Inch Cape
OFFSHORE LIMITED

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# Inch Cape Offshore Wind Farm

# European Protected Species Risk Assessment – OSP Piling and Export Cable Works

Inch Cape
OFFSHORE LIMITED

## Inch Cape Acceptance

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# Acronyms & Abbreviations

| Acronym | Term |
|---|---|
| ADD | Acoustic Deterrent Device |
| BE | Best Estimate |
| BEIS | Department for Business, Energy & Industrial Strategy |
| CaP - EC | Cable Plan – Export Cable |
| CBRA | Cable Burial Risk Assessment |
| CI | Confidence Interval |
| CoP | Construction Programme |
| dB | Decibel |
| DP | Dynamic Positioning |
| ECC | Export Cable Corridor |
| EDR | Effective Deterrence Range |
| EEC | European Economic Community |
| EPS | European Protected Species |
| FCS | Favourable Conservation Status |
| IAMMWG | Inter Agency Marine Mammal Working Group |
| ICOL | Inch Cape Offshore Limited |
| JNCC | Joint Nature Conservation Committee |
| kHz | Kilohertz |
| kJ | kiloJoule |
| KP | Kilometre Point |
| m | Metre |
| m/s | Metre per Second |
| MBES | Multi Beam Echo Sounder |
| ML | Most Likely |
| MMO | Marine Mammal Observer |

| Acronym | Term |
|---|---|
| MPA | Marine Protected Area |
| MU | Management Unit |
| nm | Nautical Mile |
| μPa | Micropascal |
| $\mu Pa^2 s$ | Micropascal squared second |
| OfTI | Offshore Transmission Infrastructure |
| OSP | Offshore Substation Platform |
| OWF | Offshore Wind Farm |
| PLGR | Pre-Lay Grapnel Run |
| PTS | Permanent Threshold Shift |
| ROV | Remotely Operated Vehicle |
| SAC | Special Area of Conservation |
| SBI | Sub-Bottom Imager |
| SCANS | Small Cetaceans in European Atlantic Waters and the North Sea |
| SCOS | Special Committee on Seals |
| SEL | Sound Exposure Level |
| SMU | Seal Management Unit |
| SNH | Scottish Natural Heritage |
| SPL | Sound Pressure Level |
| SSCV | Semi-Submersible Crane Vessel |
| SSS | Side Scan Sonar |
| STW | Scottish Territorial Waters |
| UK | United Kingdom |
| USBL | Ultra-Short Baseline |
| UXO | Unexploded Ordnance |
| WC | Worst-case |

# 1 Introduction

Inch Cape Offshore Limited (ICOL) has consent to develop an offshore wind farm (OWF) in the outer Firth of Tay region within Scottish Territorial Waters (STW). The consented Inch Cape OWF will comprise up to 72 wind turbines and be located approximately 15 km to the east of the Angus coastline (Figure 1.1). The Development Area (the wind farm array area) is in water depths of between 40 - 57 m.

The Offshore Transmission Infrastructure (OfTI) for the ICOL OWF comprises one Offshore Substation Platform (OSP) and the Offshore Export Cable Corridor (ECC). The OSP is located on the west side of the Development Area (Figure 1.2). The Offshore ECC will consist of two 220 kV export cables approximately 85 km long, between the landfall point at Cockenzie in East Lothian and the boundary of the Development Area, and 1.4 km across at the widest point, reducing to approximately 250 m at the landfall.

In 2019 a revised Marine Licence was granted for the OfTI connecting the landfall location, near Cockenzie, East Lothian, and the Inch Cape OWF. A varied Marine Licence (MS-00010593), to capture changes to deposit quantities and revision to the Offshore ECC coordinates, was granted 9th November 2023.

This document assesses the potential risk to marine European Protected Species (EPS), basking sharks and seals from the proposed construction of the OfTI in order to ascertain whether EPS and basking shark licences are required and can be awarded.

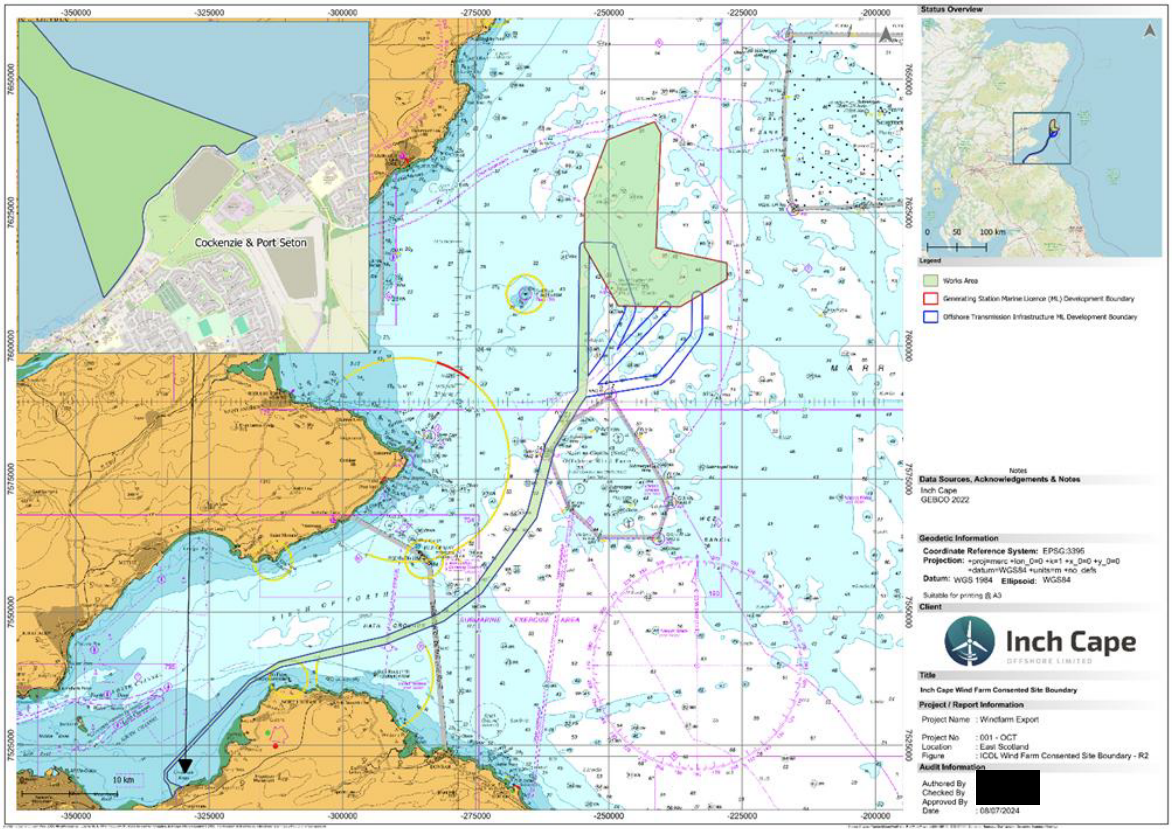


Figure 1.1: Project Location

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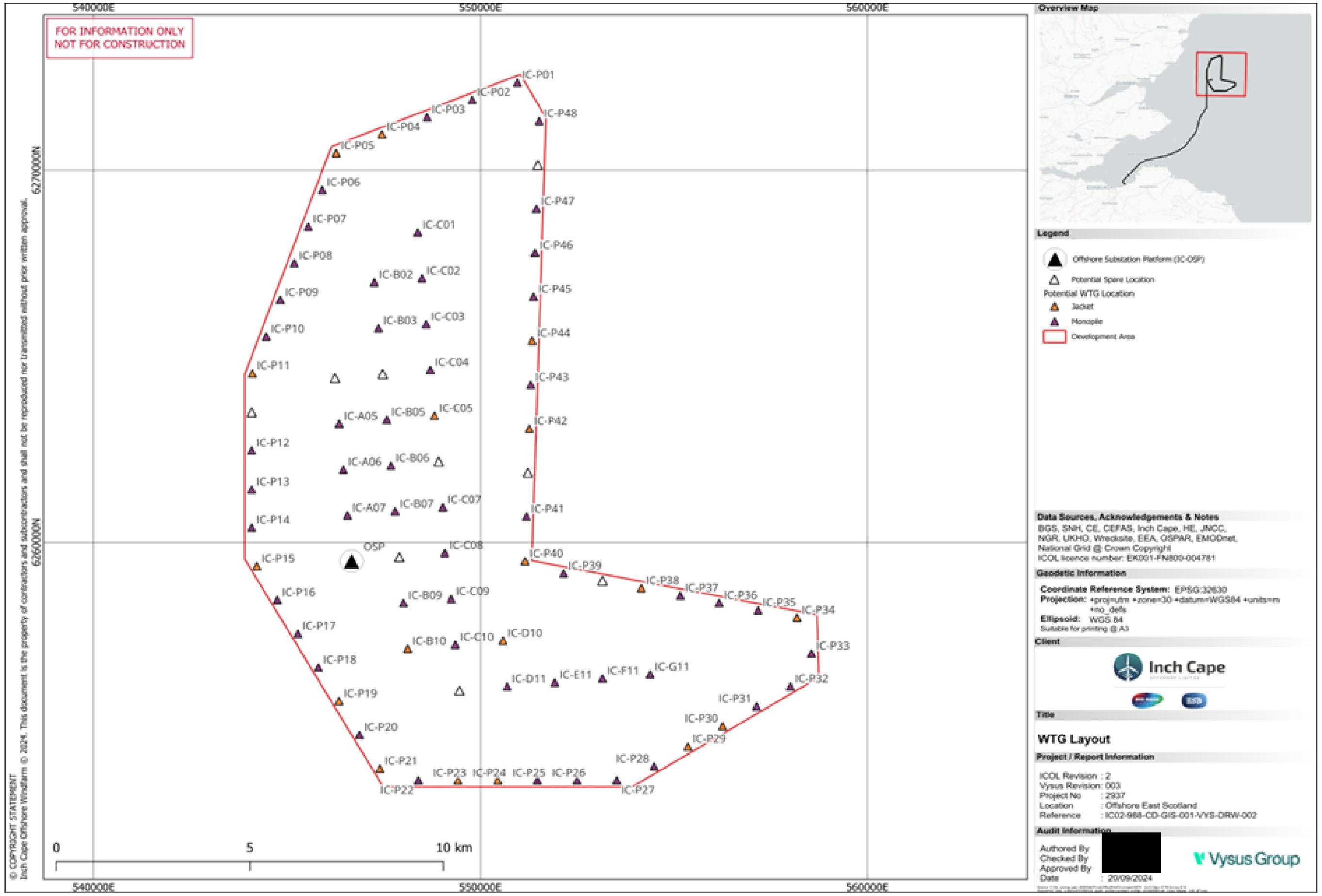


