Malin Head Offshore Wind Farm

Foreshore Licence Application for Site Investigation Works

European Protected Species Risk Assessment for Annex IV Species

Document Control

Revision	Date	Authored:	Checked:	Approved:
00	06/07/2022	[redacted]	[redacted]	[redacted]
Revision	**Date**	**Authored:**	**Checked:**	**Approved:**
Revision	**Date**	**Authored:**	**Checked:**	**Approved:**

Guidelines of use of report:

This report (hereafter the "Services") was prepared by Gavin & Doherty Geosolutions Ltd. (GDG) for **Malin Array Limited** (hereafter the "Client") in accordance with the terms of a contract between **Malin Array Limited** and GDG. The Services were performed by GDG, taking into account the limits of the scope of works required by the Client, the time scale involved, and the resources agreed between **Malin Array Limited** and GDG. Third parties using any information contained within this report do so at their own risk. The content of this report is based on the information received from the client, information available to GDG such as NPWS data with regard to Natura 2000, GIS data available for the proposed site investigation area and other such scientific type data available.

GDG provide no other representation or warranty whether express or implied, in relation to the Services expressly contained in the paragraph above.

This report is produced in support of an application for a site investigation licence under Section 3 of the Foreshore Act 1933, as amended, and should not be used for any other purpose apart from that expressly stated in this document.

Table of Contents

Index of Figures

Index of Tables

List of Abbreviations

ADCP	Acoustic Doppler Current Profiler
API	American Petroleum Institute
BH	Borehole
CPOD	Cetacean Passive Acoustic Network
CPT	Cone Penetration Test
DAHG	Department of Culture, Heritage and the Gaeltacht
EC	European Commission
EEZ	Exclusive Economic Zone
EPS	European Protected Species
EU	European Union
GDG	Gavin and Doherty Geosolutions
IMO	International Maritime Organization
ISO	International Organization for Standardization
ITM	Irish Transverse Mercator
JNCC	Joint Nature Conservation Committee
LiDAR	Light Detection and Ranging
MARPOL	The International Convention for the Prevention of Pollution from Ships
MBES	Multibeam echosounder
Minister	Minister for Housing, Local Government and Heritage
MAP	Maritime Area Planning Act 2021
NM	Nautical Mile
NPWS	National Parks and Wildlife Service
PTS	Permanent Threshold Shift
SPL	Sound Pressure Level
SSS	Side Scan Sonar
TTS	Temporary Threshold Shift
UK	United Kingdom
UTM	Universal Transverse Mercator
VC	Vibrocore
WGS	World Geodetic System

Glossary of Terms

Acoustic Doppler Current Profiler (ADCP)	An Acoustic Doppler Current Profiler is a hydroacoustic current meter similar to a sonar, used to measure water current velocities over a depth range using the Doppler effect of sound waves scattered back from particles within the water column.
Boreholes	A borehole is a narrow shaft bored in the ground, either vertically or horizontally.
Cone Penetration Test (CPT)	The cone penetration or cone penetrometer test (CPT) is a method used to determine the geotechnical engineering properties of soils and delineating soil stratigraphy.
Exclusive Economic Zone	Marine area from the territorial seas boundary seaward to a distance of 200 miles or otherwise as agreed under international statute.
Foreshore	The foreshore of Ireland is classed as the land and seabed between the high water of ordinary or medium tides (shown HWM on Ordnance Survey maps) and the twelve-mile limit (12 nautical miles equals approximately 22.24 kilometres). Foreshore also covers tidal areas of rivers particularly estuaries.
Foreshore Licence Application Area	In this report means the area within the 12 NM limit of the Irish coastline where an Application for a Licence under Section 3 of the Foreshore Act 1933, as amended, is being submitted to the Department of Housing, Local Government and Heritage for a licence to undertake site investigation works.
Geophysical Surveys	Geophysical surveys are sound-based physical sensing techniques that produce a detail image or map of an area. Ground-based surveys may include: Seismic surveys - vibrations are recorded with geophones to provide information about the properties of rocks.
Geotechnical Surveys	Geotechnical investigation and evaluation which includes methods to acquire and evaluate subsurface information (i.e. drilling and sampling, laboratory testing, cone penetration testing, and pressure meter testing).
Grab Samples	A grab sample is a sample of sediment taken from the seabed.
Habitats Directive	Adopted in 1992, the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. It forms the cornerstone of Europe's nature conservation policy with the Birds Directive and establishes the EU wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging developments.
Interim Campaign	Site Investigation surveys designed to build on the level of detail acquired during the preliminary campaign with the aim of developing a detailed ground model of the site that will feed into the overall design of the windfarm. For this application it refers to the second geotechnical campaign.
Irish Transverse Mercator (ITM)	Irish Transverse Mercator (ITM) is the geographic coordinate system for Ireland. It was implemented jointly by the Ordnance Survey Ireland (OSi) and the Ordnance Survey of Northern Ireland (OSNI) in 2001. The name is derived from the Transverse Mercator projection it uses and the fact that it is optimised for the island of Ireland. ITM95 (EPSG:2157) is used to map the project area for the Foreshore Licence Map.
LiDAR	LiDAR is a method for measuring distances by illuminating the target with laser light and measuring the reflection with a sensor. Differences in laser return times and wavelengths can then be used to make digital 3-D representations of the target. It has terrestrial, airborne, and mobile applications.
Magnetometer	A magnetometer is a device that measures magnetism—the direction, strength, or relative change of a magnetic field at a particular location. The measurement of the magnetization of a magnetic material is an example
Maritime Area Planning Act 2021	Legislation reforming consenting within Ireland's marine area, including introducing both an offshore specific consenting regime and extending the powers

