Firths) and western navigational corridors (Cromarty Firth). Overall annual traffic volume that can approach or exceed 1,000 vessel movements per year (Affric 2025). These zones, displayed in dark red in Figure 7, suggest significant year-round vessel traffic, likely associated with port operations, industrial activities, and established shipping lanes. For the Port of Ardersier itself, it has been reported that there are currently ~340 vessel movements per year (Haventus 2025), whilst the Invergordon Service Base, Nigg Energy Park and Deephaven (all located in the Cromarty Firth) collectively reported a yearly average of 882 vessels from 2019 – 2023 (Affric 2025). Surrounding these hotspots are zones of high to moderate activity, with movement densities ranging from 101 to 500 movements/km² throughout 2024. These areas extend along the broader southern channel and northeast toward the outer Moray Firth, highlighting key transit routes for commercial and possibly recreational vessels. Moderate vessel movements, shown in yellow to light green, span large portions of the central and eastern regions of the Inner Moray Firth, with densities between 26 and 100 movements/km² throughout 2024. These areas likely represent regular passage routes with less frequent or concentrated use. Peripheral and more offshore regions generally exhibit lower activity, with many areas recording fewer than 25 movements/km² or none at all. This spatial pattern of vessel movement aligns closely with the spatial patterns observed temporally (see Figure 9 for spatial patterns of vessels observed temporally) and reinforces the strategic importance of the Ardersier Port and adjacent corridors as the focal points of maritime activity in the Inner Moray Firth. However, the 'density' of vessels (i.e., how much time vessels spend in each grid cell) remains low throughout the Inner Moray Firth (see Figure 8).

Figure 7: Average number of vessel movements in the Inner Moray, per km2, throughout 2024.



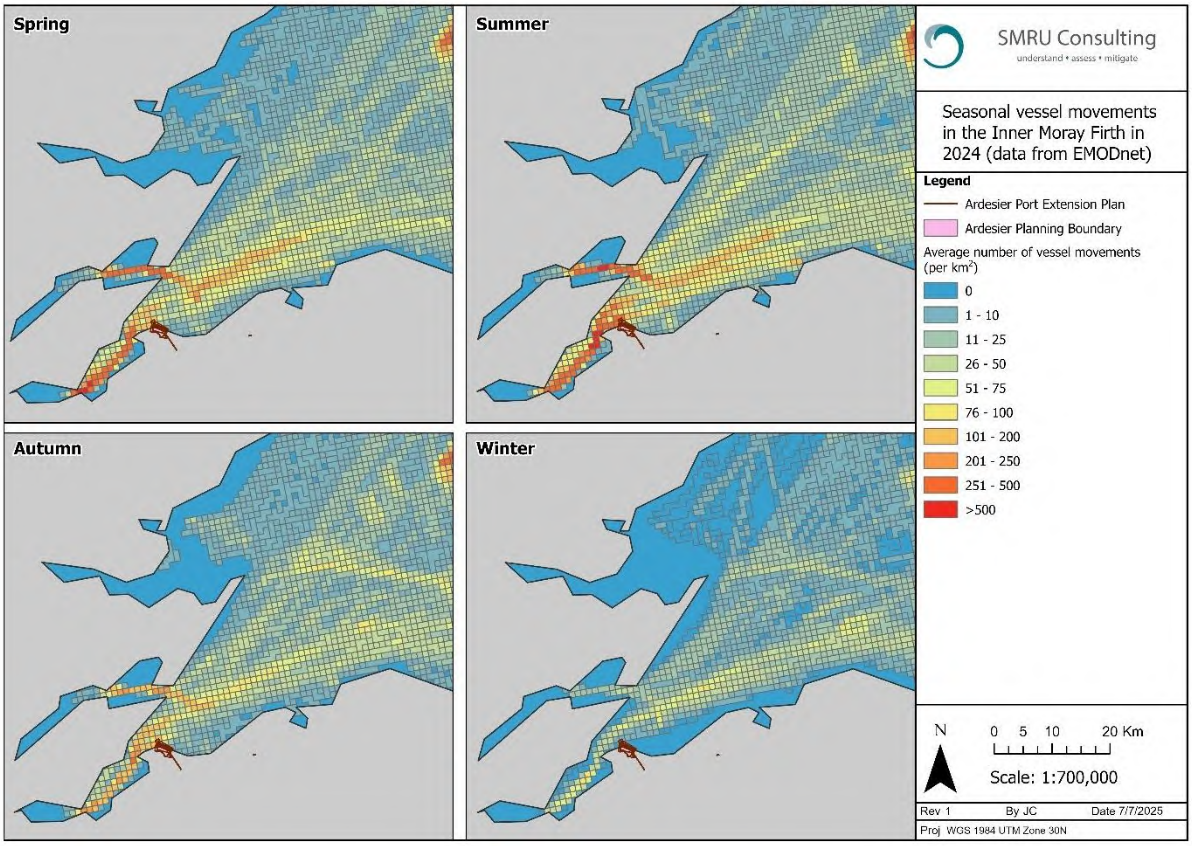
Areas with the highest vessel density (those with over 100 hours/km²) are concentrated around the channels leading to the Invergordon Service Base, Nigg Energy Park, and the Port of Inverness. Increased levels of vessel density are also present within the Moray West OWF, likely associated with construction activities. These zones, shown in red in Figure 8, indicate areas where vessels either remained stationary for extended periods, such as at anchor or while berthed, or were engaged in slow manoeuvring. Moderate-density areas, with vessels spending between 26 and 100 hours per square kilometre, are observed along major navigational routes east of the Ardersier Planning Boundary. These zones likely represent areas of consistent but transient traffic associated with port approaches and departures. Broader central and eastern sections of the Inner Moray Firth exhibit low to moderate vessel presence, with vessels spending between 6 and 25 hours/km^2. This suggests regular passage but minimal loitering, characteristic of navigational transit corridors. Peripheral and offshore areas show minimal vessel presence, with only 1 to 5 hours/km^2, while several outer regions register restricted vessel activity. These patterns highlight the core areas of maritime activity and may reflect both physical navigational constraints and operational practices.

Figure 8: Average number of hours per month that vessels were present within each grid cell (1 km2) in the Inner Moray Firth in 2024.



Seasonal variations for vessel movements throughout 2024 (**Error! Reference source not found.**) demonstrate that during Spring, vessel activity is generally moderate throughout the Inner Moray Firth. Notable hotspots, with densities ranging from 101 to over 500 movements/km², are concentrated near the Port of Ardersier, along the main northeastern channel and within the Cromarty Firth and to the Port of Inverness. Summer sees the highest level of vessel activity across all seasons. Areas with high densities of vessel movements, ranging from 101 to over 500 movements/km², expand significantly compared to Spring. These high-traffic areas are particularly prominent around Port of Ardersier and stretch along the primary shipping routes from the Cromarty Firth, the Port of Inverness and towards the Outer Moray Firth. During Autumn, there is a noticeable decline in vessel movement compared to Summer. Despite this reduction, some moderately high-density zones persist near the port and along key navigation channels. Much of the area returns to moderate usage, with movement densities between 26 and 100 movements/km². In Winter, vessel activity is at its lowest. Most of the region experiences minimal movement, with densities ranging from 0 to 25 movements/km². The only areas with slightly elevated activity are those immediately surrounding the Port of Ardersier, the Cromarty Firth and the Inverness and Beauly Firths.

Figure 9: Average number of vessel movements, seasonally, in the Inner Moray, per km2, throughout 2024. Winter (December – February); Spring (March – May); Summer (June – August); Autumn (September – November).



3.5.2 Sensitivity

3.5.2.1 Harbour porpoise

During the construction of the offshore windfarms within the Moray Firth, harbour porpoise occurrence decreased with increasing vessel presence, with the magnitude of decrease depending on the distance to the vessel (Benhemma-Le Gall et al. 2021). Additional studies conducted during offshore windfarm construction demonstrated that harbour porpoise detections in the vicinity of the pile driving location decline prior to a piling event, likely due to vessel activity (Brandt et al. 2018, Benhemma-Le Gall et al. 2021, Benhemma-Le Gall et al. 2023). Further, a study in the North Sea by Pigeault et al. (2024) highlighted that harbour porpoises avoid areas with high maritime traffic, where porpoise were significantly less likely to be present within 9 km of areas frequently used by ships, with the average number of ships and the average closest approach distance over time being the most effective predictors of disturbance. Specifically, areas that experienced repeated or prolonged close-range ship traffic, i.e., when vessels approached on average closer than 2.1 km for more than 30 minutes, porpoise sightings dropped by 50%. Overall, the proximity and frequency of ship presence had a stronger correlation with porpoise absence than predicted sound levels (Pigeault et al. 2024).

Data examining the surfacing behaviour of harbour porpoise in relation to vessel traffic in Swansea Bay from land-based surveys found a significant correlation between harbour porpoise sightings and the number of vessels present (Oakley et al. 2017). When vessels were up to 1 km away, 26% of the interactions observed were considered to be negative (animal moving away or prolonged diving). The proximity of the vessel being an important factor, with the greatest reaction occurring just 200 m from the vessel. The type of vessel was also relevant, as smaller motorised boats (e.g. jet-ski, speed boat, small fishing vessels), were associated with more negative behaviours than larger cargo ships, although this type of vessel was a less common occurrence (Oakley et al. 2017). Vessels associated with offshore wind farm construction are typically larger than these types of small, motorised vessels, and, therefore, it would be anticipated that the behavioural response would not be as severe. Telemetry data can also be used to identify fine-scale changes in behaviour. Between 2012-2016, seven harbour porpoises were tagged in a region of high shipping density in the inner Danish waters and Belt seas (Wisniewska et al. 2018). Periods of high vessel noise coincided with erratic behaviour including 'vigorous fluking', bottom diving, interrupted foraging, and the cessation of vocalisations. Four out of six of the animals that were exposed to noise levels above 96 dB re 1 µPa (16 kHz third octave levels) produced significantly fewer buzzes with high quantities of vessel noise. In one case, the proximity of a single vessel resulted in a 15 minute cessation in foraging (Wisniewska et al. 2018). In a more recent study by Frankish et al. (2023), harbour porpoises were fitted with GPS-Acoustic Tagging devices that recorded fine-scale movement (location, depth, orientation) and broadband noise levels, to understand how broadband ship noise (10 Hz–20 kHz) affects the behaviour of harbour porpoises by analysing GPS and acoustic data from tagged individuals as they navigate near vessels. Frankish et al. (2023) observed clear and consistent changes in swimming and diving patterns when porpoises were exposed to broadband ship noise including abrupt changes in swimming direction, increased dive depth and delays in surfacing. Porpoises reacted more strongly when vessels passed within 1–2 kilometres of an individual and behavioural shifts often began several minutes before the ship was visible, indicating acoustic cues as the trigger (Frankish et al. 2023).

Although the aforementioned studies have observed short-term changes in harbour porpoise presence and behaviour in the vicinity of vessels, Owen et al. (2024) demonstrated that – through use of two years of continuous passive acoustic monitoring data – rerouting of a high-vessel traffic shipping lane in the Kattegat, Sweden & Denmark, did not change patterns of presence and foraging in harbour porpoise. For example, areas that experienced increased ship noise and vessel traffic after the rerouting did not show declines in porpoise detection or feeding buzzes. Likewise, areas where ship activity decreased did not see increases in porpoise presence (Owen et al. 2024). The lack of shift in porpoise behaviour suggests that porpoises strongly prefer certain habitats, possibly due to prey availability or other ecological factors, even when these areas are exposed to more disturbance. This implies that short-term avoidance seen in other studies doesn't necessarily translate to long-term displacement (Owen et al. 2024). While porpoises stayed in the area, ship noise did intermittently reach levels known to cause short-term behavioural changes in individuals. However, these levels were rare (<1% of the time). Thus, subtle physiological or behavioural impacts (e.g., stress or reduced echolocation range) may still be present but not detectable through acoustic presence data alone and cumulative impacts like chronic stress, acoustic masking, or reduced communication range could still affect individual fitness and long-term population health (Owen et al. 2024).

Behaviour-based modelling has indicated the potential for vessel disturbance to have population-level effects under certain circumstances. Nabe-Nielsen et al. (2014) simulated harbour porpoise response to vessels did not result in further population decline when prey sources recovered fast (after two days), but if prey availability remained low then vessels were estimated to have a significant negative impact on the population. However, whilst this negative trend was estimated, when comparing the theoretical impact of vessel presence versus bycatch, the latter was found to have a greater effect on population size as it causes direct mortality and, therefore, Nabe-Nielsen et al. (2014) suggest that conservation efforts should instead focus more closely on this issue.

In conclusion, harbour porpoise show a reasonable ability to adapt to vessel disturbance. Although short-term avoidance and behavioural responses (e.g., altered diving, movement away) are well documented, individuals continue to use areas with regular vessel activity, including construction zones and high-traffic areas. Long-term data (e.g., Owen et al. 2024) suggest site fidelity and persistence, even when noise exposure increases — indicating that porpoises can adapt to recurring vessel presence under certain ecological conditions. Further, harbour porpoise exhibit some tolerance to vessel noise and presence. While close-range encounters (particularly within 1–2 km) can elicit behavioural responses, these are generally short-term and not linked to reduced survival or reproduction. Lastly, porpoise typically return to previous activity patterns and locations once vessels have passed, and there is no clear evidence of displacement or long-term reduction in habitat use following vessel exposure The sensitivity of harbour porpoise to disturbance from vessel activity is therefore classified as **Low.**

3.5.2.2 Bottlenose dolphins

Visual observations have demonstrated that vessels within 400 m of a dolphin group have been found to result in short-term changes to bottlenose dolphin behaviour through both targeted, and non-targeted approaches (Clarkson et al. 2020, Puszka et al. 2021, Mills et al. 2023). For example, Mills et al. (2023) demonstrated that bottlenose dolphin foraging and socialising behaviours decreased near vessels (e.g., tugboat, cargo ship, recreational boat) and showed more milling and resting behaviours when vessels were absent or at greater distances. Larger vessels, especially those moving at higher speeds, had a more pronounced effect on dolphin behaviour, whilst tugboats and cargo ships were associated with stronger avoidance responses compared to slower or smaller recreational boats (Mills et al. 2023).

Studies using passive acoustic monitoring have also suggested that vessel disturbance (from large dredging vessels) has been shown to negatively affect bottlenose dolphin foraging activity as the results indicated a short-term 49% reduction in foraging activity (though this did not vary with noise level) (Pirotta et al. 2013). However, animals resumed foraging after the vessel had ceased operations. The susceptibility to disturbance was variable depending on the location and year, suggesting circumstantial impacts of vessel noise on bottlenose dolphins. The physical presence of vessels, and not just the noise created, plays a large role in disturbance responses (Pirotta et al. 2015b). Changes in behaviour as a result of vessel presence may also include increased swimming speeds (when resting or socialising), increased travelling time (less time resting, socialising and foraging) as well as characteristics of whistles (Constantine et al. 2004, La Manna et al. 2013, Marley et al. 2017b, Piwetz 2019).

It is hypothesised that the quality of the habitat impacts the behavioural response to disturbance (Marley et al. 2017a). In Italy, bottlenose dolphins would tolerate vessel presence within certain levels and were more likely to leave an area if disturbance was persistent (La Manna et al. 2013). Similarly, high levels of tolerance to vessel disturbance were observed in Aberdeen harbour where vessel traffic is consistently high (Pirotta et al. 2013). Therefore, the degree to which an animal will be disturbed is likely linked to their baseline level of tolerance (Bejder et al. 2009).

New et al. (2013) developed a mathematical model simulating the complex interactions of the coastal bottlenose dolphin population in the Moray Firth to determine if an increased rate of disturbance resulting from vessel traffic was biologically significant. The scenario modelled increased vessel traffic from 70 to 470 vessels a year to simulate the potential increase from the proposed offshore development. An increase in commercial vessel traffic only is not anticipated to result in a biologically significant increase in disturbance because the dolphins have the ability to compensate for their immediate behavioural response and, therefore, their health and vital rates are unaffected (New et al. 2013).