**Figure 1.2: OSP Location**

# 2 Planned Construction Work

## 2.1 OSP

A comprehensive overview of the construction of the OSP is given in Section 4 of the OSP Piling Strategy (ICO2-INT-EC-OFC-005-INC-STR-001).

### 2.1.1 Jacket Installation

The OSP is supported by a four-legged jacket substructure with eight post-installed skirt piles (diameter 2.591 m) driven into the seabed through pile sleeves at each jacket leg. Each pile is attached to its sleeve via a grouted shear key connection with weld beads on the pile and in the pile sleeves.

### 2.1.2 Pile Driving

#### *2.1.2.1 Proposed Installation Sequence*

The OSP will require 8 skirt piles (37.3 m in length) to secure the jacket foundation. Each pile will be installed in the following sequence:

- Jacket to be transported to site using a towed barge;
- Jacket to be lifted from barge and installed at location using a Semi-Submersible Crane Vessel (SSCV);
- Pin piles transported on separate coaster vessel and transferred to SSCV deck;
- Jacket levelness will be checked prior to pile driving to the target penetration utilising a soft start procedure and additional required noise mitigation (see Section 6);
- The first four gripper skirt piles will be lifted off to the SSCV deck, upended and stabbed in turn then driven;
- Intermediate jacket level survey to be performed to determine if active levelling is required, followed by levelling if required;
- Engage pile grippers;
- Install final 4 piles;
- Grouting between the skirt piles and the pile sleeves will be undertaken;
- Perform final jacket level survey.

Using this method, it is anticipated that 4 piles can be installed in 24 hours.

#### *2.1.2.2 Hammer Energies*

The OSP pile drivability assessment was undertaken by the installation contractor Heerema in early 2024. The conclusion (of the drivability assessment) was that a maximum hammer energy of 3500 kJ will be required for the OSP foundation piling.

#### 2.1.2.3 Soft Start and Ramp Up Procedure

A 30-minute[1] soft start will be implemented with a maximum hammer energy of 350 kJ (10% full power). On completion of the soft start the hammer energy will be slowly ramped up until the desired power is reached. There is uncertainty with respect to soil layering across the OSP footprint. Therefore, three scenarios (Best Estimate (BE), BE+5 metres (m), BE-5 m) have been modelled to account for the potential variation in the depth of the critical layer for pile driveability (Table 2.1 to Table 2.3).

**Table 2.1: Soft start and ramp up procedure for the BE scenario**

| BE | 10%<br>350 kJ | 20%<br>700 kJ | 30%<br>1050 kJ | 40%<br>1400 kJ | 50%<br>1750 kJ | 60%<br>2100 kJ | 70%<br>2450 kJ |
|---|---|---|---|---|---|---|---|
| No of strikes | 6 | 110 | 175 | 150 | 170 | 110 | 490 |
| Duration (mins) | 30 | 3 | 6 | 5 | 7 | 4 | 20 |
| Strike rate (bl/min) | 0.2 | ~36.7 | ~29.2 | 30.0 | ~24.3 | 27.5 | 24.5 |
| **1,211 strikes over 1 hour, 15 minutes per pile**<br>**4,844 strikes over 5 hours for four piles** | | | | | | | |

**Table 2.2:Soft start and ramp up procedure for the BE+5 m scenario**

| BE+5 m | 10%<br>350 kJ | 20%<br>700 kJ | 30%<br>1050 kJ | 40%<br>1400 kJ | 50%<br>1750 kJ | 60%<br>2100 kJ | 70%<br>2450 kJ | 80%<br>2800 kJ | 90%<br>3150 kJ | 100%<br>3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| No of strikes | 6 | 110 | 175 | 150 | 170 | 135 | 155 | 130 | 135 | 45 |
| Duration (mins) | 30 | 3 | 6 | 5 | 7 | 5 | 6 | 5 | 5 | 2 |
| Strike rate (bl/min) | 0.2 | ~36.7 | ~29.2 | 30.0 | ~24.3 | 27.0 | ~25.8 | 26 | 27 | 22.5 |
| **1,211 strikes over 1 hour, 14 minutes per pile**<br>**4,844 strikes over 4 hours, 56 minutes for four piles** | | | | | | | | | | |

[1] The standard soft start (20 minutes) was extended to allow animals additional time to flee during the low hammer energy period thus reducing the cumulative PTS risk.

Table 2.3: Soft start and ramp up procedure for the BE-5 m scenario

| BE-5 m | 10%<br>350 kJ | 20%<br>700 kJ | 30%<br>1050 kJ | 40%<br>1400 kJ | 50%<br>1750 kJ | 60%<br>2100 kJ |
|---|---|---|---|---|---|---|
| No of strikes | 6 | 90 | 175 | 470 | 450 | 45 |
| Duration (mins) | 30 | 3 | 6 | 16 | 18 | 2 |
| Strike rate (bl/min) | 0.2 | 30.0 | ~29.2 | ~29.4 | 25.0 | 22.5 |
| **1,236 strikes over 1 hour, 15 minutes per pile**<br>**4,944 strikes over 5 hours for four piles** | | | | | | |

### 2.1.3 Proposed Vessels

The following vessels will be used for the OSP Piling construction work:

- A Semi-Submersible Crane Vessel (SSCV) will be used to position the OSP components in place;
- A towed barge which will deliver the components to the Inch Cape OWF Site;
- Tugs will be required for towing the transport barge; and
- Coaster vessel transporting

## 2.2 ECC

The ECC construction work will follow boulder clearance, Unexploded Ordnance (UXO) identification and clearance, and a geophysical survey planned to be undertaken in Q3/4 2024 and Q1/2 2025. These works are all covered under separate EPS Licences (EPS/BS-00010986, EPS/BS-00010808, EPS/BS-00010894).

Detailed information on the construction of the ECC is provided in the Inch Cape Offshore Wind Farm Cable Plan – Export Cable (CaP - EC) (IC02-INT-EC-OFC-012-INC-PLA-002).

### 2.2.1 Pre-Installation Preparatory Works

#### *2.2.1.1 Pre-Lay Grapnel Run*

A Pre-Lay Grapnel Run (PLGR) will be conducted along each of the export cable routes. The PLGR involves a vessel towing a grapnel train over the cable routes. The objective is to find and recover debris (e.g. wires or fishing nets) presented within the cable installation corridor. Depending on the size and type of debris, it will be either removed from the route or recovered to the vessel deck.

A PLGR will not be performed on the part of the cable routes that cross other third-party assets (exclusion zones). The PLGR train will be recovered and secured to deck prior crossing the asset. Clearance requirements as per the crossing agreements will be adhered to whilst launching and recovering the grapnel train at the crossing locations.

#### *2.2.1.2 Pre-lay surveys*

Pre-lay surveys to inform cable micro-siting will be undertaken using Sub-Bottom Profiling (SBP), SSS, MBES and visual methods (e.g. ROV, drop down videos). These will provide the final identification of objects on the seabed surface, such as boulders and debris, and assess seabed morphology prior the installation works. The contractor may wish to carry out additional geotechnical surveys along the route in order to gather more data on the soil conditions. This would be through CPT or vibrocore, never penetrating more than 6m below seabed. Input from the pre-installation survey will be used for final route engineering of the subsea cable. The route will be adjusted where possible and required, within the consented corridor.

Surveys will be carried out either from sensors mounted on surface vessels, or sensors mounted to ROV's. For some survey types, surveys may be carried out by Unmanned Surface Vessels (USV's).

#### *2.2.1.3 Third Party Crossing Preparation*

Before cables are laid, mattresses will be installed over any existing third-party assets (cables and pipelines) in addition to cable joints and the OSP.

Two crossings have been identified along the route, one over a National Gas grid pipeline and the other potential crossing over a 220 kV cable.

### 2.2.2 Cable Lay Operations

The export cable will be installed onto the seabed to an anticipated target depth of at least 1.2 m for the majority of the cable length, in order to provide adequate protection to the cables. The final depth will be dependent on a Cable Burial Risk Assessment (CBRA) (as outlined in the CaP - EC (IC02-INT-EC-OFC-012-INC-PLA-002)). The Cable Lay Vessel (CLV) will take position nearshore, either through Dynamic Positioning (DP) or using anchoring with the support of two Anchor Handling Tugs (AHTs). Positioning in anchors is only required in the sections where water depth is not sufficient for DP operations.