	of the State to enable the State to operate a consenting regime across its entire EEZ and agreed continental shelf.
MARPOL	MARPOL is the main international convention aimed at the prevention of pollution from ships caused by operational or accidental causes. It was adopted at the International Maritime Organization (IMO) in 1973. The Protocol of 1978 was adopted in response to a number of tanker accidents in 1976–1977.
Metocean	Metocean conditions refer to the combined wind, wave and climate (etc.) conditions as found on a certain location. They are most often presented as statistics, including seasonal variations, scatter tables, wind roses and probability of exceedance.
Minister	In this report Minister means the Minister for Housing, Local Government and Heritage
Multibeam Echosounder (MBES)	An echosounder uses sound waves to measure water depth. A transducer mounted under the vessel emits a pulse which travels through the water to the seafloor and bounces back to a receiver. The time it takes for the signal to return is measured, and because the speed of sound through water (~1500 m/s) is known, the water depth under the boat is measured. This is the basic principle of hydrography and seafloor mapping. A multibeam echosounder (MBES) measures multiple echoes at a time.
Offshore Export Cable Corridor (OECC) Area	Area where site investigations will take place to determine the suitability of that area as a route for the export electricity cable from the windfarm to land.
Pollution Event	A 'pollution incident' includes a leak, spill or escape of a substance, or circumstances in which this is likely to occur.
Preliminary Campaign	Site Investigation surveys early in the project development programme designed to give an overview of the receiving environment with the aim of developing a first stage ground model. For this application it refers to the first geotechnical campaign.
Offshore Wind Farm (OWF) Area	Proposed area where site investigations will take place to determine the locations of the Offshore Wind Turbines.
Side Scan Sonar (SSS)	Side-scan uses a sonar device that emits conical or fan-shaped pulses down toward the seafloor across a wide angle, perpendicular to the path of the sensor through the water, which may be towed from a surface vessel or submarine or mounted on the ship's hull.
Sub-Bottom Profiler	A Sub-bottom profiler is a type of sonar system that produces a 2-dimensional stratigraphic cross section by using acoustic energy to image sub-surface features in an aquatic environment.
Universal Transverse Mercator (UTM)	The UTM (Universal Transverse Mercator) coordinate system divides the world into sixty north-south zones, each 6 degrees of longitude wide. UTM zones are numbered consecutively beginning with Zone 1 and progress eastward to Zone 19. UTM 29N (EPSG:32629) is used to map the project area.
Vibrocore	Vibrocoring is the state-of-the-art sediment sampling methodology for retrieving continuous, undisturbed cores. Vibrocorers can work in a variety of water depths and can retrieve core samples at different lengths depending on sediment lithology and project objectives.
Wave Buoy	Wave buoy – used to measure the movement of the water surface as a wave train. The wave train is analysed to determine statistics like the significant wave height and period, and wave direction.
World Geodetic System (WGS)	The World Geodetic System (WGS) is a standard for use in cartography, geodesy, and satellite navigation including GPS. WGS84 is a geocentric reference ellipsoid and a geodetic datum, in that it defines the centre of mass of the earth as its origin, and the direction of the earth's axis as the minor axis of the reference ellipsoid. WGS84 (EPSG:4326) is used to map the project area.

1 Introduction

Malin Array Limited proposes to investigate the feasibility of developing an offshore wind farm, Malin Head Offshore Wind Farm (OWF), off the coast of County Donegal.

Malin Array Limited have commissioned Gavin and Doherty Geosolutions (GDG) to prepare this report in support of an application for a Foreshore Licence under Section 3 of the Foreshore Act 1933, as amended, to carry out site investigation activities to determine the suitability of the Foreshore Licence Application Area for the development of an offshore wind farm.

Malin Array Limited intends to undertake a survey campaign at the proposed Foreshore Licence Application Area in order to inform the location and design of the proposed offshore wind farm and cable route to shore. The marine surveys will include geophysical, geotechnical, environmental, metocean and archaeological marine surveys.

1.1 Aim of this Report

This report is part of the Foreshore Licence Application to the Foreshore Unit of the Department of Housing, Planning and Local Government and includes information to inform a risk assessment for Annex IV species under Article 12 of the Habitats Directive (92/43/EEC).

This report aims to support the application process and provide the necessary information to the competent authorities to assist them in making an informed decision on the likely impact of this project on Annex IV species.

1.2 Structure of the Report

This report is structured into the following chapters to include information relating to the proposed site investigation activities, the Annex IV Species that can potentially occur in the proposed survey area, the potential impacts to Annex IV species and measures to ensure Annex IV species are protected. Specifically, the chapters describe or comprise the following elements:

- Chapter 1 (this chapter): Description of the proposed site investigation activities
- Chapter 2: Legislation and regulatory background
- Chapter 3: Identification of the Annex IV Species that may be found on or near the Foreshore Licence Application Area
- Chapter 4: Identification of potential impacts on the basis of the proposed site investigation activities
- Chapter 5: Risk Assessment for protection of Annex IV species under Article 12 of the Habitats Directive
- Chapter 6: Proposed mitigation measures
- Chapter 7: Presents the conclusions from this report

1.3 Foreshore License Application Area

The Foreshore License Application Area is situated off the coast of County Donegal (Figure 1-1). The Offshore Wind Farm Area is located off the coast of County Donegal.

Malin Array Limited acknowledges that it is only possible at this time to obtain a Site Investigation Licence for that area situated within the 12nm boundary. Malin Array Limited is not proposing at this time to undertake any intrusive surveys outside the 12nm limit regulated under the Foreshore Act 1933, as amended.

This Foreshore Licence Application seeks consent to conduct site investigation activities within the 12nm boundary to establish the potential for offshore wind farm development off the coast of County Donegal. If the Foreshore Licence Application Area investigation activities, together with desktop studies and stakeholder engagement, indicates the feasibility of developing a wind farm, the project will be progressed at that point in accordance with the National Marine Planning Framework and other relevant legislation including the new consenting regime for offshore renewable energy being legislated for through the Maritime Area Planning Act 2021 (MAPA).