In conclusion, vessel disturbance can elicit a variety of responses in bottlenose dolphins (Constantine et al. 2004, La Manna et al. 2013, Pirotta et al. 2015b, Marley et al. 2017a, Marley et al. 2017b). However, bottlenose dolphins have been observed to display tolerance to vessel disturbance, particularly in areas where vessel traffic has always been high (Pirotta et al. 2013). Furthermore, behavioural changes in bottlenose dolphins are not always considered biologically significant (New et al. 2013), and the coastal bottlenose dolphin population in east Scotland (Moray Firth) has continued to expand despite high baseline vessel traffic levels, indicating resilience and effective adaptation to current disturbance regimes. This suggests that while individual dolphins show short-term behavioural responses, the population is not currently limited or negatively affected by vessel presence within the observed range of disturbance. The sensitivity of bottlenose dolphins to disturbance from vessel activity is therefore classified as **Low.**

3.5.2.3 Seals at sea

A telemetry study that included the tagging of 28 harbour seals (at both Ardersier and the Dornoch Firth) in the Inner Moray Firth found high exposure levels of harbour seals to shipping noise (Jones et al. 2017a). The overlap between seals and vessel activity most frequently occurred within 50 km of the coast, and in proximity to seal haul outs. Despite the distributional overlap and high cumulative sound levels, there was no evidence of reduced harbour seal presence as a result of vessel traffic (Jones et al. 2017a). Similarly, Mathews et al. (2016) reported that higher vessel counts in the study area were not associated with reduced seal counts, noting that the total counts included seals in the water, and therefore they were less sensitive to vessel disturbance. Further, Onoufriou et al. (2016) demonstrated that tracks of tagged individual seals overlapped with AIS ship track data and thus, showing that some seals repeatedly used discrete, small areas close to areas of relatively high shipping activity, suggesting that seals are not exhibiting overt avoidance of areas associated with high levels of shipping activity in the Moray Firth.

Although studies concerning grey seal interactions with vessels in the Moray Firth do not exist, a combined study of grey seal pup tracks in the Celtic Sea and adult grey seals in the English Channel found that no animals were exposed to cumulative shipping noise that exceeded thresholds for TTS (as a proxy for disturbance, using Southall et al. (2019) criteria) (Trigg et al. 2020). On the northwest coast of Ireland, a study of vessel traffic and marine mammal presence found grey seals sightings decreased with increased vessel activity in the surrounding area, though the effect size was small (Anderwald et al. 2013); and the authors noted that relationships between sightings and vessel numbers were weaker than those with environmental variables such as sea state.

Despite high exposure to vessel noise and traffic in areas like the Moray Firth, harbour and grey seals continue to use affected habitats. Behavioural responses are limited, and there is no evidence of impacts on survival or reproduction. Based on observed adaptability, tolerance, and recoverability, both seal species are assessed as having **Low** sensitivity to vessel traffic.

3.5.2.4 Seals hauled-out

Vessel disturbance studies on seals have demonstrated disturbance of seals from haul-outs in response to vessels up to 1 km (Henry and Hammill 2001, Andersen et al. 2012, Young et al. 2014, Cates and Acevedo-Gutierrez 2017). For example, Henry and Hammill (2001) reported that the distance at which at >50% of seals (in Canada) first detected boats (alert distance) occurred when the boats were up to 800 m away from the animals, however, on average seals became more alert when the vessel approached to approximately 300 m and seals were observed to enter the water (flushing distance)when boats were at distances of >200 m. Similarly, Andersen et al. (2012) reported that for harbour seals in Denmark, alertness increased when vessel approaches were between 560 m to 850 m, and flight responses were initiated at distances between 510 – 830 m. In the same study animals exhibited weaker and shorter-lasting responses during the breeding season. They were more reluctant to flee and returned to the haul-out site immediately after being disturbed, in some cases even during the disturbance. The authors attributed this seasonal tolerance to a trade-off between fleeing and nursing during the breeding season (Andersen et al. 2012).

Published literature reported that the number of vessel-caused disturbances (e.g., harbour seals flushing from the haul-out site into the water) is a function of the number of vessels, the type of vessels, how they are distributed and the distance from a haul-out site (Mathews et al. 2016, Cates and Acevedo-Gutierrez 2017, Carpenter 2021). Paterson et al. (2019) studied post-disturbance haul-out behaviour of harbour seals and found that following the disturbance by boat located at a distance of 300 m from the haul-out site. Seals displayed a high degree of haul-out site fidelity and there was no significant effect on the probability of seals moving to a different haul-out site. Although distances at which behavioural response may occur vary, due to strong dependence on the distance of the vessel from the haul-out site, Cates and Acevedo-Gutierrez (2017) highlighted the importance of developing and enforcing buffer zones relative to the level of human activity.

Marine Scotland (2014) acknowledge this, stating that *"the distance at which seals show such signs of agitation varies tremendously, depending on their location, how they are approached, whether the animals are used to the presence of humans and the time of year; [and] in particular, whether or not they have pups with them"*. It should be noted that potential impacts of seals may be different depending on type of the year. Harbour seal breeding season occurs in June and July, followed by the moulting period in August During these periods, there is typically a greater number of harbour seals hauled-out during low tide periods than at other times of year. Grey seal breeding season occurs from August to December, followed by the annual moult occurs between December and April. During the breeding and moulting season, they will spend longer hauled-out compared to other times of year. Although vessel disturbance could be most detrimental during pupping season, there is evidence that seals are more reluctant to enter the water during the annual moult (Henry and Hammill 2001).

In conclusion, grey and harbour seals hauled out in the Inner Moray Firth, including near the Port of Ardersier, Nigg Energy Park and the Port of Inverness, could be sensitive to vessel disturbance at close range. Alert and flushing behaviours occur when vessels approach within 200–850 m, with flushing more likely below 300 m. However, seals show strong site fidelity and typically return shortly after disturbance, even during vessel activity. Further, seals are less responsive during breeding and moulting, likely due to energy or nursing trade-offs. While disturbance can affect short-term behaviour, there is no evidence of long-term displacement, and responses are highly dependent on distance, vessel type, and time of year. Therefore, the sensitivity of grey seals to disturbance to haul-outs, is classified as **Low** outside of the breeding season and **Medium** during the breeding season. Due to declines in several regional harbour seal populations, this species is considered more vulnerable to pressures, including physical disturbance (SCOS 2022). Therefore, the sensitivity of harbour seal to disturbance during and outside the breeding and moult seasons at haul-outs has been assessed as **Medium.**

3.5.2.5 Minke whale

There are currently limited studies available regarding the effects of vessel disturbance on minke whale. Of the few studies available, minke whale foraging activity has been found to decrease with increased vessel interactions (Christiansen et al. 2013, Sullivan and Torres 2018), exemplified by shorter dives and changes in movement patterns (Christiansen et al. 2013). In addition, by analysing the respiration rate of minke whales, energy expenditure was estimated to be 28% higher during boat interactions, regardless of swim speed. Swim speed was also found to increase with vessel presence and these combined physiological and behavioural changes are thought to represent a stress response. As noise levels were not measured within the study, behavioural responses were therefore related to vessel presence. In addition, when considering the temporal and spatial rates of individuals' exposure over an entire season, there appeared to be no potential for a population-level effect of these acute disturbances (Christiansen et al. 2015). Further study by Christiansen and Lusseau (2015) developed a mechanistic model for minke whales to examine the bioenergetic effects of disturbance from whale watching vessels, specifically on foetal growth. The presence of whale watching vessels resulted in an immediate 63.5% reduction in net energy intake. However, the impact of disturbance was considered to be below the threshold value at which whale watching would have a significant impact on foetal growth as the number of interactions with vessels was low during the feeding season and was, therefore, of negligible impact.

When considering the impacts of whale watching vessels to those likely to occur from construction vessel activities, they cannot be directly transposed, as disturbance effects from whale watching are direct impacts, whilst those from construction activities are indirect, and the vessel types and underwater noise produced are very different. Nevertheless, minke whale are capital breeders and therefore their reproductive success could be affected by disrupted feeding activities (Stephens et al. 2009, Christiansen et al. 2013). Therefore, the sensitivity of minke whales to disturbance from vessel activity is assessed as **Medium.**

3.5.3 Magnitude

Although the presence of vessels and associated noise in the vicinity of the proposed development is not a novel impact for marine mammals in the area, additional vessel movements, and the duration for which vessels are active during construction of the ETF could introduce additional disturbance events to marine mammals above existing baseline levels.

During the construction phase of the proposed development, vessel activity will increase temporarily due to construction activities including dredging, spoil disposal, and the delivery of construction materials. Under a typical construction phase scenario, a maximum of up to eleven vessels may be present at any one time, comprising six vessels for dredging and spoil disposal and up to five barges for material deliveries. However, this represents a conservative estimate assuming complete overlap of activities. In practice, due to construction phasing and scheduling, dredging and spoil disposal are not expected to coincide consistently with barge deliveries, and not all vessels will be active or in transit simultaneously. Under a worst-case scenario it is assumed that peak vessel activity shall occur during spoil disposal operations, which are projected to occur over a 10-week period (70 days) between March and September (sometime between 2027 – 2029). During this phase, up to 13–23 barge movements per day may be required to transport 2,000,000m^3 of dredged material offshore. This results in a maximum of ~450 additional vessel movements within the Inner Moray Firth over a ten-week period, assuming spoil disposal vessels have the capacity to transport and dispose of a maximum 4,500m^3 of material during each movement.

This intensity of movement is short-term but represents a significant temporary increase in marine traffic local to the Ardersier site and spoil disposal areas. The anticipated increase in vessel movements may lead to short-term, localised impacts, particularly relating to increased underwater noise, and a higher risk of disturbance to marine mammals.

3.5.3.1 Harbour porpoise

Based on the literature discussed in 3.5.2.1, it has been shown that short-term avoidance and behavioural responses of harbour porpoise to vessels are significant at distances up to 2 km. As such, a 2 km disturbance range has been used to determine the magnitude of impact (Table 17).

Table 17: Estimated number of animals and the percentage of the MU predicted to be disturbed at any one time by construction vessels

Density (animals/km^2)	Number Impacted	% MU	% UK MU
0.2813	4	<0.001%	<0.001%
0.186	2	<0.001%	<0.001%

Using the 2 km disturbance radii, up to 4 harbour porpoise individuals are anticipated to be disturbed by construction vessels, which equates to <0.001% of the MU and/or UK MU. When considering the impact of disturbance from vessel presence and movement, it is short-term but represents a significant temporary increase in marine traffic local to the proposed development and spoil disposal areas.

Under typical construction conditions, a maximum of five vessels (primarily barges for material delivery) may operate within the area at any one time. These vessel movements are expected to be dispersed and intermittent and are not anticipated to result in significant spatial overlap with areas of highest dolphin activity. Given the low frequency, localised nature, and short-term duration of these transits, the likelihood and extent of interaction with harbour porpoise is low.

As stated in Section 3.4.2.1, during peak construction activity associated with dredging and spoil disposal, up to 11 vessels may be present at any one time, comprising six active in dredging/disposal and five associated with barge operations. While this represents a conservative, worst-case overlap, spoil disposal is anticipated to be the primary driver of vessel activity. Assuming continuous spoil disposal operations (24 hours/day for 70 days) and using an average daily presence estimate of 1.5 DPH across the March–September period, this equates to approximately 105 hours of porpoise presence during the 1,680-hour operational window (70 days × 24 hours). This represents ~6.3% of the total spoil disposal timeframe. Applying this to the estimated 450 vessel movements suggests that roughly 28 movements (450 × 0.063) may occur during periods when harbour porpoises are present.

Given that porpoise detections tend to reflect solitary or small-group behaviour, the number of individuals potentially disturbed per interaction is expected to be low. Further, given the percentage of the MU predicted to be impacted, disturbance effects shall only impact a very small proportion of the population. Further, embedded mitigation measures including a MMMP for dredging and spoil disposal activities, in addition to a NRA, will be in place for all construction-phase vessel activity. These plans will ensure that vessel routes, speeds, and scheduling are coordinated to minimise disturbance, minimise overlap in vessel activity and reduce unnecessary transits.

As such, the magnitude of disturbance from construction vessel activity from the proposed development can be assessed as **Negligible.**

3.5.3.2 Bottlenose dolphins

As stated in Section 3.4.2.2, waters adjacent to the Port of Ardersier are a well-established hotspot for bottlenose dolphin activity within the Moray Firth SAC and wider inner Moray Firth areas.

Under typical construction conditions, a maximum of five vessels (primarily barges for material delivery) may operate within the area at any one time. These vessel movements are expected to be dispersed and intermittent and are not anticipated to result in significant spatial overlap with areas of highest dolphin activity. Given the low frequency, localised nature, and short-term duration of these transits, the likelihood and extent of interaction with bottlenose dolphins is low. As such, potential disturbance is expected to be minimal and unlikely to affect the trajectory of the SAC population. Therefore, the magnitude of impact from vessel disturbance during non-dredging phases of construction is considered to be **Low**.

By contrast, during peak construction activity associated with dredging and spoil disposal, up to 11 vessels may be present at any one time, comprising six active in dredging/disposal and five associated with barge operations. While this represents a conservative, worst-case overlap, spoil disposal is anticipated to be the primary driver of vessel activity. Disposal operations are projected to occur over a 10-week period between March and September (sometime between 2027 – 2029), requiring up to 13–23 barge movements per day and resulting in approximately 450 additional vessel transits across the Inner Moray Firth. This represents a significant, temporary increase in vessel activity within an area known to support consistently high dolphin encounter rates. As stated in Section 3.4.2.2, using a mean group size of 8 individuals (Benhemma-Le Gall and Cheney, 2025), there is expected to be disturbance to an average of 8 individuals (maximum 56) over 66 vessel movements. from spoil disposal activities only. When considering the inclusion of barges for material delivery, this value is likely to increase under the worst-case scenario, indicating the possibility that a moderate number of interactions between vessels and dolphins are likely during this phase.

Although there shall be a predictable and repetitive nature to vessel routing during spoil disposal and material deliveries, the strong spatial and temporal overlap with core dolphin habitat leads to moderate risks of repeated behavioural disturbance to a small portion of the local population, however, it is unlikely to alter its long-term trajectory. The impact will occur over a medium spatial extent, but for a short-term duration. Further, embedded mitigation measures including a MMMP or dredging and spoil disposal activities, in addition to a NRA will be in place for all construction-phase vessel activity. These plans will ensure that vessel routes, speeds, and scheduling are coordinated to minimise disturbance, minimise overlap in vessel activity and reduce unnecessary transits. Therefore, the magnitude of impact vessel disturbance during the dredging phase is considered to be **Medium**.

3.5.3.3 Seals at sea

Although, under a worst-case scenario, material deliveries by barge coinciding with the spoil disposal phase will result in a temporary increase in vessel traffic—up to approximately >450 additional movements over a 10-week period—this increase is short-term, highly localised, and within an area already subject to regular vessel activity. To remain precautionary, the largest observed range of disturbance. Using the 1km disturbance radii, 2 harbour seal (0.18% MU) and 4 grey seal individuals (0.07% MU) are predicted to be disturbed by vessel presence.

When considering the impact of disturbance on seals at-sea from vessel noise, telemetry and observational studies in the Moray Firth have shown that harbour seals exhibit a high degree of tolerance to vessel traffic, with no observed reductions in habitat use or presence near areas of concentrated shipping activity (Mathews et al. 2016, Onoufriou et al. 2016, Jones et al. 2017a, Jones et al. 2017b). While there is limited local data for grey seals, wider evidence suggests similarly low responsiveness to typical vessel disturbance levels (Trigg et al. 2020). Both species continue to use areas in close proximity to ports and shipping lanes despite frequent exposure to underwater noise and vessel presence. Given the low sensitivity of seals to vessel traffic, the short duration and spatial confinement of the construction-related vessel activity, and the absence of expected impacts on population trajectory, the overall magnitude of effect is considered to be **Negligible**.

3.5.3.4 Seals hauled-out

Based on the literature discussed in 3.5.2.4, it has been shown that alert and flushing behaviours of seals occur when vessels approach within 200–850 m, with flushing more likely below 300 m.

Regular site-specific count data have been used to identify monthly and seasonal patterns in haul-out use (see Appendix 11.3). These counts represent the most recent and consistent monitoring effort available for the area and provide a robust basis for understanding seasonal seal presence and evaluating potential impacts. Therefore, for the quantitative assessment of potential disturbance to seals at the Ardersier designated haul-out site, the maximum number of seals recorded hauled-out on any one survey day, during each season, has been used as the primary metric. This approach has been adopted as density data is not typically recorded for seals using haul-out sites. Using maximum seasonal counts allows the assessment to reflect periods of peak site usage, which is particularly relevant for evaluating worst-case disturbance scenarios during sensitive periods such as breeding or moulting. A conservative estimate on the number of seals predicted to be impacted each season, and the percentage MU, is provided in Table 18. As the proportion of each seal species recorded at the Ardersier haul-out site could not be provided, an assumption has been made that all seals counted are classified as either grey or harbour seals. The percentages of the MUs predicted to be impacted reflect this.