The cable installation process can be split into six components (as outlined in the CaP – EC):

- Shore landing, where the cable is moved into the pull-in position at the landfall location;
- Surface laying, where the cable is surface laid along the cable route;
- Second end pull-in, where the cable is connected to the OSP;
- Jointing, where in-line offshore cable joints will be performed at two jointing locations;
- Trenching and burial, including a pre-lay trenching and combination of methods such as ploughs, jetting, CFE and mechanical cutters ; and
- Deployment of additional cable protection, such as rock placement and mattresses, where cable burial is not possible (currently estimated to be required for no more than 20% of the cable length).

### 2.2.3 Proposed Vessels

Several types of vessels may be required for the ECC construction works. Not all of these vessels will be used at the same time.

The proposed vessel types are:

- Construction support vessels (including multipurpose vessels, Anchor Handling Tugs (AHT), tug boats, remotely operated vehicle (ROV) support vessels, multicat workboats, safety boats, supply vessels, and others);
- Cable lay vessel (CLV);
- Rock installation vessel/ barge;
- Trenching support vessel (TSV);
- Survey support vessels;

- Jack up barge (JUB) for nearshore works;
- Diving support vessels (DSV);
- Crew Transfer Vessels (CTV);
- Guard vessels; and
- Cable transport vessel.

### 2.2.4 Sound Emitting Geophysical Survey and Positioning Equipment

All aspects of the ECC construction works (pre-installation preparatory works and cable lay operations) will require the use of sound emitting geophysical survey and positioning equipment. Examples of equipment which may be used include Ultra-Short Base Line (USBL) systems, Multi Beam Echo Sounders (MBES), Sub-Bottom Imagers (SBI) and Side Scan Sonars (SSS).

## 2.3 Timing and Duration

Offshore construction is currently expected to commence in April 2025 and is anticipated to take approximately two and a half years, running to August 2027. Details of the full programme for the construction works are provided in the Construction Programme (CoP) (IC02-INT-EC-OFC-004-INC-PRG-001).

The OSP piling work is currently planned to take place between 1st July 2025 to 30th September 2025, however the actual piling will only take place over two days (four piles per 24 hours). If pilling begins at the back of the July to September window it may run into October 2025.

The offshore ECC construction works are currently anticipated to start on 1st April 2025 and it is expected that construction work will be carried out 24/7, year-round (i.e., 24 hour working, seven days a week).

# 3 Legal Requirement

All species of cetacean in waters around the UK are considered EPS under Annex IV of the Habitats Directive (Council Directive 92/43/EEC) which covers animal and plant species of community interest in need of strict protection.

The need to consider EPS in waters off Scotland comes from two articles of legislation, these are:

- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended in Scotland) which transposes the Conservation of Natural Habitats and Wild Fauna and Flora Directive (Council Directive 92/43/EEC; referred to as the Habitats Directive) into Scottish law. This legislation covers Scottish Territorial Waters; and
- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (known as the Offshore Regulations) which transpose the Habitats Directive into UK law for all offshore activities. This legislation covers UK waters beyond the 12 nm limit.

Both of these regulations (collectively known as the 'Habitat and Offshore Marine Regulations') provide for the designation of protected European sites (Special Areas of Conservation (SACs)) and the protection of EPS as designated under the Habitats Directive.

The Offshore Regulations state in section 45, that it is an offence to:

- Deliberately capture, kill or injure any wild animal of a EPS, as listed under Annex IV of the Habitats Directive;
- Damage or destroy, or cause deterioration of the breeding sites or resting places of a EPS; and
- Deliberately disturb EPS (in particular disturbance which is likely to impair the ability of a significant group of animals of that species to survive, breed, rear, or nurture their young, or which might affect significantly their local distribution or abundance).

The Conservation of Habitats and Species Regulations 1994 (as amended in Scotland) state, under section 39, that it is an offence to:

- Deliberately or **recklessly** capture, kill or injure a wild animal of a EPS, as listed under Annex IV of the Habitats Directive;
- Damage or **recklessly** destroy, or cause deterioration of the breeding sites or resting places of an EPS; and
- Deliberately or **recklessly** disturb EPS (in particular disturbance which is likely to impair their ability to survive, breed, reproduce, nurture their young, migrate or hibernate, or which might affect significantly their local distribution or abundance).
- Disturb **any** EPS in a matter that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which is belongs;
- **Deliberately or** recklessly **disturb any dolphin, porpoise or whale (cetacean) through Regulation 39 (2).**

The additional protection afforded by the Conservation of Habitats and Species Regulations 1994 (as amended in Scotland) has been shown in **bold** in the list above. It is therefore an offence to deliberately or recklessly disturb a single cetacean in Scottish Territorial Waters.

In addition, any means of capturing or killing which is indiscriminate and capable of causing the local disappearance of - or serious disturbance to - any population of EPS is an offence.

Licences may be granted by the Marine Directorate (on behalf of the Scottish Ministers) which would allow otherwise illegal activities to go ahead.

Three tests must be passed before a license can be granted:

1. The license must relate to one of the purposes referred to in Regulation 44, which are:
   a. scientific research or educational purposes;
   b. ringing or marking, or examining any ring or mark on, wild animals;
   c. conserving wild animals, including wild birds, or wild plants or introducing them to particular areas;
   d. conserving natural habitats;
   e. protecting any zoological or botanical collection;
   f. preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment;
   g. preventing the spread of disease; or
   h. preventing serious damage to livestock, foodstuffs for livestock, crops, vegetables, fruit, growing timber or any other form of property or to fisheries;
2. There must be no satisfactory alternative (Regulation 44, 3a); and
3. The action authorised must not be detrimental to the maintenance of the population of the species concerned at a Favourable Conservation Status (FCS) in their natural range (Regulation 44, 3b).

FCS is defined in the Habitats Directive as the following:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable element of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis.

The proposed Cable Route and Development Area are both within the 12 nm limit of Scotland's Territorial Waters. However, sound from the proposed works has the potential to affect animals within both Scottish Territorial and offshore waters. Both the Habitats and Offshore Regulations therefore apply.

## 3.1 Guidance

The Marine Directorate and Scottish Natural Heritage (SNH) (now Nature Scot) produced guidance for Scottish inshore waters 'The protection of Marine European Protected Species from injury and disturbance' in March 2014 (Marine Scotland and SNH, 2014). This guidance was updated in July 2020 (Marine Scotland and SNH, 2020). Marine Directorate recognise that the guidance '…reflects a precautionary approach…' to the interpretation of the Habitats Directive with regards to EPS and requires the careful examination of the potential impact of proposed offshore activities, and the resultant noise produced, on individual animals likely to be present at the location.

The guidance states that the two main potential causes of death or injury are physical contact (with a vessel) and anthropogenic noise.  Likelihood of disturbance for individuals includes factors such as:

- Spatial and temporal distribution of the animal in relation to the activity;
- Any behaviour learned from prior experience with the activity;
- Similarity of the activity to biologically important signals (particularly important in relation to activities creating sound); and
- The motivation of the animal to remain within the areas (e.g. food availability).

Likelihood of potential impacts should include the following considerations:

- Type of activity;
- Duration and frequency of the activity;
- Extent of the activity;
- Timing and location of the activity; and
- Other known activities in the area at the same time.

# 4 EPS in Region of the Inch Cape OWF

## 4.1 Cetaceans

Four cetacean species are considered to occur on a relatively common basis in the vicinity of the Inch Cape OWF: Minke whale (*Balaenoptera acutorostrata*), bottlenose dolphin (*Tursiops truncatus*), white-beaked dolphin (*Lagenorhynchus albirostris*) and harbour porpoise (*Phocoena phocoena*) (Arso Civil et al. 2021, Gilles et al. 2023, IAMMWG, 2023).

Occasional visitors to the region include common dolphin (*Delphinus delphis*), Risso's dolphin (Grampus griseus), white-sided dolphin (*Lagenorhynchus acutus*), killer whale (*Orcinus orca*), long-finned pilot whale (*Globicephala melas*) and fin whale (*Balaenoptera physalus*). Sightings of humpback whale (*Megaptera novaeangliae*) and sei whale (*Balaenoptera borealis*) have also been recorded in recent years[2].

### 4.1.1 Density Estimates

#### *4.1.1.1 Minke Whale, White-Beaked Dolphin and Harbour Porpoise*

Design-based density estimates for minke whale, white-beaked dolphin and harbour porpoise are provided, from the most recent (2022) SCANS-IV survey and, for the survey blocks within which the noise contours from the proposed OSP piling are likely to extend (Blocks NS-H, NS-C, NS-G, NS-D, NS-E, and NS-F; Gilles et al., 2023) in Table 4.1. Since confidence intervals (CIs) around the density estimates were not provided by Gilles et al. (2023), CIs were calculated by dividing the confidence limits associated with the abundance estimates for these species by the area of the survey block.

For the offshore ECC construction works assessment only the density estimates from SCANS-IV survey block NS-D (where the Inch Cape Development Area and OfTI are located) were used.