The Foreshore Licence Application Area is situated north of Malin Head, in the Atlantic Sea off the coast of County Donegal, and it measures approximately 835.25 km^2 in total. This includes the Offshore Export Cable Corridor (OECC) Area, measuring approximately 225.22 km^2 and the Offshore Windfarm (OWF) Area, measuring approximately 610.03 km^2. The north/north-eastern boundary of the Foreshore Licence Application Area is adjoined by the 12 NM boundary. The OWF area is, at its closest point, 11.14 km from shore at Carrickaveol headland, approximately 9 km from Malin Head. The OECC Area extends to the mean high-water mark at 6 locations along the Donegal coastline at Pollan Strand, Tullagh strand, Buncrana beach, Kinnegar beach, Ballymastocker beach and Portsalon.

The Foreshore Licence Application Area, OWF Area within the 12nm boundary and OECC Area are shown in Figure 1-1. The coordinates of the Foreshore Licence Application Area are provided in the Foreshore License Application Form and Schedule of Works submitted as part of this Foreshore License Application.

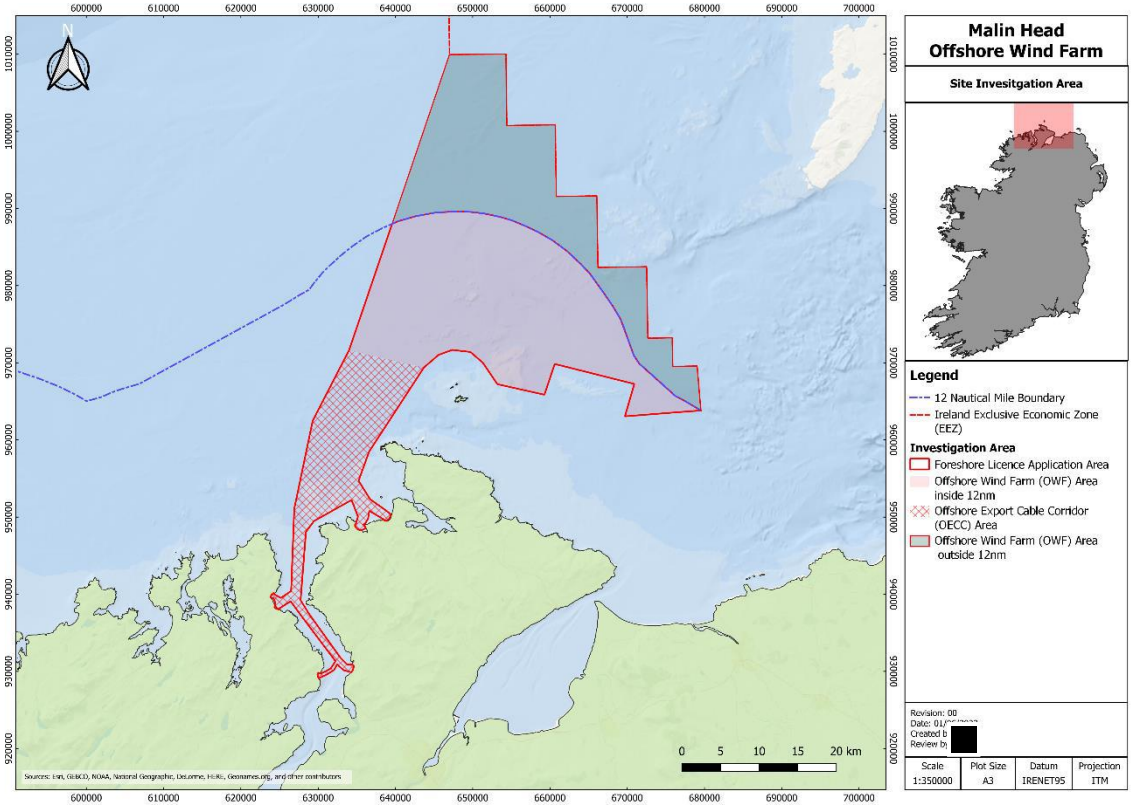

Figure 1-1: Malin Head OWF and OECC Area (red, OECC area hatched) including the OWF Area outside 12 nm (grey) for information. Note Foreshore Licence Application Area is all within 12 nm.

1.4 Site investigation works

The objective of the proposed Malin Head Offshore Wind Farm survey campaign is to determine environmental conditions and seafloor and subsurface geological characteristics within the Foreshore Licence Application Area.

The proposed programme of site investigations to be undertaken within the Foreshore Licence Application Area is discussed in detail in the Schedule of Works document accompanying this application. Indicative seafloor contacting Site investigations are shown in Figure 1-2. Note seafloor-contacting Site Investigation location distribution across the OWF area will be informed by geophysical data. OECC Site Investigation locations will be distributed every 1 km along the proposed OECC route.

The exact technical specifications of the equipment to be used will not be known until the survey contract has been awarded. However, a description of the typical equipment and survey parameters is described in the Schedule of Works document accompanying this application. For the purposes of this risk assessment, typical acoustic properties of equipment are provided. The acoustic frequencies given below are typical of the frequencies used in surveys to obtain information suitable for offshore wind in these water depths. The vessel will be transiting at a relatively slow speed (c. 5 knots) throughout the survey activities and normal speeds whilst transiting to survey site.

All efforts will be made to follow survey recommendations outlined in the Guidance on Marine Baseline Ecological Assessments & Monitoring Activities for Offshore Renewable Energy Projects Part 1 and 2 (DCCAE, April 2018), where the specific timeframes are indicated for the survey provision.

Figure 1-2 below shows the indicative survey locations across the application area.