Table 18: Estimated number of animals and the percentage of the MU predicted to be disturbed at any one time by construction vessels

Season	Number Impacted	% harbour seal SMU	% grey seal SMU
Spring	196	14.36%	3.64%
Summer	131	9.60%	2.43%
Autumn	50	3.66%	0.93%
Winter	126	9.23%	2.34%

Whilst the estimated number of seals predicted to be disturbed by construction vessels has been based on peak seasonal haul-out counts, representing a conservative, worst-case scenario, it is important to note that these counts were obtained during periods when dredging and port-related construction activities were already occurring within 500 m to 1 km of the haul-out site. This suggests that, to some degree, seals using the Ardersier designated haul-out site are habituated to vessel presence and associated disturbance occurring during the monitoring period. Therefore, the values used in the assessment – assuming all animals respond to the disturbance pathway – likely overestimate the actual number that would be impacted. Furthermore, mitigation measures such as the MMMP and NRA are expected to reduce both the frequency and severity of disturbance events. In combination, these factors support a Low magnitude assessment, reflecting the limited likelihood of significant behavioural disruption**.**

Taking into account the conservative nature of the input data, the effectiveness of embedded mitigation measures, and the likely habituation of seals to vessel traffic and construction activity—given the haul-out site's close proximity to an operational port—the magnitude of impact on both grey and harbour seals is assessed as **Low** across all seasons, including during breeding and moulting periods.

3.5.3.5 Minke whale

In baleen whales, observed changes in foraging behaviour were apparent when whale-watching vessels were within ~250 m of an animal (Sullivan and Torres 2018). This value has been used as a proxy for behavioural responses of minke whales to vessel presence, in the absence of species-specific distances. As such, a 0.25 km disturbance range has been used to determine the magnitude of impact (Table 19).

Table 19: Estimated number of animals and the percentage of the MU predicted to be disturbed at any one time by construction vessels

Density (animals/km^2)	Number Impacted	% MU	% UK MU
0.0116	<1	0.00%	0.00%
0.008	<1	0.00%	0.00%

Using the 2 km disturbance radii, <1 minke whale individuals are anticipated to be disturbed by construction vessels, which equates to <0.001% of the MU and/or UK MU. When considering the impact of disturbance from vessel presence and movement, it is short-term but represents a significant temporary increase in marine traffic local to the proposed development and spoil disposal areas. Given the percentage of the MU predicted to be impacted, disturbance effects shall only impact a very small proportion of the population. Further, embedded mitigation measures including a MMMP for dredging and spoil disposal activities, in addition to a NRA will be in place for all construction-phase vessel activity. These plans will ensure that vessel routes, speeds, and scheduling are coordinated to minimise disturbance, minimise overlap in vessel activity and reduce unnecessary transits.

As such, the magnitude of disturbance from construction vessel activity from the proposed development can be assessed as **Negligible.**

3.5.4 Significance of Effect

The magnitude of the impact is deemed to be Low for all marine mammals except for bottlenose dolphins during the dredging phase, which were assessed as Medium.

The sensitivity of the receptor is Low for all marine mammals except for minke whales which are assessed as Medium sensitivity. For seals at their haul-out sites, the sensitivity is classified as Low outside of the breeding/moult seasons and Medium during the breeding/moult seasons.

It should be noted however, that evidence on specific behavioural responses of marine mammals to construction-phase vessel activity is limited, particularly in relation to repeated barge movements and dredging support vessels. However, existing data suggest responses are typically short-term and context-dependent, with no long-term displacement expected under the proposed scenario.

Taking into account the localised extent and short-term duration of the increased vessel activity (primarily during a 10-week spoil disposal window), alongside the already high baseline vessel traffic in the Inner Moray Firth and embedded mitigation measures (MMMP and NRA), the probability of marine mammal disturbance is high, but the frequency of effect is low due to phasing and non-overlapping activities. The effect will therefore be **Negligible** for all marine mammals except for minke whales, and for bottlenose during the dredging phase, where the impact shall be **Minor.** For seals at their haul-out sites, the significance of the impacts shall be **Negligible** outside of the breeding/moult seasons and **Minor** during the breeding/moult seasons. Each of which are **Non-Significant** in EIA terms.

Table 20: Summary of the impact assessment for disturbance from construction vessels

Species	Magnitude	Sensitivity	Significance
Harbour porpoise	Negligible	Low	Negligible (not significant)
Bottlenose dolphin	Low (Non-dredging phase)	Low	Negligible during non-dredging phase (not significant)
	Medium (Dredging phase)		Minor during dredging phase (not significant)
Seals at sea	Negligible	Low	Negligible (not significant)
Seals hauled-out	Low	Low outside breeding/moult	Outside breeding/moult: Negligible (not significant)
		Medium during breeding/moult	During breeding/moult: Minor (not significant)
Minke whale	Low	Medium	Minor (not significant)

3.5.5 Secondary Mitigation

The embedded primary mitigation includes an MMMP and a NRA.

No additional marine mammal mitigation is considered necessary because the likely effect is not significant in EIA terms.

3.5.6 Residual Effect

As no additional mitigation commitments are required, the residual effect remains **Non-Significant** in EIA terms.

3.6 Collision risks associated with increased vessel traffic

3.6.1 Sensitivity

Vessel movements during construction of the proposed development have the potential to cause injury and/or mortality to marine mammals. This includes vessels involved in all stages of dredging, including movements of spoil disposal vessels from the extraction site to spoil disposal grounds also present collision risks for marine mammals.

Harbour porpoise, bottlenose dolphin, grey seal and harbour seal are highly mobile and agile and have been observed to respond to vessel noise (e.g. propellors, thrusters, geophysical survey equipment) (Erbe et al. 2019). These species are therefore likely to be able to detect nearby vessels and move out of the 'zone of influence' and the path of the vessel, thus avoiding collision, although this is dependent on the vessel movement being predictable (Nowacek et al. 2001, Lusseau et al. 2009). In a study in the Moray Firth seals were shown to utilise the same areas as vessels when moving between foraging sites and haul-outs but tended to remain beyond 20 m from vessels with only three instances of seals coming within 20 m of vessels over 2,241 days (Onoufriou et al. 2016).

Larger and less agile species, such as minke whales, may be less able to avoid moving vessels. Vessel strikes are a documented source of injury and mortality for baleen whales, and the risks of collision and likelihood of severe injury or mortality are highest with vessel speeds over 11 knots (Vanderlaan & Taggart 2007). Baleen whales are particularly vulnerable to vessel strike when resting or feeding, and studies have reported seasonal changes in collision rates with increased collision risk during months with high foraging activity (Laist et al. 2001, Panigada et al. 2006). Calves and juvenile animals are more vulnerable to collision compared to adult whales (Lammers et al. 2013), however, areas within the Inner Moray Firth and surrounding the Port of Ardersier are not known for their prevalence of minke whale juveniles or calves.

If collision occurs, it may result in serious injury to marine mammal (beyond recovery) or sudden death. Therefore, the sensitivity of marine mammals to vessel collisions is considered to be **High.**

3.6.2 Magnitude

Given the proximity of the Port of Ardersier to other active ports (e.g. Port of Cromarty Firth and the Invergordon Service Base, and the Nigg Energy Park) within the Inner Moray Firth, the area within and surrounding the Port of Ardersier already experiences a high density of commercial vessel traffic (see Section 3.5).

During construction of the proposed development, there is a risk that increased vessel activity could result in physical trauma from collision with a construction vessel. These injuries include blunt trauma to the body, or injuries consistent with propeller strikes. The risk of collision of marine mammals with vessels would 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.

There is currently a lack of information on the frequency of occurrence of vessel collisions as a source of marine mammal mortality, and there is little evidence from marine mammals stranded in the UK and Ireland that injury from vessels is an important source of mortality. The Scottish Marine Animal Stranding Scheme documents the annual number of reported strandings and the cause of death for those individuals examined at post-mortem. The SMASS data shows that very few strandings have been attributed to vessel collisions ((SMASS 2018, 2019, 2020, 2021, 2022, 2023), 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.

Predictability of vessel movement by marine mammals is known to be a key aspect in minimising the potential risks imposed by vessel traffic. The embedded mitigation of a NRA will ensure that vessel traffic moves along predictable routes, set recommended speed and define how vessels should behave in the presence of marine mammals.

During the dredging period between March and September (sometime between 2027 – 2029), it is estimated that a maximum of one of either a cutter suction dredger (CSD) or trailer suction hopper dredgers (TSHD) will be actively dredging on site at any given time. In addition, up to four disposal vessels will be on site, transiting between the dredging site and the spoil disposal site (at Burgheaddisposal area). Disposal vessels shall comprise of a combination of self-propelled split hopper barges (SHB) and TSHD. The majority of construction vessels will be large, with typical lengths ranging from 101.5 – 138.5 m for the CSD, and between 80 – 99.5 m and 89 – 97.5 m for the SHB and TSHD, respectively.

During the construction phase of the proposed development, and in addition to the temporary increase in vessels during dredging and spoil disposal, up to five additional barges are expected for construction material deliveries. In practice, full overlap of these activities is not expected due to phasing and scheduling. However, under a worst-case scenario, peak vessel activity is expected to occur during spoil disposal operations between April and September (sometime between 2027 – 2029), with up to 13-23 barge movements per day, resulting in a maximum of approximately 450 additional vessel movements within the inner Moray Firth over a ten-week period.

The likelihood of a vessel strike involving marine mammals can be influenced by vessel-specific factors such as size, draft, and speed (Schoeman et al. 2020). Larger vessels are considered to pose a greater risk due to their deeper drafts, which increase the potential strike zone. However, vessel speed may be a more significant factor in influencing the probability and severity of a collision (Todd et al. 2015). While dredging operations themselves will typically involve stationary or very slow-moving vessels (1 – 3 knots), the vessels associated with this project are capable of reaching speeds of up to 12 knots when in transit, with typical transit speeds of around 10 knots during spoil disposal. Due to the already high-volume vessel traffic within the inner Moray Firth (with vessel movements in some areas exceeding 500 movements/km^2 in 2024 Figure 7), the introduction of additional construction vessels during the port exptension is not a novel impact for marine mammals present in the area. Further, during spoil disposal, there is a potential risk of spoil material being deposited on top of a marine mammal at a disposal site, which could result in serious physical harm or fatality. However, this risk is considered negligible due to embedded mitigation measures outlined in the MMMP and NRA, such a marine mammal search period prior to spoil disposal.

Although vessel movements will occur across a medium extent, the potential impact will be localised to the immediate vicinity of the moving vessels. This potential impact may occur throughout the construction period for a short-term duration. The adoption of a NRA during construction will minimise the likelihood of vessel collisions with marine mammals. As such, the overall risk of a collision occurring is highly unlikely; if it were to occur, it would be at low frequency, and it is not expected to impact enough individuals to alter the population trajectory. As such, the magnitude of the risk of vessel collisions is **Negligible**.

3.6.3 Significance of Effect

Taking the **Negligible** magnitude of impact and **High** sensitivity of marine mammals, the overall effect of risk associate with vessel collisions during the construction is considered to be **Negligible** and **Not Significant** in EIA terms.

Species	Magnitude	Sensitivity	Significance
Harbour porpoise	Negligible	High	Negligible (Non-significant)
Bottlenose dolphin	Negligible	High	Negligible (Non-significant)
Harbour seal	Negligible	High	Negligible (Non-significant)
Grey seal	Negligible	High	Negligible (Non-significant)
Minke whale	Negligible	High	Negligible (Non-significant)

3.6.4 Secondary Mitigation

The embedded mitigation includes the commitment to NRA, which describes current guidance such as the Scottish Marine Wildlife Watching Code, that vessels need to adhere to in order to minimise the risk of collision.

Following application of this embedded measure, the effect of risk of vessel collisions is considered to be **Not Significant** in EIA terms. Therefore, no secondary mitigation is required.

3.6.5 Residual Effect

The overall effect of vessel collisions during construction is **Minor** and **Not Significant** in EIA terms.

3.7 Indirect impacts on prey availability

The activities associated with construction which could give rise to indirect impacts by affecting prey availability are: increases in underwater noise associated with piling, impacts of contaminants and sediment suspension as a result of dredging, and pollution events from the accidental release of hydraulic fluids and oils from the construction plant into the marine environment. Suspended sediments resulting from dredging activity can impact prey availability by reducing the ability of fish to feed and altering fish habitat preferences (Wenger et al. 2013, Wenger and McCormick 2013, as referenced in Todd et al. 2015). The suspended sediment can also cause gill damage in fish (Herbert and Merkens 1961, Lake and Hinch 1999, Au et al. 2004, Wong et al. 2013, as referenced in Todd et al. 2015). Any change in sediment structure can cause non-mobile organisms to be smothered by sediment, potentially reducing prey for certain fish species and having a cascading trophic effect whereby prey availability is reduced for marine mammals (Todd et al. 2015). Additionally, fish and cephalopods are vulnerable to chemical contaminants which may be released by dredging and other construction activities, and may exhibit behavioural and physiological changes in response to noise exposure associated with construction (Todd et al. 2015).

A summary of the marine mammal prey species is provided in Table 20, with key species that make up the majority of the diet in bold. Sandeels are of particular importance to harbour porpoise, grey seal, harbour seal and minke whales, and cod, saithe and whiting are the main prey items eaten by bottlenose dolphins in Scottish waters (Santos et al. 2001, Pierce et al. 2004, Santos et al. 2004, Wilson and Hammond 2019). Salmon are also a seasonally important component of the bottlenose dolphin diet, with the presence of bottlenose dolphins in the summer months coinciding with seasonal migrations of Atlantic salmon and sea trout through the Moray Firth (NatureScot 2025). The Nairn District Salmon Fisheries Board advise that the Port of Ardersier lies in close proximity to the River Nairn, which is an important river for migratory salmonids (salmon and sea trout), and as such it is likely that migratory fish travel close to the proposed works location while seeking their natal river (MD-LOT 2025). The Moray Firth is also an important habitat for sandeels, sprat and herring (NatureScot 2025), where sandeels are found in coarse sand with low silt content between 20-60 m depth (Wright et al. 2000, Macleod et al. 2004, Holland et al. 2005, NatureScot 2025) and herring lay eggs directly onto the seabed with a preference for coarse sand, gravel, shells and small stones (NatureScot 2025). As a result of the importance of seabed habitat for these species, both are vulnerable to impacts resulting from dredging activities.

Table 21: Prey species of the marine mammals present in the Moray Firth. Key species which make up the majority of the diet are in bold.

Receptor	Site	Key Prey Species	Reference
Harbour porpoise	Scotland	**Whiting**, **sandeel**, small cod (*Trisopterus* spp.), blue whiting, cod, haddock, saithe, rocklings, gobies, herring, sprat, mackerel, scad, cephalopods, molluscs, brown shrimp, crabs, isopods, amphipods, other crustaceans	Santos et al. (2004)
Bottlenose dolphin	British Isles & Ireland	Sandeel, **cod**, **saithe**, **whiting**, catsharks, sprat, scad, conger eel, Atlantic salmon, blue whiting, haddock, Norway pout, pout, small cod, silvery cod, ling, hake, Atlantic horse mackerel, Atlantic mackerel, gobies, sand smelt, lanternfish, flounder, plaice, dab, brill, sole, various squid, and octopus sp.	Santos et al. (2001), Hernandez-Milian et al. (2015)
Grey seal	Scotland	Saithe, whiting, cod, haddock, rockling, ling, blue whiting, hake, pollock, Norway pout, small cod, plaice, lemon sole, **sandeel**, dover sole, dab, herring, sprat, mackerel, salmonid, wrasse, catfish	Hammond and Wilson (2016), Wilson and Hammond (2019)

Harbour seal	British Isles	Lamprey, eels, herring, salmonids, haddock, pollock, saithe, whiting, blue whiting, Norway pout, poor cod, bib, rockling, ling, hake, perch, scad, wrasse, **sandeel**, goby, mackerel, flounder, dab, sole, witch, halibut, and squid sp.	Gosch et al. (2014), (Wilson and Hammond 2019)
Minke whale	British Isles	**Sandeel**, herring, sprat, mackerel, goby, Norway pout / poor cod	Pierce et al. (2004)

3.7.1 Sensitivity

Marine mammals are highly mobile and wide-ranging, and therefore if any interruption to prey availability occurs, it is expected that marine mammals will have a high level of adaptability in terms of being able to switch to an alternate prey source or foraging location, a high level of tolerance in terms of being able to tolerate short periods without access to prey, and a high level of recoverability in terms of replenishing lost energy by increasing foraging. However, there can still be some energetic cost, particularly if the increased time spent searching for alternate prey sources and foraging reduces the time available for activities such as resting or reproduction (Ransijn 2023).