**Table 4.1: Minke whale, white-beaked dolphin and harbour porpoise density across the relevant SCANS-IV survey blocks. Density values were extracted from the SCANS-IV report (Gilles et al., 2023), while density confidence intervals were calculated by dividing the abundance confidence intervals by the area. All numbers have been rounded for display purposes only**

| Species | SCANS-IV Survey Block | Density | Lower CI | Upper CI |
|---|---|---|---|---|
| Minke whale | NS-H | 0.015 | 0.003 | 0.040 |
| | NS-C | 0.007 | 0.000 | 0.023 |
| | NS-G | 0.010 | 0.000 | 0.037 |
| | NS-D | 0.042 | 0.008 | 0.114 |
| | NS-E | 0.012 | 0.000 | 0.041 |
| | NS-F | 0.027 | 0.000 | 0.074 |
| White-beaked dolphin | NS-H | 0.002 | 0.000 | 0.007 |
| | NS-C | 0.015 | 0.000 | 0.040 |
| | NS-G | 0.105 | 0.053 | 0.196 |
| | NS-D | 0.080 | 0.015 | 0.164 |
| | NS-E | 0.177 | 0.059 | 0.330 |
| | NS-F | 0.306 | 0.002 | 1.034 |
| Harbour porpoise | NS-H | 0.803 | 0.488 | 1.265 |
| | NS-C | 0.603 | 0.388 | 0.932 |

2 https://www.seawatchfoundation.org.uk/recentsightings/

| Species | SCANS-IV Survey Block | Density | Lower CI | Upper CI |
|---|---|---|---|---|
| | NS-G | 1.040 | 0.620 | 1.601 |
| | NS-D | 0.599 | 0.280 | 1.185 |
| | NS-E | 0.516 | 0.333 | 0.769 |
| | NS-F | 0.439 | 0.226 | 0.816 |

*Source: Gilles et al. (2023) – SCANS-IV.*

#### *4.1.1.2 Bottlenose Dolphin*

Both inshore and offshore bottlenose dolphin ecotypes are recognised in UK waters. The two largest inshore bottlenose dolphin populations are located in the Moray Firth, East Scotland and Cardigan Bay, Wales, which both have SACs designated for them. The east coast of Scotland bottlenose dolphin population has expanded south since the 1990s and now around 53% of the population uses the Tay Estuary and surrounding waters, which is adjacent to the Inch Cape OWF (Arso Civil et al. 2021).

Due to the behaviour and social structure of the inshore bottlenose dolphin population, which regularly travels along the coastline in close-knit groups, it is difficult to represent their population density accurately. An inferred density surface was created using the most recent population estimate for east Scotland. The weighted average for the East Coast population from 2020 to 2022 (226, CIs: 214-239, Cheney et al., 2024) was assumed to be split 50:50 between the east coast (from Rattray Head south) and the Moray Firth (Cape Wrath to Rattray Head). The 20 m depth contour was used to differentiate between the 'coastal strip' (where inshore bottlenose dolphins tend to be encountered) and the 'non-coastal strip' (where inshore bottlenose dolphins tend not to be encountered). The choice of the 20 m contour was informed by data from the south side of the Moray Firth where greater than 95% of sightings made were within the 20 m depth contour (Culloch and Robinson, 2008; Robinson et al., 2007, Quick et al., 2014). The 113 individuals assumed to be present on the east coast (i.e., 50% of the population of 226 individuals) were distributed evenly across the area inside the 20 m depth contour. Zero density was used beyond the 20 m depth contour and within the Forth and Inner Tay (where bottlenose dolphins are known not to be regularly present) (Cheney et al., 2024).

### 4.1.2 Reference Populations and Management Units

Throughout the assessment the number of potentially impacted individuals is presented in the context of the wider North Sea population and relevant local Management Unit (MU). Table 4.2 presents the reference population abundance estimates used in the assessment.

**Table 4.2: Cetacean reference population abundance estimates**

| Species | Reference population | Abundance | | Reference |
|---|---|---|---|---|
| | | Estimate | 95 % CI | |
| Minke whale | Celtic and Greater North Seas MU | 20,118 | 14,061 - 28,786 | Inter-Agency Marine Mammal Working Group (IAMMWG) (2023) |
| | UK portion of MU | 10,288 | 6,210 - 17,042 | |
| Bottlenose dolphin | East coast population | 226 | 214 - 239 | Cheney *et al.* (2024) |
| | Coastal East Scotland MU | 224 | 214 - 234 | IAMMWG (2023) |
| White-beaked dolphin | Celtic and Greater North Seas MU | 43,951 | 28,439 - 67,924 | IAMMWG (2023) |
| | UK portion of MU | 34,025 | 20,026 - 57,807 | |
| Harbour porpoise | North Sea MU | 346,601 | 289,498 - 419,967 | IAMMWG (2023) |

| Species | Reference population | Abundance | | Reference |
|---|---|---|---|---|
| | | Estimate | 95 % CI | |
| | UK portion of North Sea MU | 159,632 | 127,442 - 199,954 | |

## 4.2 Marine Turtles

In addition to marine mammals, there are up to five species of marine turtle which have been sighted in British waters. The leatherback turtle (*Dermochelys coriacea*) is the most commonly recorded species in UK waters however, the species is thought to be at the most extreme northern limit of its natural range in UK waters with its range being limited by the 15ºC isotherm (McMahon and Hays, 2006; BEIS, 2016). Sightings in the North Sea are uncommon with most UK sightings occurring in the Irish Sea (BEIS, 2016). Due to the low likelihood of occurrence of marine turtles in the vicinity of the Inch Cape OWF, they have not been considered further. However, any mitigation proposed for cetacean EPS will also be applied to marine turtles.

## 4.3 Other (non-EPS) Species

### 4.3.1 Basking Shark

Basking sharks are protected under Schedule 5 of the Wildlife and Countryside Act 1981. There have been few sightings of this species in the North Sea (Drewery, 2012; Wilson *et al*., 2020) which indicates a low abundance in the vicinity of the Inch Cape OWF. Due to their habit of feeding at slow speed very close to the surface, basking sharks are potentially at risk from collision with boat traffic (Wilson *et al*., 2020). In contrast, although there is little information on sound detection in basking sharks, there is no direct evidence of sound causing basking shark mortality or stress (Wilson *et al*., 2020). Although the potential effects of noise on basking sharks have not therefore been assessed, any mitigation measures proposed for EPS will also be applied to basking sharks.

### 4.3.2 Seals

Two seal species occur on a relatively common basis in the North Sea: Grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) (Carter *et al*., 2022).

#### *4.3.2.1 Density Estimates*

For harbour and grey seals, at-sea density surfaces were derived by scaling the UK-wide relative density surfaces provided by Carter *et al.* (2022). Carter *et al.* (2022) used telemetry data from grey (n =114) and harbour (n=239) seals, collected from 26 sites across the UK and Ireland between 2005 and 2019. These telemetry data were modelled and used to predict seal relative at-sea densities over a 5 km x 5 km grid. To obtain an annual estimate of absolute at-sea density, the predicted relative density needed to be scaled using population estimates.

Current population assessments are carried out using aerial surveys during the month of August when harbour seals undergo an annual moult and most of the population is hauled out on land and thus available to be counted (Special Committee on Seals (SCOS), 2022). These numbers only represent hauled out individuals during the summer months, thus to obtain an annual estimate for at-sea individuals, population counts were corrected first for the proportion of hauled-out individuals during the summer months (taken from SCOS-BP 21/02 in SCOS (2021) for grey seals and Lonergan *et al.* (2013) for harbour seals) and then by the annual estimates of the proportion of the population expected to be at sea (SCOS, 2021). The equation to calculate the final count was:

$$\widehat{N} = \frac{N}{H} \times S$$

Where *N* is the counted population (see table below), *H* is the haul out proportion, and *S* is the proportion at sea. When $\widehat{N}$ is multiplied by mean relative density values in each raster cell provided by Carter *et al.* (2022) as a proportion, the sum totals the population estimate across the UK and Ireland. Values used are provided in Table 4.3. This method was used to create estimates of absolute abundance across UK and Irish waters, at 5 x 5 km resolution. The density per grid cell was also calculated by dividing the abundance by the cell area, resulting in a density of seals per $km^2$.

This process resulted in final expected at-sea abundances of 153,591 for grey seal and 39,878 for harbour seal, which were used to scale the Carter *et al.* (2022) surfaces.

**Table 4.3: Input values used for seal relative density surface scaling**

| Species | Count (hauled out, August) | Proportion hauled out in August (low-high estimates) | Total population size | Annual at-sea proportion | Annual at sea estimate for scaling Carter surfaces |
|---|---|---|---|---|---|
| Grey seal | 44,833 | 0.2515 (0.2907 - 0.2145) | 178,262 (154,224 – 209,012) | 0.8616 | 153,591 (132,880 – 180,084) |
| Harbour seal | 34,862 | 0.72 (0.88-0.54) | 48,419 (39,615 – 64,559) | 0.8236 | 39,878 (32,627 – 53,171) |

*Source: Grey seal proportions hauled out from SCOS-BP 21/02. Harbour seal proportion hauled out from Lonergan et al. (2013).*

#### *4.3.2.2 Reference Populations and Management Units*

For management purposes the UK and Ireland seal population has been divided into Management Units (SCOS, 2022). The Inch Cape development occurs within the East Scotland Seal Management Unit (SMU). However, given the far-ranging behaviour of grey seals (Table 4.1A), the Orkney & North Coast, and North East England SMUs (Table 4.1B) were also considered in the assessment.

Based on scaled Carter surfaces, 40% of the UK and Ireland at-sea population of grey seals are predicted to occur within the East Scotland (18,259 individuals), Orkney & North Coast (28,703 individuals), and North East England (14,558 individuals) SMUs, giving a total of 61,520 individuals. The equivalent number for harbour seals is 0.95% of the at-sea population, which equates to 377 individuals in the East Scotland SMU.