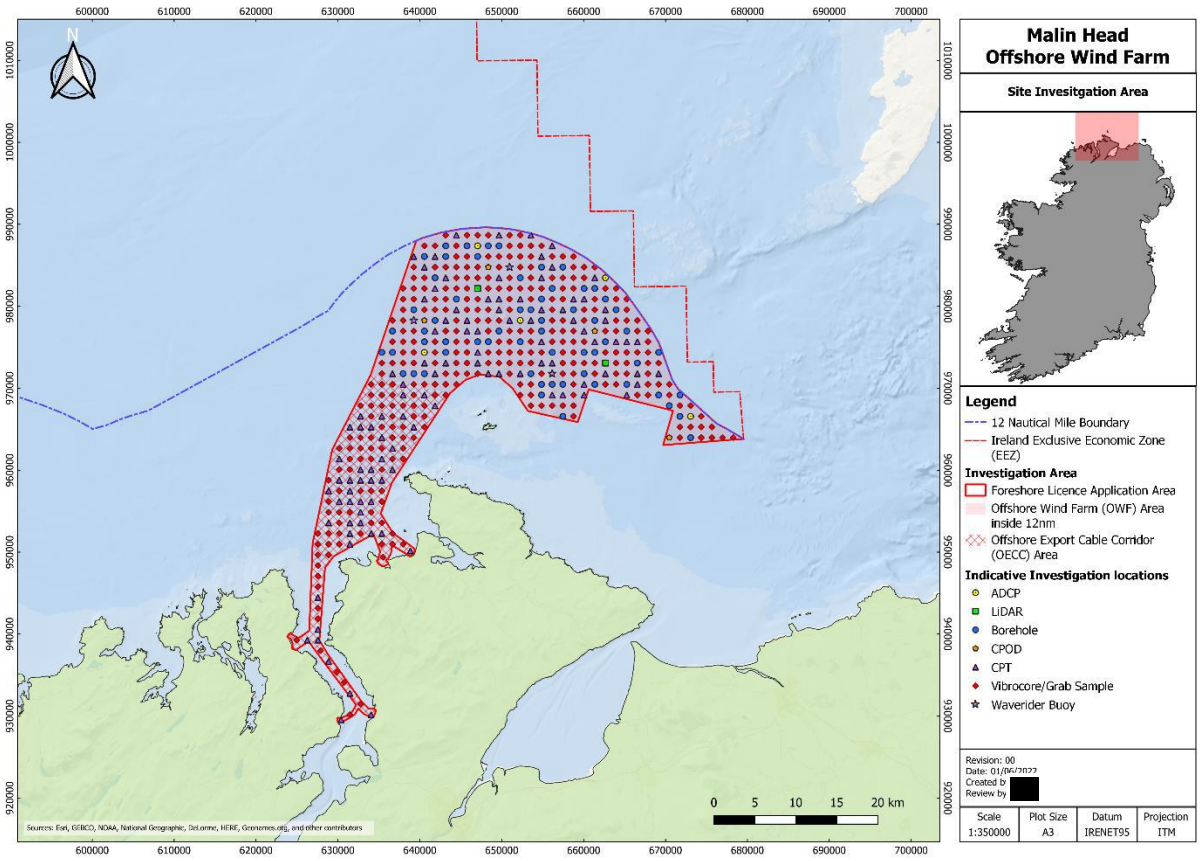

Figure 1-2: Indicative Geotechnical, Metocean and Ecological Survey Locations

1.5 Survey Schedule

Subject to the award of a Foreshore licence, as well as favourable weather conditions, Malin Array Limited propose a survey works schedule that will be phased over a total of 5 years.

As well as the uncertainty associated with the timing for obtaining a Foreshore Licence, it is not possible at the time of writing to provide exact details on the proposed survey schedule. However, the intention is to begin survey activities as soon as feasible following award of the Foreshore Licence, possibly in Spring of 2022 with a staged programme of investigations over the subsequent four years (2023, 2024, 2025, 2026), capitalising on suitable weather windows over the total period of five years. This phased approach will progress the overall development towards detailed design stage. Procurement of survey contractors will be undertaken to ensure that suitable weather windows can be utilised as soon as possible following licence award.

The exact survey mobilisation dates will be known at that point in the process. For further details on the proposed site investigation activities please see the Schedule of Works document that has been provided in support of the application.

2 Legislation and Regulation

2.1 European Protected Species (EPS)

All species of cetacean (whales, dolphins and porpoises) occurring in European Union (EU) waters are considered European Protected Species (EPS) under Annex IV of the Habitats Directive (Council Directive 92/43/EEC). As directed by Article 12 of the Directive, species listed in Annex IV are considered species of community interest in need of strict protection across their entire natural range within the EU, both within and outside Natura 2000 sites. In addition to cetaceans, other EPS occurring in Irish waters are the Eurasian otter (*Lutra lutra*) and the leatherback turtle (*Dermochelys coriacea*).

The Habitats Directive has been transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No 477 of 2011). These consolidate the earlier European Communities (Natural Habitats) Regulations 1997 to 2005 and the European Communities (Birds and Natural Habitats) (Control of Recreational Activities) Regulations 2010.

These Regulations provide for the strict protection of Annex IV listed species, including all cetaceans, in their natural range. As such, it is an offence to:

- Deliberately capture or kill any specimen of these species in the wild;
- Deliberately disturb these species particularly during the period of breeding, rearing, hibernation and migration;
- Deliberately take or destroys eggs of those species from the wild;
- Damage or destroy a breeding site or resting place of such an animal; or
- Keep, transport, sell, exchange, offer for sale or offer for exchange any specimen of these species taken in the wild, other than those taken legally as referred to in Article 12(2) of the Habitats Directive.

'Deliberate' has been interpreted by the European Commission, in its 2007 'Guidance document on the strict protection of animal species of community interest under the Habitats Directive 92/43/EEC', as

"'Deliberate' actions are to be understood as actions by a person who knows, in light of the relevant legislation that applies to the species involved, and the general information delivered to the public, that his action will most likely lead to an offence against a species, but intends this offence or, if not, consciously accepts the foreseeable results of his action".