In the Moray Firth, sandeels are a key prey species in the diet of harbour porpoise, bottlenose dolphin, seals, and minke whales (Hammond et al. 1994, Thompson et al. 1996, Brown and Pierce 1998, Santos et al. 2001, Pierce et al. 2004, Santos et al. 2004, Wilson and Hammond 2019). In a study on harbour porpoise stranded in Scottish waters, Santos et al. (2004) found that whiting and sandeels comprised approximately 80% of the diet. Similarly, a diet study on the stomach contents of stranded minke whales in Scottish waters showed sandeels were the most important prey species and contributed two-thirds of the diet (Pierce et al. 2004). Sandeels dominate the autumn and winter diet of grey seals in Scottish waters and are dominant in harbour seal scrats across all seasons (Wilson and Hammond 2019, Scottish Government 2023). The Moray Firth SAC Conservation and Management Advice report (NatureScot 2025) recommends that developers should *"reduce or limit pressures (loss of prey) that have the potential to damage, reduce, or loss habitat of key prey species (particularly sandeel)."* Although most of the marine mammals assessed here are likely able to supplement their diet with other species when required, studies in the southern outer Moray Firth found that minke whale distribution was positively correlated with areas of sandy-gravel sediments which represent suitable sandeel habitat (Robinson et al. 2009). As large, migratory baleens, minke whales are therefore more vulnerable to having to move to different areas in search of prey which may impact their energy stores required during migration, and are expected to be more sensitive to prey disruption in key foraging areas such as the Southern Trench MPA. However, the inner Moray Firth, including the dredging and dump sites, are not considered key minke foraging areas and as a result overall sensitivity is low in this area. Therefore, the sensitivity of marine mammals to indirect impacts on prey availability is assessed as **Low.**

3.7.2 Magnitude

Activities relating to the construction of the proposed development may influence water quality as a result of sediment disturbance and the accidental release of fuels, oils and/or hydraulic fluids. Sediment disturbance could also lead to the release of chemical contaminants and organic hydrocarbons into the marine environment. Each impact could have indirect implications on marine mammal prey availability. Additionally, the underwater noise associated with construction activities, particularly piling, has the potential to disturb prey populations and may result in temporary changes in prey behaviour or distribution.

3.7.2.1 Accidental release of fuels, oils and/or hydraulic fluids

With regards to the accidental release of fuels, oils and/or hydraulic fluids, the impact of pollution is associated with the construction of infrastructure and use of supply/service vessels, which may lead to a reduction in prey availability affecting marine mammal survival rates. However, with implementation of an appropriate POEMP and Port Oil Spill Contingency Plans (see EIAR Chapter 11 (Marine Mammals)), a major incident that may impact any fish species at a population level is considered very unlikely, as these impacts are expected to be localised and short-lived. The impact of the accidental release of fuels, oils and/or hydraulic fluids is therefore considered not significant in EIA terms when considering its impact on marine mammal prey items and was **scoped out** of the marine mammal assessment within the EIA Scoping Report (SCOP-0062).

3.7.2.2 Sediment disturbance and fish habitat loss

When considering sediment disturbance, dredging and dumping works are the most likely contributor to sediment disturbance and thus, increased turbidity. The risks of sediment disturbance and fish habitat loss are particularly relevant to demersal spawning species present in the Moray Firth, such as herring and sandeels. Sandeels are highly substrate-specific spawners and spend a large amount of time buried in the sediment, with specific requirements in terms of the silt content of the sediment. They are absent in substrates with a silt content greater than 10% (Wright et al. 2000, Holland et al. 2005). Their eggs remain attached to the seabed during development. However, sandeel eggs are expected to be tolerant to increased sediment deposition and smothering, due to the common resuspension and deposition events which occur in their natural high energy environment. Herring are a mobile species with the capacity to avoid unfavourable areas, but nonetheless rely on the substrate for spawning and sediment deposition could potentially smother herring eggs and disrupt the development of larvae. When considering the material to be dredged as part of the proposed development, it is expected to be predominantly composed of undisturbed sands and gravels (EnviroCentre Limited 2024). The sand component is expected to remain suspended for a longer time than the gravel component, but the effects are expected to be temporary and localised due to the short duration of dredging activity (~4 months). As a result of the short duration of dredging activity and the minimal impacts of increased sediment deposition on fish prey species present in the area, marine mammals are not expected to have reduced access to prey. The impact magnitude of sediment suspension impacting prey availability is therefore assessed as **Negligible.**

3.7.2.3 Release of contaminants from the sediment

As part of historic capital and maintenance dredging campaigns, sediment samples of the material to be dredged have previously been collected and tested against the Revised Action Levels (RAL) criteria as adopted by Marine Scotland. These tests assess the presence of metals, tributyl tin (TBT), polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and total hydrocarbons (THC content) to evaluate the chemical quality of dredged material and its potential impact on the marine environment when considering sea disposal options. Overall, there has been low levels of chemical contaminants and organic hydrocarbons present in the dredged sediments and they have previously been identified as suitable for disposal (EnviroCentre Limited 2024). Whilst a BPEO has not yet been concluded for the dredging activities as part of the proposed development, any future BPEO that is authored for the proposed development shall take the appropriate measures to ensure that dredged materials meet acceptable environmental standards. Thus, the impact magnitude of the accidental release of chemical contaminants and/or organic hydrocarbons impacting prey availability is expected to be **Negligible**.

3.7.2.4 Underwater noise

Fish species are generally sensitive to lower frequency sounds, such as the frequency profile which may be produced by dredging (Popper et al. 2003, Popper and Fay 2011, as referenced in Todd et al. 2015) and some species, such as cod, avoid low-frequency vessel noise and/or vessels themselves (Mitson 1995, Mitson and Knudsen 2003, De Robertis and Wilson 2011, as referenced in De Robertis and Handegard 2013) (Handegard et al. 2003, as referenced in Todd et al. 2015). Cephalopods may respond to the particle motion of low-frequency sound with altered breathing rhythms and movement or induced acoustic trauma and damage to sensory organs (Packard et al. 1990, Mooney et al. 2010, Solé et al. 2013, as referenced in Todd et al. 2015).

In addition, fish in close proximity to pile driving can suffer physical injuries such as swim bladder rupture or internal bleeding due to rapid pressure changes (Popper et al. 2014). For example, intense impulsive noise from pile driving can lead to Temporary Threshold Shift (TTS**)** or PTS in fish, and salmonids, such as Atlantic salmon (*Salmo salar*), present in the North Sea, are particularly sensitive to low-frequency impulsive sounds and may be vulnerable during migration period (Gillson et al. 2022). Fish may also exhibit avoidance behaviour, moving away from pile driving activity, potentially leading to disruption of migration, spawning, or feeding (Slabbekoorn et al. 2010), however, environmental assessments conducted for offshore wind developments in the North Sea have predicted that while localised impacts on fish may occur during piling, population-level effects are unlikely due to mitigation (e.g., soft-start procedures) and spatial avoidance (MMO 2014).

Although the temporary and localised exposures to noise associated with construction activity at the proposed development are unlikely to have any long-lasting effects on the fitness and survival of fish and cephalopods, the noise associated with construction activity may cause temporary relocation, communication making, and changes in behaviour of marine mammal prey species (Todd et al. 2015). The impact magnitude of the underwater noise associated with construction impacting prey availability is therefore expected to be **Negligible.**

3.7.2.5 Summary

It is expected that there would be no significant impact on the distribution or quality of marine mammal prey species as a result of the construction activities. As such it is highly likely that impacts to prey species would result in only very slight or imperceptible changes to marine mammal receptors, and it is expected that this will not result in any population level change. Therefore, indirect impacts on marine mammals via changes in prey availability during construction are most likely to be of **Negligible** magnitude.

3.7.3 Significance of Effect

The magnitude of impact is assessed as negligible for all marine mammal receptors and the sensitivity is assessed as **Low** for all receptors. The effect is therefore of **Negligible** significance, and the impact is **Non-significant** in EIA terms (Table 21.

Table 22: Summary of indirect impacts on prey availability to marine mammals during the construction phase.

Receptor	Magnitude	Sensitivity	Significance
Harbour porpoise	Negligible	Low	Negligible (not significant)
Bottlenose dolphin	Negligible	Low	Negligible (not significant)
Grey seal	Negligible	Low	Negligible (not significant)
Harbour seal	Negligible	Low	Negligible (not significant)
Minke whale	Negligible	Low	Negligible (not significant)

3.7.4 Secondary Mitigation

No additional marine mammal mitigation is considered necessary because the likely effect in the absence of further mitigation is not significant in EIA terms.

3.7.5 Residual Effect

The overall effect of indirect impacts to prey species during construction is **Negligible** and **Not Significant** in EIA terms.

4 Operations & Maintenance Phase

4.1 Collision risks associated with increased vessel traffic

4.1.1 Sensitivity

The sensitivity of marine mammals to vessel collision risks is considered to be the same as that presented for construction (see Section 3.6.1). Therefore, the sensitivity of marine mammals from vessel collisions is classified as **High** for all marine mammals.

4.1.2 Magnitude

As discussed in Section 3.6.1 for construction, vessel activity during the operational phase could result in physical trauma on marine mammals from collisions with vessels. The risk of vessel collisions is influenced by the vessel type of speed (Laist et al. 2001) and indirectly by ambient noise levels underwater and marine mammal behaviour. Predictability of vessel movement by marine mammals is known to be a key aspect in minimising the potential risks imposed by vessel traffic, as it allows marine mammals to better anticipate and avoid vessels (Nowacek et al. 2001, Lusseau 2006, New et al. 2020). The adoption of a NRA based on best practice vessel handling protocols (e.g., following the Scottish Marine Wildlife Watching Code) will minimise the potential for any impact by ensuring that vessel traffic moves along predictable routes, setting recommended speed and defining how vessels should behave in the presence of marine mammals.

Vessel traffic during the operational phase is anticipated to be 400 vessel calls per year as a maximum worst-case scenario (Haventus 2025), which is an increase of ~60 vessels per year compared to current levels. The types of vessels expected to operate from the Port of Ardersier are primarily large vessels servicing offshore industries, including:

- Heavy Load Carriers (>150 m): 7 different vessel types arriving on-site, in total, per year; number of movements unknown
- Heavy Lift Vessels (>100 m): 4 different vessel types arriving on-site, in total, per year; number of movements unknown
- Jack-up Barges (>80 m): 7 different vessel types in total, number of movements unknown
- General Cargo Vessels (>140 m): 2 different vessel types arriving on-site, in total, per year; number of movements unknown
- Bulk Carrier (150 m): 1 vessel type arriving on-site, in total, per year; number of movements unknown
- Semi-submersible (137 m): 1 vessel type arriving on-site, in total, per year; number of movements unknown

While some of the vessels expected to operate are capable of reaching speeds up to 13 knots, most are expected to transit at typical speeds around 10 knots. Vessel activity levels will be sustained over a long-term duration (50 years), however, the increase in traffic is not considered a novel impact due to the already high volumes of vessel movements in the inner Moray Firth (see Figure 7 & Figure 9).

Although vessels may transit over a broad geographical area (e.g., from the port to offshore wind farm sites), the physical risk of collision is localised to the immediate vicinity of the moving vessel. The implementation of a NRA during the O&M phase will further minimise the potential for the collisions to take place. Following the application of embedded mitigation, the risk of a collision occurring is unlikely and if it occurs, it would be at a very low frequency, and it is not expected to impact enough individuals to alter the population trajectory. The magnitude of vessel collisions during O&M is assessed as **Negligible.**

4.1.3 Significance of Effect

Taking the **High** sensitivity and the **Low** magnitude of impact, the overall effect of risk associated with vessel collisions during O&M is considered to be **Minor** and **Not Significant** in EIA terms.

Table 23: Summary of the impact assessment for collision risk from O&M vessels

Species	Magnitude	Sensitivity	Significance
Harbour porpoise	Negligible	High	Negligible (Non-significant)
Bottlenose dolphin	Negligible	High	Negligible (Non-significant)
Harbour seal	Negligible	High	Negligible (Non-significant)

Grey seal	Negligible	High	Negligible (Non-significant)
Minke whale	Negligible	High	Negligible (Non-significant)

4.1.4 Secondary Mitigation

The embedded mitigation includes the commitment to NRA. Following application of this embedded measure, the effect of risk of vessel collisions for all species is considered to be **Not Significant** in EIA term. Therefore, no secondary mitigation is required.

4.1.5 Residual Effect

The overall effect of vessel collisions during O&M is **Negligible** and **Not Significant** in EIA terms.

4.2 Disturbance associated with increased vessel traffic, including to seal haul-out sites

4.2.1 Sensitivity

4.2.1.1 All marine mammals (including seals at-sea)

The sensitivity of marine mammals to vessel disturbance will be species dependent. The sensitivity is considered to be the same as that presented for construction (see Sections 3.5.2.1 – 3.5.2.4). Therefore, the sensitivity to disturbance from vessel activity is therefore classified as **Low** for all marine mammals, with the exception of minke whales which are considered to have **Medium** sensitivity to vessel disturbance.

4.2.1.2 Seal haul-out sites

The sensitivity is considered to be the same as that presented for construction (see Sections 3.4.1.4 & 3.5.2.4). Therefore, the sensitivity of grey seals to disturbance to haul-outs, is classified as **Low** outside of the breeding season and **Medium** during the breeding season. Due to declines in several regional harbour seal populations, this species is considered more vulnerable to pressures, including physical disturbance (SCOS 2022). Therefore, the sensitivity of harbour seal to disturbance during and outside the breeding and moult seasons at haul-outs has been assessed as **Medium.**

4.2.2 Magnitude

The area surrounding the proposed development is already subject to high levels of vessel activity. As outlined in Section 4.1.2, the Port of Ardersier currently experiences approximately ~340 vessel movements per year (Haventus 2025).

During the operational phase of the proposed development, there are anticipated to be a maximum of 400 vessel calls per year as a worst-case scenario (Haventus 2025) representing an increase of ~60 additional vessel calls from current annual movements. The anticipated traffic would primarily consist of large vessels servicing offshore industries.

The expected vessel types and numbers are discussed in Section 4.1.1. These vessel types vary in size and noise output, which can influence the potential for disturbance, as described in Section 3.5. However, the Inner Moray Firth, including the vicinity of the Port of Ardersier, is an area where marine mammals are regularly exposed to commercial vessel activity. Given the existing baseline of high traffic, the increased vessel movements are not considered a novel source of disturbance. Animals in the area, including cetaceans and pinnipeds, are likely to exhibit some degree of habituation to vessel noise and presence. Although the frequency of potential disturbance events is predicted to increase to a moderate level, depending on seasonal animal presence and the timing and routing of vessel transits, the spatial extent remains localised. While a small proportion of individuals may be affected at any one time, the impact is not anticipated to result in long-term changes to population trajectories. The anticipated number of individuals predicted to be impacted by vessel disturbance shall be synonymous with those described in Section 3.5.3.

Table 24: Summary of predicted number of individuals to be impacted by vessel disturbance during operations and maintenance

Species	EDR	Number disturbed	% MU
Harbour porpoise	2 km	4	<0.001%
Bottlenose dolphin	1 km	8 (mean group size)	3.4%
Seals at sea	1 km	2 harbour seals 4 grey seals	0.18% - harbour seals 0.07% - grey seals
Seals hauled-out	NA	50-196 (depending on season)	Harbour seal: 3.7 – 14.4 % Grey seal: 0.93 – 3.64%
Minke whale	0.25 km	<1	<0.001%

Further, to minimise potential impacts, a NRA will be implemented during operations and maintenance. The NRA will include routing protocols, speed restrictions, and awareness training for crews, thereby reducing the likelihood of high-risk interactions with marine mammals.

Taking into account the existing high vessel traffic baseline; the negligible increase in vessel movements; the implementation of mitigation through a NRA; and the anticipated habituation of animals in the area, the magnitude of impact is assessed as **Negligible**.

4.2.3 Significance of Effect

The magnitude of the impact is deemed to be Low. The sensitivity of the receptor is Low for all marine mammals except minke whales which are assessed as Medium sensitivity. For seals at their haul-out sites, the sensitivity is classified as Low outside of the breeding/moult seasons and Medium during the breeding/moult seasons.

The effect will therefore be **Negligible** for all marine mammals except minke whales, which the impact shall be **Minor.** For seals at their haul-out sites, the significance of the impacts shall be **Negligible** outside of the breeding/moult seasons and **Minor** during the breeding/moult seasons. Each of which are **Non-Significant** in EIA terms.

Table 25: Summary of the impact assessment for disturbance from operational and maintenance vessel traffic

Species	Magnitude	Sensitivity	Significance

Harbour porpoise	Negligible	Low	Negligible (not significant)
Bottlenose dolphin	Negligible	Low	Negligible (not significant)
Seals at sea	Negligible	Low	Negligible (not significant)
Seals hauled-out	Negligible	Low outside breeding/moult Medium during breeding/moult	Outside breeding/moult: Negligible (not significant) During breeding/moult: Negligible (not significant)
Minke whale	Negligible	Medium	Negligible (not significant)

4.2.4 Secondary Mitigation

The project has already committed to the adoption of an NRA, and no additional mitigation measures are required to reduce the significance of the impact.

4.2.5 Residual Effect

As no additional mitigation commitments are required, the residual effect remains **Non-Significant** in EIA terms.

4.3 Indirect impacts on prey availability

4.3.1 Sensitivity

The sensitivity is considered to be the same as presented for construction (see Section 3.7.2). Therefore, the sensitivity to indirect impacts on prey availability is classified as **Low** for all marine mammals.