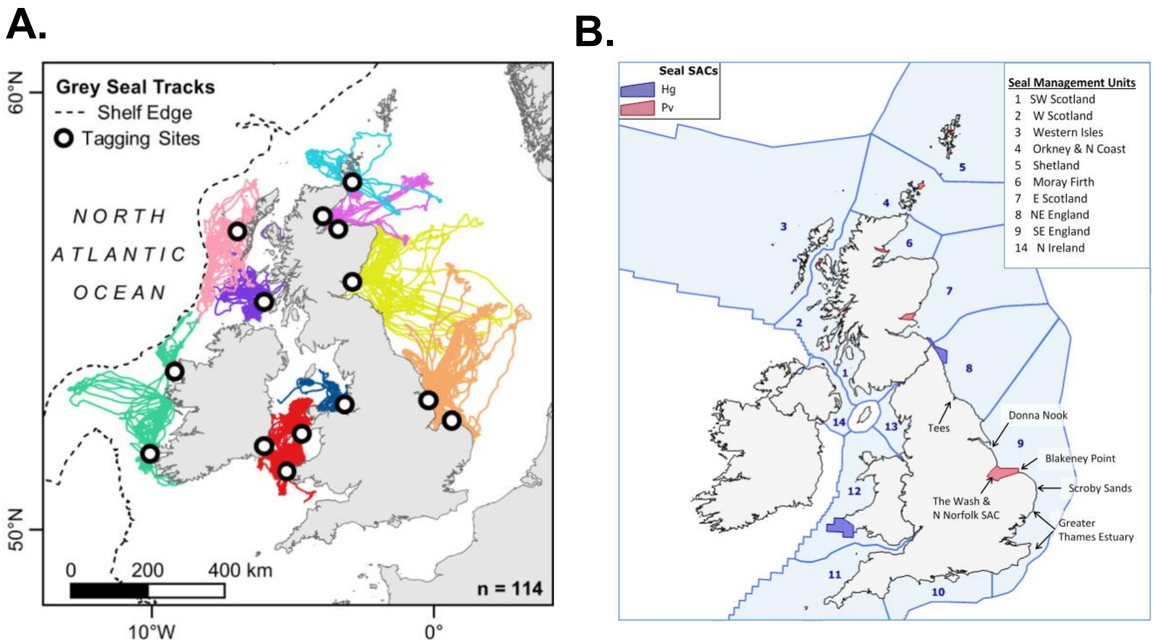


**Figure 4.1:. A. Figure presented in Carter et al. (2022) showing the satellite tracking data for 114 grey seals used to predict at-sea species specific habitat-use map across the British Isles. B. Figure presented in Thompson et al. (2010) showing the boundaries of the Seal Management Units in the UK**

## 4.4 Designated Sites

Bottlenose dolphins and harbour porpoises are the only two marine EPS for which the designation of Special Areas of Conservation (SACs) is required. The closest designated site for bottlenose dolphins (Moray Firth SAC) is greater than 200 km from the Inch Cape OWF, however, with the southerly expansion of the east Scotland bottlenose dolphin population there is potential for connectivity between the Proposed Development and animals from the population which uses this SAC (although it should be noted that their distribution is coastal and therefore they are unlikely to occur in the vicinity of the array area). The closest designated site for harbour porpoise (Southern North Sea SAC) is greater than 200 km from the Inch Cape OWF.

The closest protected area for minke whale (Southern Trench MPA) is approximately 98 km from the Inch Cape OWF at its closest point. There are no designated sites (SACs) or protected areas (MPAs) for white-beaked dolphins.

For both grey seals and harbour seals the designation of Special Areas of Conservation (SACs) is required. The closest (Isle of May SAC) and second closest (Berwickshire and North Northumberland Coast SAC) SAC's which list grey seal as a qualifying interest feature are 4 - 5 km and 26 km from the Inch Cape OWF (cable corridor) at its closest point respectively. The Isle of May SAC has a stable or potentially declining population of grey seals with an estimated pup production of 1,885 (2019) and an August count of 97 (2021) (SCOS 2022). The Berwickshire and North Northumberland Coast SAC has an increasing number of grey seals with an estimated pup production of 7,322 (2019) and an August count of 4251 (2020) (SCOS, 2022).

The closest SAC which lists harbour seal as a qualifying interest feature (Firth of Tay and Eden Estuary) is approximately 25 km from the Inch Cape OWF at its closest point.

There are additional non-EPS species which have designated sites in close proximity to the Inch Cape OWF. Consideration of designated sites is provided in 'Consideration of HRA: OSP Pile Driving at Inch Cape' (Natural Power document reference 1369759).

# 5 Risk Assessment

During the proposed OSP and ECC construction works, there is potential for marine EPS and seals to be impacted. The main activities associated with the work which may impact these species are:

- Increased anthropogenic noise from the OSP piling driving and the ECC construction; and
- Collision risk (with the construction vessel(s)).

Increased anthropogenic noise from the vessels themselves has been considered as a potential impact but has not been assessed individually. This is because noise from vessel(s) is unlikely to significantly increase vessel noise in this area and any displacement due to noise from vessels alone is likely to be small-scale, when compared to potential disturbance from other sources (e.g. ECC construction works (route preparation activities, cable installation and geophysical survey and positioning equipment)), and temporary. The vessels will be involved in the construction of the OSP and ECC and therefore other sounds will be emitted for the majority of the time they are at sea. These potential impacts (increased anthropogenic noise from OSP and ECC construction works) have been assessed.

The quantitative assessments in this section consider the cetacean and seal species for which density estimates are available (section 4.1.1). Whilst not considered specifically in this assessment, any assessment of, or mitigation measures put in place for, the species assessed quantitatively are considered to be appropriate/relevant for the other species which may occur.

## 5.1 Overview of the Potential Effects of Anthropogenic Noise on Marine Mammals

It is widely documented that marine mammals are sensitive to underwater noise with the level of sensitivity depending on the hearing ability of the species (Table 5.1).

Potential effects of underwater noise on marine mammals can be summarised as:

- Auditory injury; and
- Behavioural responses.

**Table 5.1: Marine mammal hearing ranges**

| Functional hearing group | Example species | Estimated auditory bandwidth (kHz) |
|---|---|---|
| Low frequency cetacean | Minke whale | 0.007 - 35 |
| High frequency cetacean | Bottlenose dolphin, white-beaked dolphin | 0.15 - 160 |
| Very high frequency cetacean | Harbour porpoise | 0.2 - 160 |
| Phocid carnivores in water | Harbour seal, grey seal | 0.05 - 86 |

*Source: Southall et al. (2019).*

### 5.1.1 Auditory Injury (PTS)

Southall *et al.* (2019) provide thresholds for received sound levels that have the potential to induce the onset of auditory injury (Permanent Threshold Shift – PTS) in marine mammals (Table 5.2). Sound from piling is generally impulsive (whereas sound from other sources e.g., vessels, route preparation activities and cable lay operations is non-impulsive i.e., continuous). It is worth noting that the criteria refer only to the 'onset' of injury risk rather than a confident assessment of an occurrence of the effect.

Joint Nature Conservation Committee (JNCC) *et al*. (2010) proposes that a permanent shift in the hearing thresholds (PTS) of an EPS would constitute an injury offence. The Southall *et al*. criteria for injury are based on quantitative sound level and exposure thresholds over which PTS onset could occur (Table 5.2). If it is likely that an EPS could become exposed to sound at or above the levels proposed, then there is a risk that an injury offence could occur.

**Table 5.2: Permanent threshold shift (PTS) onset thresholds for marine mammals**

| Functional hearing group | Example species | Impulsive | | Non-impulsive |
|---|---|---|---|---|
| | | Sound Pressure Level (SPL)peak (dB re 1 µPa @ 1 m) | Sound Exposure Level (SEL) (dB re 1 µPa2s @ 1 m) | SEL (dB re 1 µPa2s @ 1 m) |
| Low frequency cetacean | Minke whale | 219 | 183 | 199 |
| High frequency cetacean | Bottlenose dolphin<br>White-beaked dolphin | 230 | 185 | 198 |
| Very high frequency cetacean | Harbour porpoise | 202 | 155 | 173 |
| Phocid carnivores in water | Harbour seal<br>Grey seal | 218 | 185 | 201 |

*Source: Southall et al. (2019).*

## 5.1.2 Behavioural Responses

Behavioural responses may arise where an activity is audible (see Table 5.1) and at a level above ambient noise. Different methods were used to assess behavioural responses from the OSP piling works and the ECC construction works.

### *5.1.2.1 OSP Piling*

Two methods were used to estimate the number of individuals that may potentially show a behavioural response to the OSP piling activity: (i) Effective deterrence ranges (EDR), (ii) Underwater noise modelling and use of dose-response relationships.

EDRs have been regularly used in noise assessments and the licensing process to determine the spatial extent of disturbance from different noise sources. In this case two EDRs were used; the 15 km EDR for pin piles without noise abatement (JNCC, 2023) and a newly proposed 9.4 km EDR for monopiles (Benhemma-Le Gall *et al*., 2024)[3].

The use of underwater noise modelling and dose-response relationships to estimate the number of individuals that can show a behavioural response to piling activity is an approach previously used during the ICOL Section 36 and Marine Licence variation in 2022. This approach works by estimating the number of individuals within unweighted SEL noise level contours, and then estimating the probability that those individuals will respond to the noise level using appropriate dose-response relationships.