Therefore, anyone carrying out an activity which they should reasonably have known could cause injury as defined in the Regulations, could be committing an offence.

In Ireland, further protection is afforded to all cetaceans, as well as grey and harbour seals and the Eurasian otter under the Wildlife Act (1976) and its subsequent Amendments. Under the Wildlife Act and its amendments, it is an offence to hunt, injure or wilfully interfere with, disturb or destroy the resting or breeding place of a protected species (except in some instances under licence or Ministerial

permit). The Wildlife Act applies to waters within Ireland's Territorial Sea, i.e., out to the 12 nm limit from the baseline[1].

Please note, for the purposes of this assessment, grey and harbour seals are not included as they are not Annex IV species. Effects of the proposed site investigation activities on Natura 2000 sites where grey and/or harbour seals (and/or harbour porpoise and/or bottlenose dolphins), are designated features are considered in the SISAA document which accompanies this Foreshore Licence Application.

2.2 Guidance

In 2007, the National Parks and Wildlife Service (NPWS) of the Department of Arts, Heritage and the Gaeltacht produced a 'Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters' (NPWS, 2007). These were reviewed and amended in 2014 to produce 'Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters' DAHG, 2014). This guidance aims to:

1. Give an understanding of selected sound sources introduced into the environment by specific human activities, which may impact detrimentally on protected marine mammal populations or individuals of those species,
2. Describe a structured, staged process for the informed assessment of risk and decision making with regard to such sources
3. Outline practical risk avoidance and/or risk reduction measures which must be considered in order to minimise the potential effects of sound sources on the natural ecology of marine mammal species

This DAHG (2014) guidance recommends that listed coastal and marine activities, including geophysical acoustic surveys, undergo a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species to address any area-specific sensitivities, both in temporal and spatial extent, and to inform the consenting process. This document also sets out a generalised framework for the consideration of risk from particular sound-producing activities in the waters of Ireland's Exclusive Economic Zone (EEZ) and offers guidance for planning and risk management, where necessary.

Additionally, 'The protection of marine European Protected Species from injury and disturbance: Guidance for the marine area in England and Wales and the UK offshore marine area', published in 2010 by the JNCC, Natural England and the Countryside Council for Wales (now Natural Resources Wales) (JNCC *et al.*, 2010), has been used as a complement to the NPWS (2014) guidelines.

[1] The baseline is the low water mark from which the limit of the territorial seas is measured (i.e. 12nm)

3 Annex IV species in the vicinity of the FLA Area

Ireland has recorded 25 species of cetacean, all of which are recognised as protected species under the EU Habitats Directive and the Irish Wildlife Act 1976, as amended. Of these 25 species, fourteen- Common dolphin, Bottlenose dolphin, Harbour porpoise, Fin whale, Minke whale, Humpback whale, Northern right whale, Northern bottlenose whale, Sowerby's beaked whale, Gervais's beaked whale, Killer whale, Risso's dolphin, Atlantic white-sided dolphin and White-beaked dolphin have been recorded off the north west coast and may be present in the proposed survey area at least on a seasonal basis (O'Brien *et al*., 2009; Wall *et al*., 2013, Ireland's Marine Atlas, 2021).

Leatherback turtles have been observed off the west coast in recent years and otters may also interact with very small areas of the landfalls should they be present in any rivers within range of landfall areas, such as minor rivers which fall within the range for coastal dwelling otters.

Table 3-1 presents a short synopsis of the Annex IV species that may be found within or near the proposed site investigation area.

Table 3-1: Annex IV species that may be found within or near the Foreshore Licence Application Area

Species	Species Information
Harbour Porpoise (*Phocoena phocoena)*	Generally found in the northern latitudes of the Pacific and Atlantic oceans, mainly in the continental margins. They are the most widespread of any species in Ireland, observed in all inshore waters around the entire coastline and almost all records were within 10 km of the coast (Berrow *et al*., 2010). The harbour porpoise is the smallest cetacean found in Irish waters and generally appears shy, avoiding other species and rarely interacting with boats, which can make observing it difficult in anything other than calm waters. Harbour porpoises are particularly abundant between Howth Head and Dalkey off Co. Dublin, where boat-based surveys conducted by IWDG produced the highest counts anywhere in Ireland. (IWDG, 2022a; NPWS, 2022; 2019). Harbour porpoises rarely occur over deep water but have been observed over relatively shallow (<200m) offshore banks (DAGH, 2009)
Common dolphin (*Delphinus delphis*)	Deemed the second most frequently reported species of cetacean after the harbour porpoise, and the most abundant of all cetacean species recorded in Ireland (Berrow *et al.*, 2010). Common dolphins occur in all Irish waters including offshore waters and the Irish Sea, but highest concentrations appear to occur off the south and west coasts (DAGH, 2009). There appears to be an eastward movement of this species along the south coast during autumn and winter, with sightings peaking off County Kerry towards late summer, off County Cork between September and January and off County Waterford between November and February (Berrow *et al.*, 2010).
Bottlenose dolphin (*Tursiops truncatus*)	A large, robust, and gregarious dolphin found in tropical and temperate waters worldwide (Wall *et al*., 2013). In Ireland, bottlenose dolphin shows both a coastal and offshore distribution with most sighting records off the western seaboard and in the Celtic Sea, although it is also found in the Irish Sea and in waters along the edge of the continental shelf (DAGH, 2009). Resident or semi-resident populations are known from the Shannon Estuary, Tralee Bay, the Mayo coast and Cork Harbour. Results from a study by