4.3.2 Magnitude

Activities relating to the operations of the proposed development may influence water quality as a result of accidental release of fuels, oils and/or hydraulic fluids.

With regards to the accidental release of fuels, oils and/or hydraulic fluids, the impact of pollution is associated with the construction of infrastructure and use of supply/service vessels may lead to a reduction in prey availability which may affect species' survival rates. However, with implementation of an appropriate POEMP and Port Oil Spill Contingency Plans, a major incident that may impact any species at a population level is considered very unlikely. The impact of the accidental release of fuels, oils and/or hydraulic fluids is therefore **Negligible** when considering its impact on marine mammal prey items.

4.3.3 Significance of Effect

The magnitude of the impact is deemed to be **Negligible**. The sensitivity of the receptor is **Low** for all marine mammals. Therefore, the effect of indirect impacts on prey is considered to be **Negligible** for all receptors and **Non-significant** in EIA terms.

Table 26: Summary of indirect impacts on prey availability to marine mammals during the O&M phase.

Receptor	Magnitude	Sensitivity	Significance
Harbour porpoise	Negligible	Low	Negligible (not significant)
Bottlenose dolphin	Negligible	Low	Negligible (not significant)
Grey seal	Negligible	Low	Negligible (not significant)
Harbour seal	Negligible	Low	Negligible (not significant)
Minke whale	Negligible	Low	Negligible (not significant)

4.3.4 Secondary Mitigation

No additional marine mammal mitigation is considered necessary because the likely effect in the absence of further mitigation is not significant in EIA terms.

4.3.5 Residual Effect

The overall effect of indirect impacts to prey species during construction is Negligible and Not Significant in EIA terms.

4.4 Long term habitat changes, displacement and/or barrier effects

This section assesses the potential for long-term barrier effects on marine mammals resulting from the operation of the proposed development . Barrier effects refer to the disruption of regular movement or migration routes due to physical or behavioural avoidance of anthropogenic structures or activities, potentially affecting access to foraging, breeding, or resting habitats.

4.4.1 Sensitivity

As aforementioned, despite ongoing port and harbour operations and vessel activity, bottlenose dolphins and seals continue to be regularly sighted in the Inner Moray Firth, and long-term surveys indicate continued and regular use by dolphins and seals. This suggests that the presence of coastal industrial structures and increased vessel activity have not created permanent or large-scale movement barriers (Cheney et al. 2018, Hague et al. 2019, Cheney et al. 2024, Benhemma-Le Gall and Cheney 2025). As disturbance associated with increased operational vessel traffic is likely the primary source of habitat change, displacement or long-term barrier effects, it can be assumed that the sensitivity of marine mammals here shall be synonymous with those described in Section 0. As such, sensitivity of the receptor is **Low** for all marine mammals except minke whales which are assessed as **Medium** sensitivity. For seals at their haul-out sites, the sensitivity is classified as **Low** outside of the breeding/moult seasons and **Medium** during the breeding/moult seasons.

4.4.2 Magnitude

The proposed development is situated in a coastal environment within the inner Moray Firth, within the Moray Firth SAC designated for bottlenose dolphins, and adjacent to the Ardersier (Whiteness Sands) seal haul-out site designated site the Marine (Scotland) Act 2010. Bottlenose dolphins in this region are known to show high site fidelity and regularly use specific coastal corridors, such as the narrow channel between Chanonry Point, Ardersier, and Fort George (Cheney et al. 2013, Benhemma-Le Gall and Cheney 2025). Harbour and grey seals are known to haul out at the Ardersier (Whiteness Sands) seal-haul out site which overlaps with the proposed development, and harbour porpoise have also been reported as present within the Inner Moray Firth (see Appendix 11.3 for full details).

Although situated in a coastal environment within the inner Moray Firth, the proposed development will not obstruct the Chanonry Point–Fort George–Ardersier channel. All new operational structures associated with the Port of Ardersier are either land-based or positioned within the existing port envelope and inner harbour. While some temporary displacement during operational vessel activity is expected (Section 4.2.1), this will be spatially and temporally limited, with no evidence suggesting permanent habitat loss for marine mammals.

There is limited evidence suggesting that coastal port infrastructure such as breakwaters, jetties, or quays causes long-term displacement or movement disruption to marine mammals. For example, Nigg Energy Park and the Invergordon Service Base have undergone significant port extension, allowing for the fabrication and storage offshore wind turbine structures, the mooring of oil & gas platforms, and the berthing of large vessels such as cruise liners. Despite ongoing operations and vessel activity, marine mammals continue to be regularly sighted in the Inner Moray Firth, including around Nigg Energy Park, Invergordon and the Port of Ardersier (Graham et al. 2017b, Benhemma-Le Gall and Cheney 2025). Long-term surveys in the Moray Firth indicate continued and regular use by dolphins and seals, suggesting that the presence of coastal industrial structures and increased vessel activity have not created permanent or large-scale movement barriers (Cheney et al. 2018, Hague et al. 2019, Cheney et al. 2024, Benhemma-Le Gall and Cheney 2025).

This body of evidence supports the conclusion that marine mammals can continue to use industrialised port areas where movement corridors are preserved and activities are spatially predictable. All operational infrastructure is confined to land or the existing port envelope, avoiding key marine mammal movement corridors such as the Chanonry Point–Fort George–Ardersier channel. While minor, temporary displacement during vessel activity may occur, such effects are spatially and temporally limited and very unlikely to occur at a frequency that would influence population dynamics. Evidence from similar nearby developments shows continued and regular presence of marine mammals despite ongoing industrial activity, indicating no lasting displacement or behavioural change. The extension is not expected to result in any perceptible change to local marine mammal populations or alter their long-term population trajectory and as such, the magnitude of any long-term barrier effect is assessed as **Negligible.**

4.4.3 Significance of Effect

The sensitivity of the receptor is Low for all marine mammals except minke whales which are assessed as Medium sensitivity. For seals at their haul-out sites, the sensitivity is classified as Low outside of the breeding/moult seasons and Medium during the breeding/moult seasons.

The magnitude of the impact is deemed to be Negligible.

The effect will therefore be **Negligible** to **Minor** for all marine mammals**.** For seals at their haul-out sites, the significance of the impacts shall be **Negligible** outside of the breeding/moult seasons and **Minor** during the breeding/moult seasons. Each of which are **Non-Significant** in EIA terms.

Table 27: Summary of the impact assessment for disturbance from long term habitat changes, displacement and/or barrier effects

Receptor	Magnitude	Sensitivity	Significance
Harbour porpoise	Negligible	Low	Negligible (not significant)
Bottlenose dolphin	Negligible	Low	Negligible (not significant)
Grey seal	Negligible	Low (outside breeding/moult	Negligible (not significant) outside breeding/moult
		Medium (during breeding/moult)	Minor (not significant) during breeding/moult
Harbour seal	Negligible	Low (outside breeding/moult	Negligible (not significant) outside breeding/moult
		Medium (during breeding/moult)	Minor (not significant) during breeding/moult
Minke whale	Negligible	Medium	Minor (not significant)

4.4.4 Secondary Mitigation

The project has already committed to the adoption of an NRA, and no additional mitigation measures are required to reduce the significance of the impact.

4.4.5 Residual Effect

As no additional mitigation commitments are required, the residual effect remains **Non-Significant** in EIA terms.

5 Cumulative Effects

5.1 Marine Mammal CEA Methodology

Effects of the proposed development alone are generally spatially restricted to the inner harbour area, however, certain impacts have the potential to be observed over a wider area in the inner Moray Firth. These cumulative effects are the effects of the proposed development, combined with the effects from other projects, on the same receptor or group of receptors. Chapter 14 (Cumulative) details how potential cumulative effects will be assessed for the proposed development through a CEA. A CEA screening process has identified the relevant other plans, projects, and activities which are to be included in the assessment. These other plans or projects may present different levels of potential cumulative effect when combined with the Proposed Development, informed by other plan/project's readiness and likelihood for actual operation. The screening process for potential impacts on marine mammals as well as projects to be included in the cumulative assessment are presented in this section.

Certain impacts assessed for the proposed development alone are not considered in the marine mammal CEA due to:

- the highly localised nature of the impacts; and
- management and mitigation measures (embedded commitments) in place at the proposed development and on other projects will reduce the risk of cumulative effects occurring.

The impacts excluded from the marine mammal CEA for these reasons are presented in Table 28.

Table 28: Impacts screened out from further consideration in the CEA with justification for screening

Impact	Justification
Auditory injury (PTS)	Where PTS may result from activities such as pile driving, geophysical surveys and UXO clearance, as a requirement of European Protected Species legislation, suitable mitigation must be put in place to reduce injury risk to marine mammals to negligible levels across all projects considered in the cumulative assessment (JNCC 2010b, a, 2017). Similarly, any risk of PTS during decommissioning will be determined via appropriate decommissioning plans and if required, mitigated. Any non-piling construction noise sources will have an extremely local spatial extent and therefore represent a minimal risk of injury. Moreover, it is anticipated that underwater noise associated with vessel activity will deter animals from the injury zone. As such, assuming application of appropriate mitigation measures, any risk of injury it is considered highly unlikely and potential for cumulative effects on marine mammals due to PTS as a result of piling, UXO, other non-piling construction activities and decommissioning was not considered further.
Disturbance from Unexploded Ordnance (UXOs)	In line with the DEFRA et al. (2021) joint interim position statement, it is expected that, where feasible, across all projects, UXO clearance campaigns will be conducted using low-order deflagration techniques. These techniques are now considered to have 100% success rate (Ocean Winds 2024). Moreover, it is

Impact	Justification
	expected that the detonation of a UXO would elicit a startle response and potentially very short-duration behavioural responses and would therefore not be expected to cause widespread and prolonged displacement (JNCC 2020). Given that behavioural disturbance is considered negligible in the context of UXO clearance as the duration of the impact (underwater noise) is extremely short, the potential for cumulative effects is considered unlikely and this impact was not considered further.
Disturbance from other construction activities (excluding dredging)	Disturbance from other (non-piling) construction activities is anticipated to be highly localised and is closely associated with the disturbance from vessel presence required for the activity. As such, cumulative effects have been assessed under “disturbance from vessels” impact and potential for cumulative effects due to other (non-piling) construction activities was not considered further.
Indirect impacts associated resulting in marine mammal prey item disturbance and/or displacement	The changes in prey availability are expected to be highly localised across all projects. As such, the potential for significant cumulative effects is minimal and, therefore, this impact was not considered further.
Long-term habitat changes, displacement and/or barrier effects	The potential risks associated with long term displacement and barrier effects are expected to be highly localised across harbour developments. As such, the potential for significant cumulative effects is minimal and therefore this impact was not considered further.
Disturbance from vessels during construction	Vessel routes to and from offshore construction projects will, for the majority, 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 predominantly confined to construction sites. The vessel movements for offshore developments are likely to be limited and slow, resulting in less risk of disturbance to marine mammal receptors. NRAs shall also be in place for each development during construction, to help minimise the interactions between marine mammal and vessels despite minimal increases in vessel traffic beyond the baseline.
Vessel collision risks	During both construction and operational phases, it is expected that across all projects’, vessel movements will be managed through the implementation of vessel codes of conduct that will mitigate the negative impacts to marine mammals (e.g. limited vessel speeds, adherence to vessel transit routes), following relevant guidance to minimise the risks of injury to marine mammals. As such, the potential for significant cumulative effects is minimal and this impact was not considered further.

The impacts that are considered in the marine mammal CEA are as follows:

- The potential for disturbance from underwater noise from piling during construction of offshore wind farms (OWFs) (where data are available) and the construction of other projects and developments (including dredging activities);
- Disturbance to seal haul-out sites; and
- Disturbance from vessels during construction and O&M.

5.2 CEA Project Screening

The time period considered in the CEA for marine mammals is 2025 to 2034 inclusive to account for projects constructing up to a year on either side of the Proposed Development construction. This allows for the quantification of impacts both prior to and post construction of the proposed development and during the period when piling and/or dredging at the proposed development is anticipated (between 2026 and 2029). The screening range was defined as the Moray Firth.

Each project, plan or activity has been considered and screened in or out based on effect–receptor pathway, data confidence and the temporal and spatial scales involved. The CEA long-list of projects was screened to remove all projects that have:

- No temporal overlap;
- No physical effect-receptor overlap; and
- No effect-receptor pathway.

The following projects were screened out of the marine mammal CEA short list as they were already operational/active and thus considered to be existing impacts included within the baseline (this includes all shipping ports, shipping routes and oil and gas pipelines), or no construction timeline was available:

- Maintenance Dredging and Deposit – Macduff Harbour;
- Caithness-Moray HVDC Link;
- SHEFA 2;
- FARICE-1; and
- Flora Floating OWF.

Projects which were screened into the CEA for marine mammals are detailed in Table 29.

Table 29: List of projects and developments screened into the marine mammal CEA (all projects were screened in for each species). Pre-C = pre-construction, C = offshore construction, D = dredging, P = piling, P & D = piling and dredging.

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Ardersier ETF Extension	Port	Pre-C	P	P & D		D	Operational				
Invergordon Phase 5	Port	Pre-C	P	P	Operational						
Port of Nigg East Quay - Inner Berthing Structure	Port	P	P	Operational							
Maintenance Dredging and Sea Disposal - Port of Nigg	Port	D	D	Operational							
Maintenance Dredging - Port of Cromarty Firth	Port	D	D	D	D	Operational					
Dredging and Sea Deposit - Banff Harbour	Port	N/A	D	D	D	Operational					
Maintenance Dredging and Deposit- Portsoy Harbour	Port	D	D	D	Operational						

<table>
<tr><th>Proposed Development</th><th>Type</th><th>2025</th><th>2026</th><th>2027</th><th>2028</th><th>2029</th><th>2030</th><th>2031</th><th>2032</th><th>2033</th><th>2034</th></tr>
<tr><td>Buckie Maintenance Dredging and Deposit</td><td>Port</td><td>D</td><td>D</td><td colspan="2">D</td><td colspan="6">Operational</td></tr>
<tr><td>Portknockie Maintenance Dredging and Deposit</td><td>Port</td><td>D</td><td>D</td><td colspan="8">Operational</td></tr>
<tr><td>Moray West</td><td>Fixed OWF</td><td>C</td><td colspan="9">Intended to be operational from 2025</td></tr>
<tr><td>Caledonia</td><td>Fixed & Floating OWF</td><td colspan="3">N/A</td><td>P</td><td>P</td><td>P</td><td colspan="4">Intended to be operational from 2030</td></tr>
<tr><td>Shetland HVDC Link</td><td>Cable</td><td>C</td><td colspan="9">Operational</td></tr>
<tr><td>Broadshore</td><td>Floating OWF</td><td colspan="4">N/A</td><td>P</td><td>P</td><td>P</td><td>P</td><td colspan="2">Operational</td></tr>
<tr><td>Sinclair</td><td>Floating OWF</td><td colspan="4">N/A</td><td>P</td><td>P</td><td>P</td><td>P</td><td colspan="2">Operational</td></tr>
<tr><td>Stromar</td><td>Floating OWF</td><td colspan="6">N/A</td><td>P</td><td>P</td><td>P</td><td>P</td></tr>
<tr><td>Fraserburgh Harbour Expansion</td><td>Port</td><td colspan="3">N/A</td><td>C</td><td>C</td><td>C</td><td>C</td><td>C</td><td colspan="2">Operational</td></tr>
<tr><td>Maintenance Dredging - Wick Harbour</td><td>Port</td><td>D</td><td colspan="9">Operational</td></tr>
</table>

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Orkney - Caithness 220 kV Link	Cable	C	C	C	C	Operational					

5.3 CEA Assumptions and Limitations

5.3.1 Assumptions - Number of Impacted Individuals

For all screened-in offshore developments that had a quantitative impact assessment available (EIAR chapter), the maximum number of animals predicted to be disturbed was obtained from the Marine Mammals EIAR chapter and used in this CEA for that specific project. It is noted that different quantitative impact assessments used different methods to assess disturbance from pile driving and/or other construction activities such as dredging. For pile driving activities, all project assessments used a dose-response function. For other construction activities, such as dredging, impacts were largely assessed qualitatively. Where no quantitative impact assessment was undertaken for a specific project (i.e., for qualitative assessments) despite an EIAR being available, it was assumed that the number of individuals impacted was zero.

For all projects that have no EIAR chapter, the following piling assumptions were made:

- a 26 km EDR was assumed for fixed foundation OWF projects;
- a 15 km EDR for floating OWF projects; and
- a 5 km EDR was assumed for port and/or harbour development extensions.

For dredging activities, the EDRs assumed for each species and used in CEA were in-line with the assessment methodology undertaken for the proposed development (5 km for harbour porpoise, minke whales and seals, 1 km for bottlenose dolphins, see Appendix 11.2).