Further information on the use of these approaches is provided in in Section 7.1.3 of the OSP Piling Strategy

[3] As previous estimates of monopile EDRs (without noise abatement) ranged as far as 26 km and were estimated to be larger than pin pile EDRs (15 km without noise abatement), we have applied the 9.4 km EDR to the current pin pile assessment. The assumption is that it (and therefore the 15 km EDR) is probably a conservative estimate for pin piles.

(IC02-INT-EC-OFC-005-INC-STR-001).

#### *5.1.2.2 ECC Construction*

The number of individuals that may potentially show a behavioural response to the ECC construction works was calculated for the geophysical survey and positioning equipment used during construction. For harbour porpoises, it is recommended that a 5 km EDR for geophysical survey equipment is used (JNCC, 2020), however, more specific ranges are available for some equipment types (JNCC, 2023). Using these estimated deterrence ranges, the maximum daily area of the zone of potential impact was calculated for the ECC construction works for all species other than bottlenose dolphins (where the zone of potential impact at a single point in time was calculated).

The number of individuals that may potentially show a behavioural response to the ECC construction works was not calculated for increased anthropogenic noise from route preparation activities and cable installation works due to their smaller disturbance ranges (which were identified from literature sources, see section 5.3) compared to the EDR for geophysical survey and positioning equipment.

## 5.2 Increased Anthropogenic Noise from OSP Piling

A comprehensive assessment of the impacts of the OSP piling works is given in Section 7 of the OSP Piling Strategy (IC02-INT-EC-OFC-005-INC-STR-001).

Here, the outputs have been considered in terms of EPS legislation.

### 5.2.1 Underwater Noise Modelling

Underwater noise modelling to assess the effects of the installation of the OSP foundations was undertaken by Subacoustech Environmental Ltd. using the INSPIRE model (Appendix A). The study focused on modelling the OSP foundation using impact piling at a representative location in the west of the Inch Cape OWF array area.

Three modelling scenarios (BE, BE+5 m, BE-5 m) were considered for the study based on different ground conditions (variations in the top depth of sandy / potentially gravelly sediment). They all considered 2.591 m diameter piles and a hammer with a maximum blow energy capacity of 3500 kJ.

The soft start and ramp up procedure for each scenario is summarised in Table 2.1- 2.3, Section 2.1.2.3.

### 5.2.2 Flee Speeds

Flee speeds for the different marine mammal species included in this assessment were used to accurately model the responses of individual animals to the noise produced from the piling works (Table 5.3). A range of flee speeds were available for minke whale and harbour porpoise which were all included in the full assessment presented in the OSP Piling Strategy (IC02-INT-EC-OFC-005-INC-STR-001). Here, the assessment has focused on the flee speeds presented in Table 5.3. These flee speeds are considered to reflect appropriate animal motivation (i.e., responses to pile driving and Acoustic Deterrent Device (ADD) stimuli) and consider the latest data. For minke whale (low frequency cetacean) and harbour porpoise (very high frequency cetacean) a range of flee speeds were used in the modelling, however, the assessment has focussed on the outputs using the flee speeds shown in bold.

**Table 5.3: Marine mammal flee speeds used in this assessment**

| Functional hearing group | Example species | Flee speed (m/s) | Reference |
|---|---|---|---|
| Low frequency cetacean | Minke whale | 2.1 | SNH (2016) |
| | | **4.19** | **McGarry *et al.* (2017)** |

| | | | |
|---|---|---|---|
| High frequency cetacean | Bottlenose dolphin<br>White-beaked dolphin | 1.52 | Bailey and Thompson (2006) |
| Very high frequency cetacean | Harbour porpoise | 1.4 | SNH (2016) |
| | | **1.97** | **Kastelein *et al*. (2018)** |
| Phocid carnivores in water | Harbour seal<br>Grey seal | 1.8 | SNH (2016) |

### 5.2.3 Prediction of Potential Impact of OSP Piling

All three piling scenarios and all flee speeds were assessed in the OSP Piling Strategy (IC02-INT-EC-OFC-005-INC-STR-001). Here, the results from the 'worst-case' BE+5 m scenario are presented (Table 5.3).

#### *5.2.3.1 Auditory Injury*

**Instantaneous PTS**

The maximum instantaneous PTS ranges from the first blow of the soft-start (hammer energy 350 kJ) were estimated using the Southall *et al.* (2019) $SPL_{peak}$ criteria (Table 5.4). For low frequency cetaceans, high frequency cetaceans and phocid seals in water these were predicted to be less than 50 m.

Assuming a flee speed of 1.97 m/s for harbour porpoises the use of an ADD for 5.08 minutes would ensure no animals were found within the instantaneous PTS onset zone. More details on the proposed mitigation can be found in section 6.

**Table 5.4: Maximum instantaneous PTS onset (unweighted SPLpeak) ranges for BE+5 m scenario**

| Functional hearing group | Example species | Greatest maximum range (m) |
|---|---|---|
| Low frequency cetacean | Minke whale | <50 |
| High frequency cetacean | Bottlenose dolphin<br>White-beaked dolphin | <50 |
| Very high frequency cetacean | Harbour porpoise | 600 |
| Phocid carnivores in water | Harbour seal<br>Grey seal | <50 |

**Cumulative PTS**

The conservative estimate for the range of the cumulative PTS zone for bottlenose dolphins, white-beaked dolphins, grey seals and harbour seals is less than 100 m. For each of these species the total number of individuals which have potential to be exposed to noise levels sufficient to induce the onset of cumulative PTS is less than one for the BE+5 m scenario (Table 5.5).

Considering the worst-case scenario for minke whale (scenario BE+5 m with 2.1 m/s flee speed), cumulative PTS onset impact ranges for minke whales were estimated up to 11 km from the piling location, with potentially 11 individuals (0.11 % of the UK MU) within the impact zone, assuming no mitigation in place (other than the extended soft start). Assuming a 2.1 m/s fleeing speed, it would take 87.30 minutes for a minke whale starting at the pile to exit the cumulative PTS impact zone before piling commences. Using ADDs for this duration would present an unnecessarily high level of disturbance to other species (i.e. harbour porpoise) which is disproportionate to the risk of cumulative PTS given the inherent precaution in the estimation of cumulative PTS ranges. For the BE+5 m scenario using the 4.19 m/s flee speed estimates a PTS onset impact range of 2.1 km from the piling location, with potentially less than 1 individual (0.01 % of the UK MU) within the impact zone, assuming no mitigation other than extended soft-start (Table 5.5).

The assessment of worst-case scenario for harbour porpoise (scenario BE+5 m with 1.4 m/s flee speed) showed that PTS onset impact ranges for harbour porpoise are up to 4.5 km from the piling location, with potentially 33 individuals (0.02% of the UK MU) within the impact zone, assuming no mitigation in place (other than the extended soft start). These estimates are considered to be extremely conservative as, on top of the conservatisms in the methodology associated with cumulative PTS modelling, vessel presence prior to the beginning of pile driving has been shown to act as a deterrent. Using fleeing speed of 1.97 m/s, PTS onset impact ranges for harbour porpoise were estimated as up to 2.2 km from the piling location, with potentially 7 individuals (0.004% of the UK MU) within the impact zone, assuming no mitigation in place (other than the extended soft start).

**Table 5.5: Number of individuals estimated to have the potential to be within the cumulative PTS impact zone under the BE+5 m scenario. For each species, the flee speed used in the assessment is indicated. The maximum impact range in meters is also presented along with the duration of ADD playback that would be required to clear the impact area where necessary**

| Species | Flee speed (m/s) | Number of individuals impacted (95% CI) | Max range (m) | ADD duration to clear zone (mins) |
|---|---|---|---|---|
| Minke whale | 2.1 | 11.03 (2.23 – 30.03) | 11,000 | 87.30 |
| | 4.19 | 0.31 (0.06 - 0.84) | 2100 | 8.35 |
| Bottlenose dolphin | 1.52 | 0 (0 - 0) | <100 | n/a |
| White-beaked dolphin | 1.52 | 0.003 (0.000 - 0.005) | <100 | n/a |
| Harbour porpoise | 1.4 | 33.26 (15.53 – 65.82) | 4,500 | 53.57 |
| | 1.97 | 7.01 (3.27 – 13.88) | 2200 | 18.61 |
| Grey seal | 1.8 | 0.06 (0.05 - 0.07) | <100 | n/a |
| Harbour seal | 1.8 | 0.0001 (0.0001 - 0.0001) | <100 | n/a |

Given the conservatisms in the cumulative PTS modelling (including assumptions on impulsiveness and non-recovery between pulses), it is reasonable to suggest a 15-minute pre-piling ADD duration is appropriate to provide mitigation that reasonably lowers the risk of cumulative PTS to minke whale and harbour porpoise, without resulting in excessive disturbance to all species which may occur in the area.

#### *5.2.3.2 Behavioural Responses*

**Effective deterrence ranges (EDR) approach**

The estimated number of individuals within the 9.4 km (Benhemma-Le Gall *et al.,* 2024) and 15 km (JNCC, 2023) EDRs are presented in Table 5.6. The number of individuals which have the potential to be present within the EDR was equivalent to less than 1% of the relevant Management Unit abundance for all species except grey seal for the 15 km EDR (for which it was 1.35%).