Species	Species Information
	Mirimin *et al*. (2011) comparing bottlenose dolphin biopsies indicate that there is a degree of isolation of the Shannon Estuary population from animals encountered elsewhere around the coast, and that a larger pelagic population exists that is also genetically distinct from the Irish coastal populations.
Risso's dolphin (*Grampus griseus*)	In Ireland during the summer months Risso's dolphin favours inshore waters and offshore islands, especially The Saltee Islands off County Wexford, the County Cork coast and the Blasket Islands off County Kerry in contrast to deep-water habitats elsewhere in the world (IWDG, 2022b). According to Berrow *et al.* (2010), most sightings occur between May and July suggesting a late spring inshore movement. Although Risso's dolphins have been reported off all coasts in Ireland, their distribution is more clustered with regular sightings inshore off the northwest and southeast coasts, with most records of Risso's dolphins in the UK and Ireland being within 11 km of the coast (DAGH, 2009).
Killer whale (*Orcinus orca*)	Killer whales are the largest delphinid growing up to 9.5m. They are easily identified with striking coloration and large dorsal fins, particularly in the adult males. They are the most widely distributed cetacean in the world (Shirihai & Jarrett, 2006), and have been recorded off all Irish coasts in all seasons, with markedly fewer sightings in the Irish Sea (Wall *et al*., 2013), but mainly in shallow continental shelf waters (DAGH, 2009). Photo identification has linked killer whales sighted off Ireland with the "West Coast Community" resident off Scotland (Berrow *et al*., 2010).
Minke whale (*Balaenoptera acutorostrata*)	The minke whale is the most common and widely distributed of the baleen whales in Ireland and the most likely to be encountered in shallow waters. It occurs off all coasts, including the Irish Sea, but most records are from southern and southwestern coastal waters. The species has also been observed over offshore banks (DAGH, 2009). The smallest of the baleen whales, their length averages 8.5 metres. Usually encountered singly or in small groups, sightings are most frequent off the Irish coast in spring and autumn (Wall *et al*., 2013).
Fin whale (*Balaenoptera physalus*)	Growing up to 24m, Fin whales are the second-largest animal in the world after the blue whale (*Balaenoptera musculus*) and the largest baleen whale likely to be present close to shore off Ireland. The Fin whale has a worldwide distribution in mainly temperate and polar sea (Shirihai & Jarrett, 2006). In Irish waters, nearshore sightings cluster to the south and southwest of the country with peaks in the number of animals in the autumn and early winter (DAGH, 2009), but they are also well-represented off the shelf edge in deeper waters (Wall *et al*., 2013).
Humpback whale (*Megaptera novaeangliae*)	The Humpback whale is a global species found in all the major ocean basins. In Ireland, Humpback whales have been recorded in small numbers close inshore mainly off the south and southwest coasts, although all coasts are represented, including the Irish Sea; However, records offshore are relatively scarce (DAGH, 2009). Sightings of the iconic humpback have increased recently in Irish waters, with the Irish photo-ID catalogue of unique humpback whale sightings currently comprising 92 animals (IWDG, 2022c).

Species	Species Information
Northern right whale (*Eubalaena glacialis*)	The current North Atlantic population is around 300–350 individuals and is centred off the east coast of North America. There have been a few sightings in recent years in the Gulf of St Lawrence, two off Iceland in 2003, and one in the former whaling ground off Cape Farewell in 2004 (IWC, 2005). A sighting in May 2000 was also reported by Ó Cadhla et al. (2004) from international waters overlying the Hatton Bank, several hundred kilometres to the northwest of Ireland. It is found closer to land than are most large whales, especially during the breeding season. Calves may be born in the protected waters of a shallow bay.
Northern bottlenose whale (*Hyperoodon ampullatus*)	Northern bottlenose whales are found only in the North Atlantic and are rarely sighted in Irish waters. Ó Cadhla et al. (2004) reported one sighting off the Hatton Bank in August 2001, with two other records off the Co. Mayo coast and in the Rockall Trough in 2000. This species occupies a comparatively narrow ecological niche; the primary food source is thought to be squid of the Genus *Gonatus* (Hooker et al., 2001; Whitehead et al., 2003). Northern bottlenose whales may also occasionally eat fish (such as herring and redfish), sea cucumbers, starfish, and prawns. They do much of their feeding on or near the bottom in very deep water (> 800 m, and as deep as 1,400 m; Hooker and Baird, 1999).
Sowerby's beaked whale (*Mesoplodon bidens*)	Sowerby's beaked whales are confined to the North Atlantic Ocean. The species has the most northerly distribution of all species of the Genus Mesoplodon in the Atlantic and is the most frequently observed and frequently stranded Mesoplodon species Genus in the northeast Atlantic. There are 13 stranding records from Ireland, including in the Irish Sea and at least two live strandings. Few definite sightings have been recorded in Irish waters to date, one of which occurred during the SIAR survey off western Ireland in 2000 (Ó Cadhla et al., 2004), and it is likely that some of the unidentified beaked whales observed in waters off the northwest coast overlying the continental slope were Sowerby's beaked whales. Sowerby's beaked whales occur almost exclusively in deep waters beyond the continental shelf edge (MacLeod, 2000). The habitat preferences of this species are poorly known.
Gervais's beaked whale (*Mesoplodon europaeus*)	Gervais‟ beaked whales are probably continuously distributed in deep waters across the tropical and temperate Atlantic Ocean, both north and south of the equator (MacLeod and Mitchell, 2006). There is one stranding record for Ireland from Co. Sligo in 1989 (Berrow and Rogan, 1997).
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	In Ireland Atlantic white-sided dolphins have been mainly reported off the northwest coasts, especially in waters overlying the continental slope (Reid et al. 2003; Ó Cadhla et al., 2004). The Atlantic white-sided dolphin is found primarily in cool waters (7-12ºC) overlying the continental shelf and slope, but it also occurs in oceanic waters across the North Atlantic. Individual White-sided dolphins frequently live strand along the Irish coast, and these have included mass strandings (Berrow and Rogan, 1997; Rogan et al., 1997).
White-beaked dolphin (*Lagenorhynchus albirostris*)	White-beaked dolphins inhabit cold temperate to sub-polar waters of the North Atlantic, from a line between Cape Cod and France, north to southern