5.3.2 Assumptions – Density Estimates

Where no quantitative impact assessment was available (no project specific EIAR), for harbour porpoise and minke whales, the density was assumed to be that of the SCANS IV block in which the development was located. For seals, the density was assumed to be the average at-sea density estimate (derived from Carter et al. (2025)) throughout the array area (for OWF projects) and/or project development area. For bottlenose dolphins, the density was assumed to be the average density estimate (derived from the scaled Thompson et al. (2015) surface) throughout the array area (for OWF projects) and/or project development area.

5.3.3 Limitations

It should be noted that there are significant levels of precaution / conservatism within this CEA, resulting in the estimated effects being highly precautionary. The main areas of precaution / conservatism in the assessment include:

- The approach of summing across concurrent activities assumes that there is no spatial overlap in the impact footprints between individual activities, which is highly conservative considering the close proximity of many of the offshore developments;
- The inclusion of projects with a high degree of uncertainty; for example, those lacking consent, an EIAR, and/or scoping report. In such instances, realistic worst-case scenarios are assumed in the absence of other information;
- The exact timing of pile driving or construction activities for each development is unknown, therefore it has been assumed that these activities could occur at any point throughout the construction window. This has resulted in piling/construction activities occurring over multiple consecutive years with associated estimated disturbance levels far greater than would occur in reality;

- The timelines presented in EIAR chapters are realistic worst-case scenarios and the true period of piling/construction activity will likely be shorter;
- The assumption that all floating OWF developments will install pile-driven anchor (pin-pile) foundations.
- For projects with likely piling activities, in the absence of project-specific assessments of the number of disturbed animals from piling, EDRs based on those recommended for harbour porpoise have been applied; these can be considered precautionary for other species of marine mammal, which have not been reported to respond as strongly to relevant underwater noise as harbour porpoise.

5.4 Disturbance from Construction Activities (including Piling and Dredging)

5.4.1 Harbour Porpoise

5.4.1.1 Sensitivity

Harbour porpoise have been assessed as having a **Low** sensitivity to disturbance from pile driving activities, dredging activities, and other construction activities which involve vessels to be present on-site.

5.4.1.2 Magnitude

Error! Reference source not found. outlines the number of harbour porpoise predicted to be disturbed at each project in each year. The data have been split by whether a quantitative impact assessment is available as there is considerably more certainty in the number of animals predicted to be disturbed from project specific quantitative impact assessments. Therefore, the CEA results focus on projects with a quantitative impact assessment, while acknowledging that other projects are planned/expected.

Focusing on those projects for which a quantitative impact assessment is already available, there is expected to be disturbance to a maximum of 8,202 harbour porpoise per day in 2028 and 2029 (2.37% MU, 5.14% UK MU), assuming pile driving at Caledonia occurs concurrently with pile driving and dredging activities at the proposed development (Error! Reference source not found.). **Of this, the proposed development is predicted to contribute 0.01% of the disturbance impact.**

Including projects with no quantitative impact assessment available yet, the maximum number of harbour porpoise anticipated to be disturbed is in 2028, where the number increases slightly to 8,268 harbour porpoise per day (2.39% MU, 5.18% UK MU) (Table 30). **Of this, the proposed development is predicted to contribute 0.01% of the disturbance impact.**

It is expected that disturbance from construction activities across multiple projects is likely to occur at a low frequency or intensity, affecting a small proportion of the harbour porpoise population which has the potential to cause short-term changes in the population from baseline conditions[4]. Therefore, the magnitude has been assessed as **Low**.

Table 30: Harbour porpoise Cumulative Effects Assessment: potential disturbance from underwater noise. Colour key: Pre-construction, Piling, Construction, Dredging, Piling & Dredging.

[4] Note: no population modelling has been conducted for this CEA due to a lack of detailed information on potential piling schedules across projects.

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	EIA?
Ardersier ETF Extension	Port	Pre-C	0	1	1	1	Operational					Yes
Invergordon Phase 5	Port	Pre-C	0	0	Operational							Yes
Port of Nigg East Quay - Inner Berthing Structure	Port	0	0	Operational								Yes
Maintenance Dredging and Sea Disposal - Port of Nigg	Port	22	22	Operational								No
Maintenance Dredging - Port of Cromarty Firth	Port	22	22	22	22	Operational						No
Dredging and Sea Deposit - Banff Harbour	Port	N/A	22	22	22	Operational						No
Maintenance Dredging and Deposit- Portsoy Harbour	Port	22	22	22	Operational							No
Buckie Maintenance Dredging and Deposit	Port	22	22	22	Operational							No
Portknockie Maintenance Dredging and Deposit	Port	22	22	Operational								No
Moray West	Fixed OWF	0	Intended to be operational from 2025									Yes
Caledonia	Fixed & Floating OWF	N/A			8201	8201		Intended to be operational from 2030				Yes
Shetland HVDC Link	Cable	22	Operational									No
Broadshore	Floating OWF	N/A				199	199	199	199	No		No
Sinclair	Floating OWF	N/A				199	199	199	199	No		No
Stromar	Floating OWF	N/A						199	199	199	199	No

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	EIA?
Fraserburgh Harbour Expansion	Port	N/A			22	22	22	22	22	Operational		No
Maintenance Dredging - Wick Harbour	Port	22	Operational									No
Orkney - Caithness 220 kV Link	Cable	0	0	0	0	Operational						Yes
Results of CEA												
All Projects	# Individuals	154	**132**	**89**	**8268**	**8622**	8621	619	619	199	199	**Yes & No**
	% MU	0.04%	**0.04%**	**0.03%**	**2.39%**	**2.49%**	2.49%	0.18%	0.18%	0.06%	0.06%	
	% UK MU	0.10%	**0.08%**	**0.06%**	**5.18%**	**5.40%**	5.40%	0.39%	0.39%	0.12%	0.12%	
	% Ardersier ETF	0.00%	**0.00%**	**1.12%**	**0.01%**	**0.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	
Projects with a EIAR Available	# Individuals	0	**0**	**0**	**8202**	**8202**	8201	0	0	0	0	**Yes**
	% MU	0.00%	**0.00%**	**0.00%**	**2.37%**	**2.37%**	2.37%	0.00%	0.00%	0.00%	0.00%	
	% UK MU	0.00%	**0.00%**	**0.00%**	**5.14%**	**5.14%**	5.14%	0.00%	0.00%	0.00%	0.00%	
	% Ardersier ETF	0.00%	**0.00%**	**0.00%**	**0.01%**	**0.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	

5.4.1.3 Significance of Effect

The sensitivity of harbour porpoise to disturbance from piling and other construction activities, including dredging, has been assessed as Low, and the magnitude of the cumulative impact has been assessed as Low. Therefore, the cumulative effect of disturbance from underwater noise is considered to be of **Negligible** significance, which is **Not Significant** with respect to the EIA Regulations.

5.4.2 Minke Whale

5.4.2.1 Sensitivity

Minke whale have been assessed as having a **Negligible** to **Low** sensitivity to disturbance from pile driving activities, dredging activities, and other construction activities which involve vessels to be present on-site.

5.4.2.2 Magnitude

Table 31outlines the number of minke whale predicted to be disturbed at each project in each year. The data have been split by whether a quantitative impact assessment is available as there is considerably more certainty in the number of animals predicted to be disturbed from project specific quantitative impact assessments. Therefore, the CEA results focus on projects with a quantitative impact assessment, while acknowledging that other projects are planned/expected.

Focusing on those projects for which a quantitative impact assessment is already available, there is expected to be disturbance to a maximum of 502 minke whales per day between 2028 and 2030 (2.49% MU, 4.88% UK MU). This assumes a 100% contribution from the Caledonia OWF.

Including projects with no quantitative impact assessment available yet increases this slightly to 519 minke whales per day (2.57% MU, 5.04% UK MU) (Error! Reference source not found.) between 2029 and 2030, outside of the construction window for the proposed development . **The proposed development is not expected to contribute to the cumulative disturbance of minke whale within the Moray Firth.**

It is expected that disturbance from construction activities across multiple projects is likely to occur at a low frequency or intensity, affecting a small proportion of the minke whale population which has the potential to cause short-term changes in the population from baseline conditions[5]. Therefore, the magnitude has been assessed as **Low**.

Table 31: Minke whale Cumulative Effects Assessment: potential disturbance from underwater noise. Colour key: Pre-construction, Piling, Construction, Dredging, Piling & Dredging.

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	EIA?
Ardersier ETF Extension	Port	Pre-C	0	0	0	0	Operational					Yes
Invergordon Phase 5	Port	Pre-C	0	0	Operational							Yes
Port of Nigg East Quay - Inner Berthing Structure	Port	0	0	Operational								Yes
Maintenance Dredging and Sea Disposal - Port of Nigg	Port	1	1	Operational								No
Maintenance Dredging - Port of Cromarty Firth	Port	1	1	1	1	Operational						No
Dredging and Sea Deposit - Banff Harbour	Port	N/A	1	1	1	Operational						No
Maintenance Dredging and Deposit- Portsoy Harbour	Port	1	1	1	Operational							No
Buckie Maintenance Dredging and Deposit	Port	1	1	1	Operational							No
Portknockie Maintenance Dredging and Deposit	Port	1	1	Operational								No
Moray West	Fixed OWF	0	Intended to be operational from 2025									Yes
Caledonia	Fixed & Floating OWF	N/A			502	502	502	Intended to be operational from 2030				Yes

5 Note: no population modelling has been conducted for this CEA due to a lack of detailed information on potential piling schedules across projects.

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	EIA?
Shetland HVDC Link	Cable	1	Operational									No
Broadshore	Floating OWF	N/A				8	8	8	8	No		No
Sinclair	Floating OWF	N/A				8	8	8	8	No		No
Stromar	Floating OWF	N/A						8	8	8	8	No
Fraserburgh Harbour Expansion	Port	N/A			1	1	1	1	1	Operational		No
Maintenance Dredging - Wick Harbour	Port	1	Operational									No
Orkney - Caithness 220 kV Link	Cable	0	0	0	0	Operational						Yes
Results of CEA												
All Projects	# Individuals	0	6	4	505	519	519	25	25	8	8	**Yes & No**
	% MU	0.03%	0.03%	0.02%	2.50%	2.57%	2.57%	0.12%	0.12%	0.04%	0.04%	
	% UK MU	0.07%	0.06%	0.04%	4.91%	5.04%	5.04%	0.24%	0.24%	0.08%	0.08%	
	% Ardersier ETF	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
Projects with a EIAR Available	# Individuals	0	0	0	502	502	502	0	0	0	0	**Yes**
	% MU	0.00%	0.00%	0.00%	2.49%	2.49%	2.49%	0.00%	0.00%	0.00%	0.00%	
	% UK MU	0.00%	0.00%	0.00%	4.88%	4.88%	4.88%	0.00%	0.00%	0.00%	0.00%	
	% Ardersier ETF	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	

5.4.2.3 Significance of Effect

The sensitivity of minke whale to disturbance from piling and other construction activities, including dredging, has been assessed as Negligible to Low, and the magnitude of the cumulative impact has been assessed as Low. Therefore, the cumulative effect of disturbance from underwater noise is considered to be of **Negligible** significance, which is **Not Significant** with respect to the EIA Regulations

5.4.3 Bottlenose dolphin

5.4.3.1 Sensitivity

Bottlenose dolphin have been assessed as having a **Low** sensitivity to disturbance from pile driving activities, dredging activities, and other construction activities which involve vessels to be present on-site.

5.4.3.2 Magnitude

Error! Reference source not found. outlines the number of bottlenose dolphin predicted to be disturbed at each project in each year. The data have been split by whether a quantitative impact assessment is available as there is considerably more certainty in the number of animals predicted to be disturbed from project specific quantitative impact assessments. Therefore, the CEA results focus on projects with a quantitative impact assessment, while acknowledging that other projects are planned/expected.

Focusing on those projects for which a quantitative impact assessment is already available, there is expected to be disturbance to a maximum of 60 bottlenose dolphins per day in 2028 and 2029 (25.64%

MU) (**Error! Reference source not found.**). This assumes concurrent piling, and/or concurrent piling and dredging activities from the Caledonia OWF and the proposed development . **Of this, the proposed development is predicted to contribute 13.33% of the disturbance impact.**

Including projects with no quantitative impact assessment available yet increases this slightly to 63 bottlenose dolphins per day (26.92% MU) (Table 32) in 2028 and 2029. **Of this, the proposed development is predicted to contribute 12.70% of the disturbance impact.**

Disturbance from construction activities associated with multiple projects is anticipated to occur at a low frequency and intensity, impacting a moderate portion of the bottlenose dolphin population. This may result in short-term deviations from baseline population conditions. The magnitude of potential cumulative effects is **Medium**.

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Table 32: Bottlenose dolphin Cumulative Effects Assessment: potential disturbance from underwater noise. Colour key: Pre-construction, Piling, Construction, Dredging, Piling & Dredging.

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	EIA?
Ardersier ETF Extension	Port	Pre-C	8	8	8	8	Operational					Yes
Invergordon Phase 5	Port	Pre-C	0	0	Operational							Yes
Port of Nigg East Quay - Inner Berthing Structure	Port	0	0	Operational								Yes
Maintenance Dredging and Sea Disposal - Port of Nigg	Port	0	0	Operational								No
Maintenance Dredging - Port of Cromarty Firth	Port	0	0	0	0	Operational						No
Dredging and Sea Deposit - Banff Harbour	Port	N/A	0	0	0	Operational						No
Maintenance Dredging and Deposit- Portsoy Harbour	Port	0	0	0	Operational							No
Buckie Maintenance Dredging and Deposit	Port	0	0	0	Operational							No
Portknockie Maintenance Dredging and Deposit	Port	1	1	Operational								No
Moray West	Fixed OWF	0	Intended to be operational from 2025									Yes

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	EIA?
Caledonia	Fixed & Floating OWF	N/A			52	52	52	Intended to be operational since 2030				Yes
Shetland HVDC Link	Cable	2	Operational									No
Broadshore	Floating OWF	N/A				0	0	0	0	Operational		No
Sinclair	Floating OWF	N/A				0	0	0	0	Operational		No
Stromar	Floating OWF	N/A						2	2	2	2	No
Fraserburgh Harbour Extension	Port	N/A		3	3	3	3	3	Operational			No
Maintenance Dredging - Wick Harbour	Port	0	Operational									No
Orkney - Caithness 220 kV Link	Cable	0	0	0	0	Operational						Yes
Results of CEA												
All Projects	# Individuals	3	**9**	**8**	**63**	**63**	55	5	5	2	2	**Yes & No**
	% MU	1.28%	**3.85%**	**3.42%**	**26.92%**	**26.92%**	23.50%	2.14%	2.14%	0.85%	0.85%	
	% Ardersier ETF	0.00%	**88.89%**	**100%**	**12.70%**	**12.70%**	0.00%	0.00%	0.00%	0.00%	0.00%	
Projects with a EIAR Available	#Number of Individuals	0	**8**	**8**	**60**	**60**	52	0	0	0	0	**Yes**
	% MU	0.00%	**3.42%**	**3.42%**	**25.64%**	**25.64%**	22.22%	0.00%	0.00%	0.00%	0.00%	
	% Ardersier ETF	0.00%	**100%**	**100%**	**13.33%**	**13.33%**	0.00%	0.00%	0.00%	0.00%	0.00%	

5.4.3.3 Significance of Effect

The sensitivity of bottlenose dolphin to disturbance from piling and other construction activities, including dredging, has been assessed as Low, and the magnitude of the cumulative impact has been assessed as Medium. Therefore, the cumulative effect of disturbance from underwater noise is considered to be of **Minor** significance, which is **Not Significant** with respect to the EIA Regulations.

5.4.4 Harbour seal

5.4.4.1 Sensitivity

Harbour seals at-sea, and subject to underwater noise impacts, have been assessed as having a **Low** sensitivity to disturbance from pile driving activities, dredging activities, and other construction activities which involve vessels to be present on-site.

5.4.4.2 Magnitude

Table 33 outlines the number of harbour seals predicted to be disturbed at each project in each year. The data have been split by whether a quantitative impact assessment is available as there is considerably more certainty in the number of animals predicted to be disturbed from project specific quantitative impact assessments. Therefore, the CEA results focus on projects with a quantitative impact assessment, while acknowledging that other projects are planned/expected.

Focusing on those projects for which a quantitative impact assessment is already available, there is expected to be disturbance to a maximum of 105 harbour seals per day in 2027 (7.69% MU). **Of this, the proposed development is predicted to contribute 0.00% of the disturbance impact** (**Error! Reference source not found.**). It should be noted however, that in 2026, a maximum of 82 harbour seals are predicted to be impacted per day (6.01%). This represents similar levels of disturbance which are predicted to occur in 2028 and 2029. In 2026, **the proposed development is predicted to contribute 19.78% of the disturbance impact** (Table 33).