**Table 5.6: Estimated number of disturbed, and possibly displaced individuals, across two EDRs (9.4 km and 15 km) with percentages of the relevant reference populations**

| Species | EDR (km) | Number of individuals | % of entire MU / SMU | % of UK portion of MU |
|---|---|---|---|---|
| Minke whale | 9.4 | 12 (2 – 32) | 0.06% | 0.12% |
| | 15 | 30 (6 – 80) | 0.15% | 0.29% |

| Species | EDR (km) | Number of individuals | % of entire MU / SMU | % of UK portion of MU |
|---|---|---|---|---|
| Bottlenose dolphin | 9.4 | 0 (0 – 0) | 0% | n/a |
| | 15 | 0 (0 – 0) | 0% | |
| White-beaked dolphin | 9.4 | 22 (4 – 46) | 0.05% | 0.06% |
| | 15 | 56 (11 – 116) | 0.13% | 0.16% |
| Harbour porpoise | 9.4 | 166 (78 – 329) | 0.05% | 0.10% |
| | 15 | 422 (197 – 835) | 0.12% | 0.26% |
| Grey seal | 9.4 | 337 (291 – 395) | 0.55% | n/a |
| | 15 | 831 (719 – 975) | 1.35% | |
| Harbour seal | 9.4 | 1 (1 – 1) | 0.27% | n/a |
| | 15 | 3 (3 – 5) | 0.80% | |

**Underwater noise modelling and use of dose-response relationships approach**

The total number of individuals which have the potential to be exposed to noise levels sufficient to induce a behavioural response from the OSP piling works calculated through modelling the mean unweighted SEL single strike noise level contours and applying dose-response relationships is presented in Table 5.7. It should be noted that the outputs from this analysis are likely overly conservative (see OSP Piling Strategy – IC02-INT-EC-OFC-005-INC-STR-001).

**Table 5.7: Estimated number of disturbed, and possibly displaced, marine mammals under the BE+5 m scenario with percentages of the relevant reference populations these numbers represent**

| Species | Number of disturbed individuals (95% CI) | % of entire MU impacted | % of UK portion of MU impacted |
|---|---|---|---|
| Minke whale | 425 (86 - 1158 | 2.11 | 4.13 |
| Bottlenose dolphin | 22 (21 – 23) | 9.73 | n/a |
| White-beaked dolphin | 831 (158 - 1705) | 1.89 | 2.44 |
| Harbour porpoise | 6,147 (2,889 – 12,110) | 1.77 | 3.85 |
| Grey seal | 3,927 (3,397 – 4,604) | 6.38 | n/a |
| Harbour seal | 26 (21 – 34) | 6.90 | n/a |

## 5.3 Increased Anthropogenic Noise from ECC Construction Works

The two main activities associated with the ECC construction work that might increase the level of anthropogenic noise to a level that might impact marine EPS and seals are:

- Route preparation activities (PLGR and mattress laying) and cable installation (cable landing, laying, trenching and burial) works – hereafter referred to as ‘increased anthropogenic noise from construction work’; and
- Geophysical, positioning, monitoring and navigational equipment carried by the vessels, ROVs and other remote systems – hereafter referred to as ‘sound emitting geophysical survey and positioning equipment’.

### 5.3.1 Construction Work

The proposed cable preparation works, and cable laying activities have the potential to increase levels of anthropogenic noise in the marine environment (and therefore the potential to affect marine EPS and seals).

Due to the general assumption that construction operations have minimal impact there is relatively little empirical data on noise emission source levels (Meißner *et al.,* 2006). Estimated SPLs identified from previous assessments of the noise produced from route preparation activities and cable installation (McCarthy, 2021; Thomsen *et al*., 2009) and M-weighted SEL impact ranges for a fleeing animal at 1.5 m/s (m) calculated from previous acoustic modelling for these activities (Nedwell *et al.,* 2012) are summarised in Table 5.8. These ranges, from literature sources, have been used in the assessment to identify any potential impact from the construction work activities instead of the approach outlined in Section 5.1.1.

**Table 5.8: Estimated source levels of non-pulsed route preparation activities and cable installation**

| | Activity | Estimated unweighted source level (dB re 1 µPa @ 1 m) (RMS)* | M-weighted SEL impact range for a fleeing animal for all marine mammal hearing groups |
|---|---|---|---|
| **Route preparation activities** | PLGR | 172 | <1 |
| | Rock placement (proxy for mattress laying) | 172 | <1 |
| **Cable Lay Operation** | Cable laying | 171 | <1 |
| | Dredging | 160-186 | <1 |
| | Trenching | 172 | <1 |

** Values taken from McCarthy (2021) and Thomsen et al. (2009).*

***Values taken from Nedwell et al. (2012). Note, that these use a 1.5 m/s (m) flee speed for all species.*

#### *5.3.1.1 Prediction of Potential Impact*

**Auditory Injury**

There is no potential for auditory injury from the proposed ECC construction work. This is because the M-weighted SEL impact ranges for the various activities associated with cable installation works are all very small (<1 m for all activities, Table 5.8: ).

**Behavioural Responses**

Potential behavioural impact ranges for the proposed ECC construction work activities are small – the maximum range over which there is likely to be an avoidance reaction is 140 m (for harbour porpoise; see Table 5.9). Furthermore, these potential impacts will likely be short-term and reversible as the vessels work through the area.

As these impact ranges are much smaller than those as a result of use of geophysical survey equipment (see section 5.3.2.1), which will be required for all of the ECC construction work activities, the potential for disturbance has been assessed using those estimates.

**Table 5.9: Impact ranges (m) over which an avoidance reaction is likely**

| Species | Trenching | Cable laying | Rock Placement (incl. concrete mattress laying) | Dredging |
|---|---|---|---|---|
| Harbour porpoise | 140 | 29 | 99 | <1 |

| Species | Trenching | Cable laying | Rock Placement (incl. concrete mattress laying) | Dredging |
|---|---|---|---|---|
| Bottlenose dolphin (proxy for white-beaked dolphin) | 81 | 9 | 31 | <1 |
| Minke whale | 59 | 18 | 70 | NA |
| Harbour seal (proxy for grey seal) | 12 | 2 | 17 | <1 |

*Source: McCarthy (2021); Nedwell et al. (2012).*

### 5.3.2 Sound Emitting Geophysical Survey and Positioning Equipment

The use of geophysical survey and positioning equipment which emits sound has the potential to increase levels of anthropogenic noise in the marine environment (and therefore the potential to affect marine mammals). Typical geophysical, positioning, monitoring and navigational equipment carried by the vessels, ROVs and other remote systems likely to be used as part of the ECC construction work have been examined and those which emit sound assessed. A summary of the likely frequency ranges and source levels of this equipment is provided in Table 5.10.

**Table 5.10: Details of the proposed types of geophysical equipment which emit sound**

| Equipment Type* | Typical Frequency Range (kHz) | Typical SPL (dB re 1 µPa @ 1 m) |
|---|---|---|
| Ultra-Short Base Line (USBL) | 20-34 | 196 (peak), 188 (rms) |
| Multi Beam Echo Sounder (MBES) | 170-400 | 221 (peak) |
| Sub-Bottom Imager (SBI) | 4-14 | 192 (peak) |
| Side Scan Sonar (SSS) | >200 | 210 (peak) |
| Multi Beam Imaging/ Profiling Sonar | >200 | 210-224 |
| Dual Head Scanning Sonar | >200 | <210 |
| Doppler velocity log | >200 | 214 dB |

**The frequency and source levels presented are deemed to be representative of each equipment type.*

#### *5.3.2.1 Prediction of Potential Impact*

The high frequency sounds produced by the MBES, SSS, Multi Beam Imaging/ Profiling Sonar, Dual Head Scanning Sonar and Doppler velocity log fall outside the hearing range of the marine mammals assessed (Table 5.1, Table 5.10). There is therefore no risk of auditory injury or behavioural responses from the use of this equipment and no mitigation is required. This is supported by the advice from the JNCC, who do not advise the use of mitigation for the use of MBES in shallow waters (<200 m) (JNCC, 2017). This is because it is thought that the high frequency sounds produced by MBES attenuate more quickly than the lower frequencies used in deeper waters.

**Auditory Injury**

The sounds produced by the USBL and SBI do fall within the hearing range of the marine mammals assessed (Table 5.1:, Table 5.10). However, these sounds do not reach any of the SPL auditory injury threshold for impulsive noise (Table 5.2) for the different marine mammal functional hearing groups, therefore there is no risk of auditory injury onset from the use of this equipment and no mitigation is required.

**Behavioural Responses**

It is possible that the sounds produced by the USBL and SBI may be detected by marine mammals of all hearing groups and therefore their use may have the potential to cause disturbance. The most likely response will be temporary behavioural avoidance (there is evidence that short-term disturbance caused by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises (Thompson *et al*., 2013)).

The most up to date EDR's provided in the JNCC Marine Noise Registry Help and Guidance have recommended a likely conservative EDR of 5 km for the use of SBI's for harbour porpoise (JNCC, 2023). An EDR for USBL's, is not given in this guidance, so the EDR of 5 km has also been applied following previous JNCC guidance for other geophysical surveys (JNCC, 2020), however, this is likely to be highly conservative. Without suitable alternative EDRs being available these ranges have been deemed appropriate for all marine EPS and seals assessed.