Species	Species Information
	Greenland, Svalbard in northern Norway and east to Novaya Zemlya, off Russia. They are the most abundant dolphin in the North Sea. In European waters the species typically prefers water depth less than 200m (Reilly et al., 2008). Sightings in Irish waters are mainly off the west and northwest coasts (Northridge et al., 1995; Reid et al., 2003; Ó Cadhla et al., 2003; Ó Cadhla et al., 2004) and Irish waters are probably at the southern edge of their range in the northeast Atlantic. MacLeod et al. (2009) suggest that habitat partitioning occurs between White-beaked and Common dolphins around the UK and Ireland, with White-beaked dolphins inhabiting water with surface temperatures below 13ºC and Common dolphins above 14ºC.
Eurasian otter (*Lutra lutra*)	The otter is a semi-aquatic mammal, which occurs in a wide variety of aquatic habitats such as rivers, streams, lakes, estuaries and on the coast. Coastal dwelling populations use shallow, inshore marine areas for feeding but they also require access to fresh water for bathing and terrestrial areas for resting and breeding, therefore their foraging range in the marine environment is limited to coastal areas. In Ireland, the territory of female otters is 6.5 ± 1.0 km in coastal environments (de Jongh *et al*. 2010) and males may have a larger extent; it has been suggested that the otter's range is approximately 12 km along the coast and 80 m seaward from the coast (NWPS, 2015; NPWS, *Lutra lutra* (1355) Conservation Status Assessment Report). Under water, hearing sensitivity is significantly reduced when compared to sea lions and other pinniped species, demonstrating that otter hearing is primarily adapted to receive airborne sounds (Ghoul *et al*., 2014).
Leatherback turtle (*Dermochelys coriacea*)	The leatherback turtle (*Dermochelys coriacea*) is the most widely distributed living reptile species, being found in all oceans except the Southern Ocean. Within the North Atlantic its range extends from the tropics to the high latitudes of Newfoundland right across to Europe's north-easterly fringe. It is a widely roaming species, with individuals making extensive pan-oceanic movements. Breeding is confined to warm tropical regions because of thermal constraints on egg incubation, but the species has many unique anatomical and physiological adaptations that permit it, unlike other marine turtles, to forage seasonally into cooler temperate waters. Consequently, leatherback populations have a very dynamic range. During the summer months their range is at its greatest extent with individuals located throughout the North Atlantic, whereas during the winter months their range is restricted to areas where the sea surface temperature is >15°C. (NPWS, 2019) Recent studies have shown that after nesting in the tropics the majority of North Atlantic leatherbacks head north towards cooler temperate waters. Some of these individuals head north towards the north-east Atlantic and Irish waters where they forage on jellyfish for the summer months before turning south again in the autumn as water temperatures decline (NPWS, 2019). They are generally spotted off the south and southwest coasts of Ireland during the summer months, with live sightings peaking in August (NPWS, 2019; OSPAR, 2009; King and Berrow, 2009; Doyle *et al*., 2007).

The present assessment will only consider the species regularly found in the waters off the North-west of Ireland, as other species will be occasional. Although not considered specifically in this assessment due to their low likelihood of occurrence, any assessment of, or mitigation measures put in place for the species assessed here are considered to be appropriate/relevant for other less commonly occurring species.

4 Potential Environmental Impacts

The following are the potential environmental impacts that have been identified given the nature of the site investigation activities proposed under this application:

- Disturbance from vibration and underwater noise associated with surveys
- Injury due to collision (Survey vessels/sampling equipment)
- Pollution event causing damage to Annex IV species

4.1 Disturbance from vibration and underwater noise associated with surveys

Geophysical surveys in the marine environment are a potential source of anthropogenic sound and therefore may have an impact on the marine environment. The level of environmental impact associated with this acoustic activity is variable depending on several factors including the type of equipment being used, its sound signal and propagation characteristics, and the depth in which it is operating (DAHG, 2014).

Cetaceans have evolved to use sound as an important aid in navigation, communication, and hunting (Richardson *et al*., 1995). It is widely accepted that the main environmental concern relating to marine mammals is the potential effects of anthropogenic underwater noise/sound (see Nowacek *et al*., 2007 for review). Such exposure can induce a range of effects on marine mammals: physical effects may include a temporary reduction in hearing sensitivity (Temporary Threshold Shift-TTS) which is reversible over time; or following intense noise exposure, Permanent Threshold Shift-(PTS). Other impacts include masking of biologically important noises by anthropogenic noise (perceptual impacts); behavioural changes such as displacement from feeding, resting, or breeding grounds; and stress (Southall *et al*., 2007; 2019; DAHG, 2014).

Acoustic instruments and equipment used in targeted marine geophysical investigations produce sound at frequencies within the hearing range of marine mammals (Nowacek *et al*., 2007). In order to evaluate the potential of the proposed survey equipment to cause harm to marine mammals, an assessment has been conducted using the approach described in Southall *et al*. (2007), in line with the current guidance from DAHG (2014). The Southall *et al*. (2007) noise exposure criteria have been updated by the US National Marine Fisheries Service (NMFS, 2016; NMFS, 2018) and Southall *et al*. (2019). It should be noted here that the NMFS (2018) / Southall *et al*. (2019) weightings and criteria are similar to those of Southall *et al*. (2007), although the naming of the hearing groups differs. Using the NMFS (2018) / Southall *et al*. (2019) criteria would constitute best practice for guidance on underwater noise exposure, however, in line with the current guidance from DAHG (2014), the criteria from the Southall *et al*. (2007) have been used in this report.

Southall *et al*. (2007) separated marine mammals into groups based on their functional hearing, namely low-frequency cetaceans, mid-frequency cetaceans, high-frequency cetaceans, pinnipeds in water and pinnipeds in air. For each of these groups sound pressure levels that would result in injury (PTS or TTS) were proposed for individuals exposed to single, multiple and non-pulsed sources (Table

4-1). For the purposes of this assessment, pinnipeds are not included as they are not an Annex IV species.