Including projects with no quantitative impact assessment available yet, the number of seals predicted to be disturbed increases to 352 harbour seals per day (25.79% MU) (Table 33) in 2026. **Of this, the proposed development is predicted to contribute 0.00% of the disturbance impact** (Table 33). However, when considering years for which the proposed development shall contribute to cumulative disturbance of harbour seals, the largest number of harbour seals disturbed per day occurs in 2027 (240 individuals, 17.58% MU, 9.58% contribution) when Invergordon Phase 5, the Port of Cromarty Firth, Banff Harbour, Portsoy Harbour, Buckie Harbour, and the Orkney-Caithness Cable Link are all constructing.

It is expected that disturbance from construction activities across multiple projects is likely to occur at a low frequency or intensity, but could impact a large proportion of the harbour seal population which has the potential to cause short-term changes in the population from baseline conditions[6]. Therefore, the magnitude has been assessed as **Medium**.

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Table 33: Harbour seal Cumulative Effects Assessment: potential disturbance from underwater noise. Colour key: Pre-construction, Piling, Construction, Dredging, Piling & Dredging.

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	EIA?
Ardersier ETF Extension	Port	Pre-C	0	23	23	23	Operational					Yes
Invergordon Phase 5	Port	Pre-C	0	0	Operational							Yes
Port of Nigg East Quay - Inner Berthing Structure	Port	0	0	Operational								Yes
Maintenance Dredging and Sea Disposal - Port of Nigg	Port	109	109	Operational								No

[6] Note: no population modelling has been conducted for this CEA due to a lack of detailed information on potential piling schedules across projects.

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	EIA?
Maintenance Dredging - Port of Cromarty Firth	Port	109	109	109	109	Operational						No
Dredging and Sea Deposit - Banff Harbour	Port	N/A	9	9	9	Operational						No
Maintenance Dredging and Deposit- Portsoy Harbour	Port	5	5	5	Operational							No
Buckie Maintenance Dredging and Deposit	Port	12	12	12	Operational							No
Portknockie Maintenance Dredging and Deposit	Port	26	26	Operational								No
Moray West	Fixed OWF	0	Intended to be operational from 2025									Yes
Caledonia	Fixed & Floating OWF	N/A			58	58	58	Intended to be operational from 2030				Yes
Shetland HVDC Link	Cable	1	Operational									No
Broadshore	Floating OWF	N/A				8	8	8	8	No		No
Sinclair	Floating OWF	N/A				8	8	8	8	No		No
Stromar	Floating OWF	N/A						8	8	8	8	No
Fraserburgh Harbour Expansion	Port	N/A			1	1	1	1	1	Operational		No
Maintenance Dredging - Wick Harbour	Port	1	Operational									No
Orkney - Caithness 220 kV Link	Cable	0	0	0	0	Operational						Yes
Results of CEA												
All Projects	# Individuals	267	**352**	**240**	**201**	**83**	60	3	3	1	1	**Yes & No**
	% MU	19.56%	**25.79%**	**17.58%**	**14.73%**	**6.08%**	4.40%	0.22%	0.22%	0.07%	0.07%	

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	EIA?
	% Ardersier ETF	0.00%	**0.00%**	**9.58%**	**11.44%**	**0.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	
Projects with a EIAR Available	# Individuals	0	**82**	**105**	**81**	**81**	58	0	0	0	0	**Yes**
	% MU	0.00%	**6.01%**	**7.69%**	**5.93%**	**5.93%**	4.25%	0.00%	0.00%	0.00%	0.00%	
	% Ardersier ETF	0.00%	**0.00%**	**0.00%**	**28.40%**	**0.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	

5.4.4.3 Significance of Effect

The sensitivity of harbour seals to disturbance from piling and other construction activities, including dredging, has been assessed as Low, and the magnitude of the cumulative impact has been assessed as Medium. Therefore, the cumulative effect of disturbance from underwater noise is considered to be of **Minor** significance, which is **Not Significant** with respect to the EIA Regulations

5.4.5 Grey seal

5.4.5.1 Sensitivity

Grey seals at-sea, and subject to underwater noise impacts, have been assessed as having a **Negligible** to **Low** sensitivity to disturbance from pile driving activities, dredging activities, and other construction activities which involve vessels to be present on-site.

5.4.5.2 Magnitude

Table 34 outlines the number of grey seals predicted to be disturbed at each project in each year. The data have been split by whether a quantitative impact assessment is available. There is considerably more certainty in the number of animals predicted to be disturbed from project specific quantitative impact assessments. Therefore, the CEA results focus on projects with a quantitative impact assessment, while acknowledging that other projects are planned/expected.

Focusing on those projects for which a quantitative impact assessment is already available, there is expected to be disturbance to a maximum of 2,273 grey seals in 2028 and 2029 (42.22% MU). **Of this, the proposed development is predicted to contribute 1.63% (37 individuals) of the disturbance impact**, in combination with the Caledonia OWF (Table 34).

Including projects with no quantitative impact assessment available yet, the maximum number of grey seals predicted to be impacted this increases to 2,378 grey seals (42.72% MU) (Table 34) in 2029. **Of this, the proposed development is predicted to contribute 1.61% of the disturbance impact**, in combination with the Caledonia OWF, Fraserburgh Harbour Development, and dredging activities within the Port of Cromarty Firth harbour limits and at Banff harbour (Table 34).

It is expected that disturbance from construction activities across multiple projects is likely to occur at a low frequency or intensity, but a significantly large proportion of the grey seal population which has the potential to cause short--term changes in the population from baseline conditions[7]. However, as the largest contributions to grey seal disturbance arise from a single project, the risks of cumulative disturbance are low. Therefore, the magnitude has been assessed as **Medium**.

Table 34: Grey seal Cumulative Effects Assessment: potential disturbance from underwater noise. Colour key: Pre-construction, Piling, Construction, Dredging, Piling & Dredging

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	EIA?
Ardersier ETF Extension	Port	Pre-C	1	37	37	37	Operational					Yes
Invergordon Phase 5	Port	Pre-C	0	0	Operational							Yes
Port of Nigg East Quay - Inner Berthing Structure	Port	0	0	Operational								Yes
Maintenance Dredging and Sea Disposal - Port of Nigg	Port	4	4	Operational								No
Maintenance Dredging - Port of Cromarty Firth	Port	4	4	4	4	Operational						No
Dredging and Sea Deposit - Banff Harbour	Port	N/A	7	7	7	Operational						No
Maintenance Dredging and Deposit- Portsoy Harbour	Port	13	13	13	Operational							No
Buckie Maintenance Dredging and Deposit	Port	2	2	2	Operational							No
Portknockie Maintenance Dredging and Deposit	Port	361	361	Operational								No
Moray West	Fixed OWF	0	Intended to be operational from 2025									Yes
Caledonia	Fixed & Floating OWF	N/A			2236	2236	2236	Intended to be operational from 2030				Yes
Shetland HVDC Link	Cable	31	Operational									No

[7] Note: no population modelling has been conducted for this CEA due to a lack of detailed information on potential piling schedules across projects.

Proposed Development	Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	EIA?
Broadshore	Floating OWF	N/A				43	43	43	43	No		No
Sinclair	Floating OWF	N/A				46	46	46	46	No		No
Stromar	Floating OWF	N/A						221	221	221	221	No
Fraserburgh Harbour Expansion	Port	N/A			16	16	16	16	16	Operational		No
Maintenance Dredging - Wick Harbour	Port	13	Operational									No
Orkney - Caithness 220 kV Link	Cable	0	0	0	0	Operational						Yes
Results of CEA												
All Projects	# Individuals	428	**391**	**63**	**2300**	**2378**	2341	326	326	221	221	**Yes & No**
	% MU	7.95%	**7.26%**	**1.17%**	**42.72%**	**44.17%**	43.48%	6.05%	6.05%	4.10%	4.10%	
	% Ardersier ETF	0.00%	**0.00%**	**58.73 %**	**1.61%**	**0.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	
Projects with an EIAR Available	# Individuals	0	**0**	**37**	**2273**	**2273**	2236	0	0	0	0	**Yes**
	% MU	0.00%	**0.00%**	**0.69%**	**42.22%**	**42.22%**	41.53%	0.00%	0.00%	0.00%	0.00%	
	% Ardersier ETF	0.00%	**0.00%**	**0.00%**	**1.63%**	**1.63%**	0.00%	0.00%	0.00%	0.00%	0.00%	

5.4.5.3 Significance of Effect

The sensitivity of grey seals to disturbance from piling and other construction activities, including dredging, has been assessed as Negligible to Low, and the magnitude of the cumulative impact has been assessed as Medium. Therefore, the cumulative effect of disturbance from underwater noise is considered to be of **Negligible** to **Minor** significance, which is **Not Significant** with respect to the EIA Regulations**.**

5.4.6 Summary

For all marine mammal species, the sensitivity has been assessed as Negligible to Low, or Low. The magnitude of impact has been assessed as Low or Medium for all species. This has resulted in the significance of effects being **Negligible** or **Minor** for each species. Overall, this is **Not Significant** in EIA terms.

Table 35: Summary of the impact assessment for cumulative disturbance from piling and dredging

Species	Sensitivity	Magnitude	Impact Significance	% contribution of Ardersier to total CEA

				disturbance (in year with max impact)
Harbour porpoise	Low	Low	Negligible (not significant)	<0.1%
Minke whale	Negligible – Low	Low	Negligible (not significant)	0.00%
Bottlenose dolphin	Low	Medium	Minor (not significant)	12.70%
Harbour seal	Low	Medium	Minor (not significant)	24.58%
Grey seal	Negligible – Low	Medium	Negligible – Minor (not significant)	3.78%

5.5 Disturbance from Vessels (Construction)

5.5.1 Sensitivity

As assessed for the proposed development alone (Section 3.5.2 of Appendix 11.4 the sensitivity of all marine mammals to disturbance from vessel activity is assessed as Low, with the exception of minke whales, which were assessed as Medium. For hauled-out seals, the sensitivity of grey seals to disturbance to haul-outs, is classified as Low outside of the breeding season and Medium during the breeding season. For hauled-out harbour seals, the sensitivity has been assessed as Medium during and outside the breeding and moult seasons.

5.5.2 Magnitude

It is challenging 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.

Although construction vessels may transit to and from varying locations, at variable speeds depending on where they are located in the seascape (e.g., slower speeds are likely in more coastal areas, compared with offshore), vessels often travel in predictable routes. Further, vessel type plays an important role in vessel speed. For example, in offshore windfarm construction, jack-up vessels, and pilot or attending vessels travel more slowly within the wind farm site or spend long periods of time jacked-up at anchor, minimising movement and acoustic signature from engines and the use of dynamic positioning systems. In addition, during dredging activities at port and harbour development, the type of dredging vessel being utilised plays an important role in underwater noise generation. Hydraulic dredges, like cutter suction dredges, tend to produce more continuous, lower-frequency sounds, while mechanical dredges, such as clamshell or backhoe dredges, create more impulsive, higher-frequency noises. Unfortunately, there are very few species-specific studies covering these vessel types that capture vessel movement patterns as well as their acoustic signatures and the corresponding response of marine mammals.

Vessel routes to and from offshore developments will, for the majority, 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 predominantly confined to construction sites. The vessel movements for offshore construction are likely to be limited and slow, resulting in less risk of disturbance to marine mammal receptors. In addition, most projects are likely to adopt NRAs and/or comply with the existing Scottish Marine Wildlife Watching Codes such as SNH (2017b) and SNH (2017a) to minimise any potential effects on marine mammals.

To strengthen the cumulative assessment, known construction vessel activity from current and upcoming regional projects has been considered. At Nigg South Quay, a total of 482 construction vessel movements are projected over a 6-month period between 2025 and 2026 (EnviroCentre Limited 2019). At Invergordon, approximately 272 one-way construction vessel movements are anticipated over a 3-year period (2025–2027), translating to an estimated 90–120 movements per year, including transits to and from the dredge disposal site during 2026–2027 (Affric 2025). The proposed development is expected to contribute significantly to temporary increases in vessel activity, with a worst-case scenario involving up to 11 vessels present simultaneously (including dredging and barge delivery operations). During peak spoil disposal operations over a 10-week period, 13–23 barge movements per day may occur, potentially resulting in up to ~450 additional vessel movements within the inner Moray Firth.

An assessment of construction timeframes indicates that there is temporal overlap between Nigg South Quay and Invergordon, with both projects expected to be under construction during 2025–2026. There is also some overlap between the proposed development , Invergordon Phase 5 and Nigg South Quay in 2026. However, the greatest potential for temporal overlap persists in 2027 when the proposed development and Invergordon Phase 5 projects shall be in peak construction periods. This overlap presents the highest potential for cumulative marine mammal disturbance, particularly in the Cromarty Firth area, due to increased vessel movements associated with concurrent dredging and port development activity.

Although construction vessels will be moving throughout the Moray Firth, the impact is considered to be localised to the vicinity of the moving vessel and only when the vessel is moving or stationary with the engine running. The impact will therefore be temporary. Due to the number of projects included within the CEA and the frequency of overlapping timescales, it is likely that the effect will occur at moderate frequency. Although it could affect a small proportion of respective populations across the duration of the construction, it is unlikely to alter population trajectories in the long-term due to the fact that it will be taking place in areas already characterised by relatively high vessel traffic. It is anticipated that any animals displaced from the area will return once vessels leave. As such, the magnitude of the cumulative disturbance from vessels during construction is assessed as **Low**.

5.5.3 Significance of Effect

The sensitivity of all marine mammals, including hauled-out grey seals outside of the breeding and moulting season, to disturbance from vessel activity is assessed as Low, with the exception of minke whales, hauled-out harbour seals, and hauled-out grey seals during the breeding and moulting season, which were assessed as Medium. The magnitude of the cumulative disturbance from vessels during construction is assessed as Low. Therefore, the significance of effect is assessed as **Negligible, Not Significant** for all marine mammals, including hauled-out grey seals outside of the breeding and moulting season, with the exception of minke whales, hauled-out harbour seals, and hauled-out grey seals during the breeding and moulting season, where the significance of effect is assessed as **Minor,** which is **Not Significant** in EIA terms.

Table 36: Summary of significance of effects from cumulative vessel disturbance during construction, on marine mammal receptors

Species	Sensitivity	Magnitude	Significance
Harbour porpoise	Low	Low	Negligible (not significant)
Minke whale	Medium	Low	Minor (not significant))
Bottlenose dolphin	Low	Low	Negligible (not significant)
Harbour seal	Low	Low	Negligible (not significant)
Grey seal	Low	Low	Negligible (not significant)
Hauled-out seals	Grey seals during breeding/moult: Medium	Low	Minor (not significant)
	Grey seals outside breeding/moult: Low		Negligible (not significant)
	Harbour seals: Medium		Minor (not significant)

5.5.4 Secondary Mitigation

The project has already committed to the adoption of an NRA, and no additional mitigation measures are required to reduce the significance of the impact.

5.5.5 Residual Effect

As no additional mitigation commitments are required, the residual effect remains **Non-Significant** in EIA terms.

5.6 Disturbance from Vessels (Operational)

5.6.1 Sensitivity

As assessed for the proposed development alone (Section 4.2.1 of Appendix 11.4), the sensitivity of all marine mammals to disturbance from vessel activity is assessed as Low, with the exception of minke whales, which were assessed as Medium. For seals at their haul-out sites, the sensitivity was classed as Low outside of the breeding season and Medium during the breeding season.

5.6.2 Magnitude

Within the Cromarty Firth Harbour Authority limits - covering Deephaven, Nigg South Quay, and Invergordon - movements of vessels greater than 50 gross tonnes averaged approximately 882 movements per year (2019–2023), with fluctuations depending on OWF project activities (Affric 2025). Recent data for the Cromarty Firth shows an average 786 vessel movements were recorded in 2023, with monthly peaks reaching up to 150 vessel movements, resulting in an overall annual traffic volume that can approach or exceed 1,000 vessel movements per year (Affric 2025). It is important to note that within this data, vessels under 50 gross tonnes, including pilot, safety, and recreational vessels, are not recorded but are expected to contribute further to overall vessel presence (Affric 2025). Including the current volume of vessel traffic associated with vessel calls at the Cromarty Firth Ports

(~1,000), the Port of Ardersier (~340) and at the Port of Inverness (~200)[8], baseline vessel movements in the inner Moray Firth amount to approximately ~1,540 movements per year.

At the individual port level, operational vessel movements at Nigg South Quay are projected to increase modestly from a 2019 baseline of approximately 220 movements per year to around 246–255 movements per year, representing an increase of 26–35 additional vessel calls annually (EnviroCentre Limited 2019). For the proposed development, vessel movements are anticipated to increase to 400 vessel calls per year as a maximum worst-case scenario, representing an increase of ~60 additional vessel calls from current annual movements. By contrast, Invergordon is expected to operate at a higher intensity that both Nigg South Quay and the Port of Ardersier, with a worst-case scenario estimating 468 vessel movements per year, the majority of which (420) are tug operations (Affric 2025). However, there is expected to be no overall change to the number of typical operation vessel movements across all Cromarty Firth Ports (other than for Nigg South Quay). No data on anticipated vessel movements are available for the Port of Inverness.