To calculate the number of individuals of all species assessed, other than bottlenose dolphins, with the potential to be exposed to noise levels sufficient to induce a behavioural response from the use of USBL and SBI the maximum daily area of the zone of potential impact was calculated. To calculate this area it was assumed that a vessel operating a USBL or SBI (e.g. during the PLGR, cable laying or trenching activities) would be travelling slowly (estimated speed of 1 knot) along the ECC for the duration of the activity (24 hours a day). Assuming a 5 km buffer around the vessel, the maximum daily area of the zone of potential impact is 523 $km^2$. This area was used to estimate the number of individuals of each species considered to have the potential to be impacted (Table 5.11). The percentage of the reference populations estimated to have the potential to be affected was also calculated.

For bottlenose dolphins, it was deemed that a daily disturbance area was not appropriate. This is due to the behaviour and social structure of inshore bottlenose dolphin population, which involves them regularly traveling along the coastline in close-knit groups rather than being uniformly distributed. For the majority of the time, no individuals will be present and have the potential to be affected. As such, an area of potential effect focused on a single point in time (calculated using $\pi r^2$ (where r is the deterrence range of 5 km)), and the greatest density of bottlenose dolphins (0.084) along the ECC, has been used to calculate the number of individual bottlenose dolphins that may be disturbed. Using this methodology, it was calculated that for the 5 km EDR, 7 bottlenose dolphins may be impacted. This represents 3.125% of the Coastal East Scotland Management Unit for bottlenose dolphins.

**Table 5.11: The maximum number of individuals assessed, other than bottlenose dolphins, estimated to have the potential to be disturbed by geophysical survey equipment in a 24 hours period**

| Species | Number of disturbed individuals | % of entire MU / SMU impacted | % of UK portion of MU |
|---|---|---|---|
| Minke whale | 22 | 0.109 | 0.214 |
| White-beaked dolphin | 42 | 0.095 | 0.123 |
| Harbour porpoise | 313 | 0.09 | 0.196 |
| Grey seal | 158 | 0.864 | n/a |
| Harbour seal | 3 | 0.708 | n/a |

*Density estimates and reference populations for each species provided in Section 4.*

## 5.4 Collision Risk

Vessel strikes are a known cause of mortality in marine mammals and basking sharks (Laist et al., 2001). Non-lethal collisions have also been documented (Laist et al., 2001; Van Waerebeek et al., 2007). Injuries from such collisions can be divided into two broad categories: blunt trauma from impact and lacerations from propellers. Injuries may result in individuals becoming vulnerable to secondary infections or predation.

Avoidance behaviour by marine mammals (e.g., bottlenose dolphins), is often associated with fast, unpredictable boats such as speedboats and jet-skis (Bristow and Reeves, 2001; Gregory and Rowden, 2001; Buckstaff, 2004), while neutral or positive reactions for other species have been observed with larger, slower moving vessels such as cargo ships (Sini et al., 2005).

### 5.4.1 Prediction of Potential Impact

The proposed OSP construction work will require an SSCV, transport barges and tugs. During the piling activities the vessels will be stationary, travelling at low working speeds or transiting in a predictable manner. Therefore, the potential for collisions with marine mammals and basking sharks is considered to be negligible.

The proposed ECC construction work may require several types of vessels, working in different phases of the works. The majority of the work will require a single large vessel following the pre-defined cable corridor at low working speeds, except during transit. The consistent speed and direction of travel employed will mean that animals can predict the path of the vessel and potentially alter their direction of travel, thus reducing the risk of collision. Additionally, the presence of the ECC construction vessels is unlikely to significantly increase the vessel traffic in the area, especially as these will be performing activities in different phases. Therefore, the increase in potential collision risk for marine mammals and basking sharks is considered to be negligible.

All vessels to be used during the works will adhere to the Vessel Management Plan and Navigational Safety Plan (VM&NSP) (IC02-INT-EC-OFC-008-INC-PLA-001), which establishes indicative vessel transit corridors for major construction vessels and adherence to the Scottish Marine Wildlife Watching Code (SMWWC) to ensure best practice during transits, During transits for all construction activities, when vessel speed may be greater, transit watches (section 6.3) will be conducted. The adoption of these measures will minimise the potential for the collision to take place.

# 6 Mitigation Measures

## 6.1 OSP Piling

In order to ensure a negligible risk of PTS to marine EPS or seals mitigation will be required. Detailed reasoning and evidence behind these proposed mitigation measures are provided in the OSP Piling Strategy (IC02-INT-EC-OFC-005-INC-STR-001).

### 6.1.1 ADD Use

A Lofitech AS seal scarer[4] ADD will be deployed by a trained and dedicated ADD operator from the installation vessel, and active for 15 minutes, prior to commencement of the soft start and ramp up procedure.

As previously discussed in section 5.1.1, 15 minutes of ADD use is concluded to be sufficient to ensure a negligible risk of instantaneous PTS and to reasonably lower the risk of cumulative PTS to marine EPS or seals during the OSP Piling works. Further information on the reasoning behind this conclusion, including a discussion on the conservatisms of the cumulative PTS modelling (including assumptions on impulsiveness and non-recovery between pulses), is given in Section 9.1.2.4 of the OSP Piling Strategy (IC02-INT-EC-OFC-005-INC-STR-001).

### 6.1.2 Soft Start Procedure

A soft start is the gradual ramping up of piling power (hammer energy) over a period of time to allow any marine mammals to move further away from the zone of potential impact. It is recommended that the soft start period should be not less than 20 minutes in duration (JNCC, 2010).

In this instance an extended soft start of 30 minutes with the piling energy at 10% power (350 kJ) is proposed. The soft start and ramp up procedure for each piling scenario is outlined in Table 2.1– 2.3, Section 2.1.2.3.

### 6.1.3 Breaks in Piling Activity

The proposed procedure for restarting operations following a break in piling is based on the following break durations:

1. For breaks in piling of less than 10 minutes, no further mitigation is proposed. Pile driving activities may restart using the last hammer energy and strike rate (or lower) without the need to redeploy the ADD;

2. For breaks in piling of more than 10 minutes but less than 6 hours, a full soft-start and ramp-up procedure is required prior to restarting the piling activity, wherever this is safe and practicable to do so, without the need to redeploy the ADD;

3. If the break in piling is greater than 6 hours, then the full piling mitigation procedure of pre-piling ADD deployment and the soft-start and ramp-up procedure is required.

## 6.2 ECC Construction Works

No mitigation measures (other than transit watches (see Section 6.3)) have been deemed necessary to protect marine EPS, seals and basking sharks from the ECC construction work activities. This is because neither the increased anthropogenic noise from the ECC construction work nor from the sound emitting geophysical survey and positioning equipment will be of sufficient duration or level to have the potential to cause auditory injury.

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[4] https://www.lofitech.no/

## 6.3 Transit Watches

An observer on the bridge of all vessels, during both the OSP Piling and ECC construction works, will keep watch for marine EPS, basking sharks and seals during all transits to and from the work sites. Any sightings will be communicated to the Officer on watch as soon as is practicable who will ensure that marine EPS, basking sharks and seals are avoided where safe to do so. At all times the Officer on watch will minimise high powered manoeuvres or rapid changes of course, where this does not impair safety, to avoid collisions.

The observer may be the Master of the vessel, a member of the bridge crew, another member of the ship's crew or a Marine Mammal Observer (MMO) as appropriate. Observers and the vessel operator will be briefed on the Scottish Marine Wildlife Watching Code[5] and Basking Shark Code of Conduct[6].

## 6.4 Additional Measures

In addition, the following mitigation measures are proposed for non-EPS:

- In the last two weeks of July and the first two weeks of August, vessels will as far as is practicable employ slow speeds, steady courses and avoid sailing through large rafts of birds on the sea.

5 Scottish Marine Wildlife Watching Code | NatureScot

6 Download.ashx (sharktrust.org)

# 7 Assessment of Potential Offence

## 7.1 Increased Anthropogenic Noise from OSP Piling

The conclusions of the assessment for effects as a result of increased anthropogenic noise from the OSP Piling works are that:

- After mitigation, e.g., soft-start and use of ADD, there is a negligible risk of auditory injury to EPS; and
- There is the potential for EPS to respond behaviourally (see Table 5.6 and Table 5.7, section 5.2.3.2). However, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species.

Further information on how these conclusions were made is provided in section 11 of the OSP Piling Strategy (IC02-INT-EC-OFC-005-INC-STR-001).

Considering the conclusion from this work, an **EPS licence (to disturb) will be required and can be granted** as advised from the guidance provided in the Conservation of Habitats and Species Regulations 1994 (as amended in Scotland).

## 7.2 Increased Anthropogenic Noise from ECC Construction Works

The conclusions of the assessment for effects as a result of increased anthropogenic noise from the ECC Construction Works are that:

- There is no potential for auditory injury to EPS; and
- There is the potential for EPS to respond behaviourally (see Table 5.11, section 5.3.2.1). However, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species.

Considering the conclusion from this work, an **EPS licence (to disturb) will be required and can be granted** as advised from the guidance provided in the Conservation of Habitats and Species Regulations 1994 (as amended in Scotland).

## 7.3 Collision Risk

The risk of collision with vessels involved in the proposed OSP Piling and ECC construction works is negligible for the species likely to be present in this area (see section 5.3.2). All vessels to be used during the works will adhere to the SMWWC, in line with ICOL VM&SNP. Watches will be undertaken during transits whilst vessels will be moving more quickly (see section 6.3).Considering that the presence the construction vessels for the proposed works is unlikely to significantly increase the vessel traffic in the area then it is concluded that an EPS licence will not be required for this aspect of the proposed work.

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# Appendices

## Appendix 1: OSP Underwater Noise Assessment