Taking the combined operational activity across the Port of Ardersier, Port of Inverness, Nigg South Quay, Invergordon, and those within the Cromarty Firth Harbour Authority Limits (which includes those at Deephaven and the Cromarty (Car Ferry) Slipway), the total annual vessel movements within the inner Moray Firth are expected to reach approximately ~1,635 vessel movements per year. This represents a small increase in vessel presence within the Moray and Cromarty Firth regions, with associated potential for disturbance to marine mammals known to inhabit or transit these waters.

The increase in vessel movements is likely to elevate underwater noise levels and cause behavioural disturbance, particularly in areas where vessel traffic is concentrated. While many vessel transits will follow existing navigational routes (routes to which local marine mammals may be habituated) the scale and increased frequency of movements shall be small. Operational vessels tend to maintain consistent transit speeds and established routes, limiting variability in acoustic disturbance. However, the sheer volume of vessels, including numerous tug operations at Invergordon and increased offshore renewable industry construction and/or support vessels in the inner Moray Firth and arriving the Port of Ardersier, Nigg South Quay and Invergordon, may contribute to heightened cumulative disturbance pressures, particularly during periods of peak activity.

The projected increase in vessel movements within the inner Moray Firth is expected to result in approximately ~1,635 annual vessel movements, compared to a recent baseline of ~1,540. While the proposed development's contributions to these figures are small, this represents a small increase in vessel presence associated with operational activities at the Port of Ardersier, Nigg South Quay, Invergordon, Inverness, and other Cromarty Firth Harbour Authority facilities. The increase in vessel traffic is regional in extent (covering the Moray and Cromarty Firths) and of a long-term, ongoing duration, with the potential to influence areas regularly used by marine mammals for foraging and transit. Disturbance and underwater noise exposure are expected to increase, particularly in concentrated activity areas (e.g., tug operations at Invergordon, offshore wind support at Ardersier and Nigg). While this represents only a small rise in vessel activity, the consequences for marine mammal populations remain uncertain, particularly for the two qualifying features of nearby designated sites. For the resident bottlenose dolphin population of the Moray Firth SAC, the cumulative effect of increased vessel presence may contribute to behavioural disturbance, though it is unclear whether this would occur at a scale sufficient to alter population dynamics. For harbour seals, which are in decline regionally and make use of the designated haul-out site at Whiteness Sands, as well as the Dornoch Firth and Morrich More SAC, additional disturbance pressures may be of greater concern given their reduced resilience and reliance on nearshore haul-out sites close to

[8] https://portofinverness.co.uk/wp-content/uploads/2023/03/Annual-Report-2022.pdf

existing vessel routes. Accordingly, while the projected increase in vessel traffic during the operational phase is considered small, the extent to which current vessel activity has already resulted in measurable impacts is unknown. This limits confidence in determining whether cumulative vessel disturbance could reach thresholds of biological significance for these populations. Thus, based on the information available, the scale and persistence of vessel traffic assume a **Medium** magnitude of impact for bottlenose dolphins and harbour seals. For harbour porpoise, minke whale and grey seals, the magnitude of impact is assessed as **Low.**

5.6.3 Significance of Effect

The sensitivity of all marine mammals to disturbance from vessel activity is assessed as Low, with the exception of minke whales, which were assessed as **Medium**. The magnitude of the cumulative disturbance from vessels during operation is assessed **Medium** for bottlenose dolphins and harbour seal, and **Low** for harbour porpoise, minke whale and grey seal. Therefore, the significance of effect is assessed as **Minor (Not Significant)** for minke whale, bottlenose dolphins and harbour seal, and **Negligible (Not Significant)** for harbour porpoise and grey seal.

The expected rise in traffic within already active shipping corridors and port areas underscores the importance of continued implementation of mitigation measures, including adherence to marine mammal awareness protocols (incorporated in NRAs) and compliance with relevant wildlife-watching guidelines (i.e., SNH (2017b)) to minimise potential adverse effects. However, adherence to existing protocols alone may not be sufficient. There remains considerable uncertainty around the behavioural responses of marine mammals—particularly bottlenose dolphins and seals in the inner Moray Firth—to increased and cumulative acoustic and physical disturbance from vessels. To better understand and manage these impacts, enhanced monitoring is essential. This may focus on quantifying changes in bioacoustic space, bioavailable habitat, and the extent of highly ensonified zones, which may compromise marine mammal communication, foraging, and other key behaviours. These insights may, in turn, necessitate additional, adaptive mitigation measures to protect these sensitive species effectively.

Table 37: Summary of significance of effects from cumulative vessel disturbance during the operational phase, on marine mammal receptors

Species	Sensitivity	Magnitude	Significance
Harbour porpoise	Low	Low	Negligible (Not Significant)
Minke whale	Medium	Low	Minor (Not Significant)
Bottlenose dolphin	Low	Medium	Minor (Not Significant)
Harbour seal	Low	Medium	Minor (Not Significant)
Grey seal	Low	Low	Negligible (Not Significant)

5.6.4 Secondary Mitigation

The project has already committed to the adoption of an NRA, and no additional mitigation measures are required to reduce the significance of the impact.

5.6.5 Residual Effect

As no additional mitigation commitments are required, the residual effect remains Non-Significant in EIA terms.

5.7 Disturbance to Seal Haul-Out Sites

5.7.1 Sensitivity

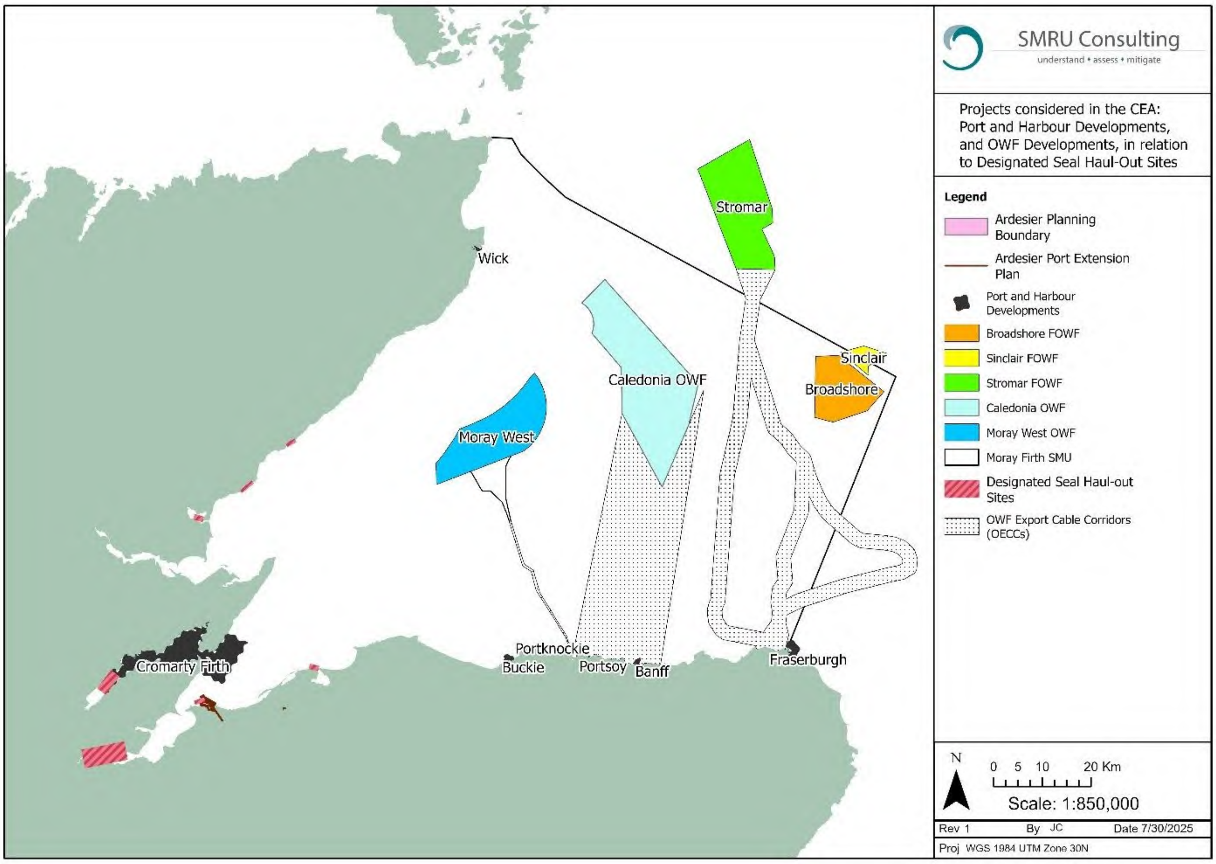
As assessed for the proposed development alone in Section 3.5.2 of Appendix 11.4, the sensitivity of seals at their haul-out sites has been assessed as **Low** (outside the breeding and moult period) to **Medium** (during the breeding and moult period).

5.7.2 Magnitude

It is difficult to reliably quantify the level of increased disturbance to seals resulting from increased vessel activity around haul-out sites on a cumulative basis. This is due to the large degree of spatial and temporal variation in vessel movements between projects in the Moray Firth, and the spatial and temporal variation in seal haul-out sites within the Moray Firth themselves. However, it is expected that the greatest additive effect to disturbance at haul-out sites would come from projects located along coastal areas within the Moray Firth. This includes the proposed development, Invergordon Phase 5, Port of Nigg East Quay, any dredging related Port Development, and the Fraserburgh Harbour Development.

In the Moray Firth, there are seven designated seal haul-out sites based on August counts (Figure 10) and three seasonal grey seal breeding sites and, therefore, vessel traffic near these haul-out sites could be increased as a result of activities from these OWFs which has the potential to increase the level of disturbance.

Figure 10: Projects considered in the CEA for impacts on designated seal haul-out sites. It should be noted that the Cromarty Firth harbour development area (as shown by its Harbour Authority Limits in the figure) includes the Invergordon Phase 5, Cromarty Firth Maintenance Dredging and Port of Nigg Developments.



The majority of port and/or harbour developments within the Moray Firth are located >10 km from the designated seal haul-out sites, except for the proposed development and for developments located within the Cromarty Firth harbour limits (Invergordon Phase 5, Cromarty Firth Maintenance Dredging and Port of Nigg Developments). Therefore, cumulative effects cannot be excluded at the Ardersier and Cromarty Firth designated haul-out sites.

Further, there are many seal haul-out sites at various locations outside these designated sites within the Moray Firth. Seals hauled-out at these non-designated sites also have the potential be disturbed by vessels transiting to and from development areas. All major ports, except Ardersier, are located approximately 1 km or further from locations where haul-out counts have been made (Table 38). Both Cromarty and Nigg are in close proximity to multiple haul-out locations: those at the Port of Nigg are the closest but there are also several more in the Cromarty Firth and Nigg (primarily grey seals) and at Ardersier (primarily harbour seals). However, vessel traffic will not be a novel occurrence in major port areas and, therefore, it is expected that seals in these areas are habituated to vessel movements nearby when considering the small increase in vessel traffic during construction.

Table 38: Proximity of port and harbours with prospective construction activities within the Moray Firth to designated seal haul-out sites, seasonal grey seal haul-out sites and August haul-out count locations

Port or Harbour	Designated Haul-Out Site		Harbour Seal August Count Location		Grey Seal August Count Location	
	Haul-Out Site	Distance	Haul-Out Site	Distance	Haul-Out Site	Distance
Wick	Duncansby – Wick	20.0 km	Wick	4.0 km	Noss Head	4.0 km

Invergordon	Cromarty Firth	8.9 km	Cromarty Firth	8.9 km	Nigg	10.1 km
Cromarty	Ardersier	11.0 km	Nigg	3.0 km	Nigg	2.0 km
Port of Nigg	Ardersier	12.0 km	Nigg	2.0 km	Nigg	1.0 km
Ardersier	Ardersier	0.5 km	Ardersier	0.5 km	Ardersier	0.5 km
Fraserburgh	Findhorn	97.9 km	Sandhaven	2.5 km	Sandhaven	2.0 km
Banff	Findhorn	66.7 km	Buckie	23.9 km	Craigenroan	23.4 km
Portsoy	Findhorn	56.1 km	Buckie	16.1 km	Craigenroan	30.9 km
Portknockie	Findhorn	46.1 km	Buckie	6.0 km	Craigenroan	20.9 km
Buckie	Findhorn	41.1 km	Buckie	2.5 km	Craigenroan	2.0 km

Vessel routes to and from offshore developments will, for the majority, 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 predominantly confined to construction sites. The vessel movements for offshore construction are likely to be limited and slow, resulting in less risk of disturbance to marine mammal receptors. In addition, most projects are likely to adopt NRAs and/or comply with the existing Scottish Marine Wildlife Watching Codes such as SNH (2017b) and SNH (2017a) to minimise any potential effects on marine mammals.

Although construction vessels will be moving throughout the Moray Firth, the impact is considered to be localised to the vicinity of the moving vessel and only when the vessel is moving close to seal haul-out locations. Due to the number of projects included within the CEA and the frequency of overlapping timescales, it is likely that the effect will occur at moderate frequency. Although it could affect a small proportion of respective populations across the duration of the construction, it is unlikely to alter population trajectories in the long-term due to the fact that it will be taking place in areas already characterised by relatively high vessel traffic. Further, embedded mitigation measures such as NRAs shall ensure construction vessels routinely use specified transit routes. As such, it is unlikely that cumulative disturbance to haul-outs could alter harbour and grey seal population trajectories and magnitude of the disturbance to haul-outs is assessed as **Low** during construction.

5.7.3 Significance of Effect

The sensitivity of seals at their haul-out sites has been assessed as Low (outside breeding and moult) to Medium (during breeding and moult). The magnitude of the disturbance to haul-outs is assessed as Low during construction. Therefore, the significance of effect is assessed as **Negligible** (outside breeding and moult) to **Minor** (during breeding and moult)**,** which is **Not Significant** in EIA terms.

Table 39: Summary of significance of effects from cumulative disturbance to seal haul-out sites during construction

Species	Sensitivity	Magnitude	Significance
Hauled-out seals	During breeding/moult: Medium	Low	Minor (not significant)
	Outside breeding/moult: Low		Negligible (not significant)

5.7.4 Secondary Mitigation

The project has already committed to the adoption of an NRA, and no additional mitigation measures are required to reduce the significance of the impact.

5.7.5 Residual Effect

As no additional mitigation commitments are required, the residual effect remains **Non-Significant** in EIA terms.

6 Glossary of Terms, Acronyms and Abbreviations

Term	Description
ADD	Acoustic Deterrent Device
CEA	Cumulative Effects Assessment
CES MU	Coastal East Scotland Management Unit
CGNS MU	Celtic and Greater North Sea Management Unit
CSD	Cutter Suction Dredger
dB	Decibel
dB re 1 µPa	Decibel referenced to 1 micropascal (underwater sound pressure unit)
dB re 1 μPa^2s	Decibel referenced to 1 micropascal squared per second (used in SEL)
DPH	Detection Positive Hours
EDR	Effective Deterrence Range
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPS	European Protected Species
ETF	Energy Transition Facility
HRA	Habitats Regulations Appraisal
Hz	Hertz
IAMMWG	Inter-Agency Marine Mammal Working Group
JNCC	Joint Nature Conservation Committee
kHz	Kilohertz
kJ	kilojoules
km	Kilometres
L_p	Sound Pressure Level
$L_{p,pk}$	Peak Sound Pressure Level
L_{rms}	Root Mean Square Sound Pressure Level
m	Metres

MF SMU	Moray Firth Seal Management Unit
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Mammal Observer
MU	Management Unit
NMFS	National Marine Fisheries Service (USA)
NS MU	North Sea Management Unit
NRA	Navigational Safety Risk Assessment
OSPAR	Oslo-Paris Convention (for Protection of the Marine Environment of the North-East Atlantic)
OWF	Offshore Windfarm
PAHS	Polyaromatic Hydrocarbons
PAM	Passive Acoustic Monitoring
PCBs	Polychlorinated Biphenyls
PCOD	Population Consequences of Disturbance
PTS	Permanent Threshold Shift
RAL	Revised Action Levels
RMS	Root Mean Square
SAC	Special Area of Conservation
SCANS	Small Cetacean Abundance in the North Sea and Adjacent Waters
SCOS	Scientific Committee on Seals
SEL	Sound Exposure Level
SEL_{cum}	Cumulative Sound Exposure Level
SHB	Split Hopper Barges
SMU	Seal Management Unit
SNCB	Statutory Nature Conservation Body
SPL	Sound Pressure Level
SPL_{peak}	Peak Sound Pressure Level
spm	Strikes per minute
TBT	Tributyl Tin
TSHD	Trailer Suction Hopper Dredger
TTS	Temporary Threshold Shift
UXO	Unexploded Ordnance

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