Table 4-1: Sound Pressure Level (SPL) injury criteria proposed by Southall et al. (2007), for individual marine mammals exposed to discrete noise events

Marine Mammal group	Injury Criteria	
	TTS	PTS
Low-Frequency Cetaceans (Baleen whales)	224dB re: 1µPa (peak)	230dB re: 1µPa (peak)
Mid-Frequency Cetaceans (including Bottlenose dolphins)	224dB re: 1µPa (peak)	230dB re: 1µPa (peak)
High Frequency Cetaceans (including harbour porpoise)	224dB re: 1µPa (peak)	230dB re: 1µPa (peak)

All geophysical surveys will adhere to international best practice, including the Department of Arts Heritage and the Gaeltacht (DAHG) 'Guidance to Manage the Risk to Marine Mammals from Man-made sound sources in Irish Waters' (DAHG, 2014). The DAHG (2014) report 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' addresses several key potential sources of anthropogenic sound that may impact detrimentally upon marine mammals in Irish waters. It incorporates a re-examination of the Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters (2007) and thereby provides replacement guidance and protective measures in this respect. The DAHG 2014 Guidance includes plan/project-specific guidance on Geophysical Acoustic Surveys in section 4.2.4 and will be followed throughout the site investigation activities.

The following auditory band widths for marine mammals which may be present in the vicinity of the Foreshore Licence Application Area are from Southall *et al*. (2007) cited in the DAHG (2014) guidance and are shown in Table 4-2. There is no data available for Eurasian otters, therefore underwater auditory detection thresholds are given for sea otter (*Enhydra lutris*) (Ghoul & Reichmuth, 2014). Leatherback turtle are known to hear in the very low frequency range, with a range of 50 - 1200 Hz with maximum sensitivity between 100-400 Hz in water (Piniak *et al*, 2012).

Table 4-2: Underwater Auditory Band Width for Marine Mammal Species (Southall et al., 2007), Sea otter (Ghoul & Reichmuth, 2014) and Leatherback turtle (Piniak et al, 2012)

Frequency	Species	Estimated Auditory Band Width (kHz)
Low Frequency Cetaceans	Baleen whales (Minke whale, Humpback whale)	0.007 – 22
Mid Frequency Cetaceans	Most toothed whales and dolphins (including Common & Risso's Dolphin)	0.15 – 160
High Frequency Cetaceans	Certain toothed whales and porpoises (including Harbour porpoise)	0.2 – 180
Low Frequency	Sea otter (*Enhydra lutris*)	0.125 – 38
Very Low Frequency	Leatherback turtle	0.05 – 1.2

Noise characteristics of the various surveys are detailed in Table 4-3 below.

Table 4-3: Noise sources during site investigation activities

Noise Source	Frequency (kHz)	Sound Pressure Level (dB re 1µPa @ 1m)
Shipping Noise	0.05 - 0.3	160 - 175
Multibeam echosounder (MBES)	200 - 700	200 - 228
Side scan sonar – Dual Frequency (SSS)	230/540 or 540/850	228
Sub-bottom profiler (SBP)	85 - 115 / 2 - 22	247
Sparker system (SBP)	2 - 16	204 - 216
Boomer system (SBP)	2.5	208 - 215
Geotechnical drilling (Rotary Boreholes)	0.002 - 50	160

Comparing the data on Annex IV species auditory band width (Table 4-2) and the noise characteristics of the surveys (Table 4-3) it is deemed that the following will be audible to marine mammals and leatherback turtle:

- Shipping noise
- Sub-Bottom Profiler (SBP)
- Drilling

The relevant surveys which are within the audible band width for marine mammals are presented in Table 4.4.

Table 4-4: Annex IV species auditory band width and relevant surveys; marine mammals known in the area are also listed.

Frequency	Species	Estimated Auditory Band Width (kHz)	Audible Survey
Low Frequency Cetaceans	Baleen whales (Minke Whale, Humpback Whale)	0.007 – 22	Shipping, SBP, Drilling
Mid Frequency Cetaceans	Most toothed whales and dolphins (Common & Risso's Dolphin)	0.15 - 160	Shipping, SBP, Drilling
High Frequency Cetaceans	Certain toothed whales, porpoises (Harbour porpoise)	0.2 - 180	Shipping, SBP, Drilling
Very Low Frequency	Leatherback turtle	0.050 – 1.2	Shipping, SBP, Drilling

4.2 Injury due to collision (survey vessels/sampling equipment)

There is a risk of collision between marine mammals and survey vessels. However, it is largely recognised that the key factors contributing to collision between marine mammals and vessels is speed (see Schoeman *et al*., 2020 for review). Injuries to marine mammals from vessel strikes are species-dependent but are generally more severe at higher impact speeds, with ships travelling at 14

knots or faster being the most likely to cause lethal or serious injuries (Wang *et al*., 2007). The vessels undertaking these surveys are likely to be either stationary or travelling considerably slower (5 knots) than this while engaged in the survey activities, thus allowing both the vessel and any animal in the area time to avoid collision.

During transit times, the survey vessels will be travelling at speeds greater than 5 knots. However, these movements are not considered to deviate from normal vessel traffic in the Foreshore Licence Application Area. Cetaceans in the area are exposed to vessels of all sizes on a regular basis as the survey site is located close to the entrance to Waterford Port and several smaller fishing harbours. As a result, they are likely to maintain a distance from all survey vessels for the short time period of survey works, before returning to the area once survey work has finished.

Therefore, the collision risk posed by the proposed survey is likely to be significantly lower than that posed by commercial shipping activity.

4.3 Pollution Event

The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78, MARPOL is short for maritime pollution and 73/78 short for the years 1973 and 1978) is one of the most important international marine environmental conventions. It aims to prevent both operational and accidental discharge into the marine from sea going vessels. Ireland ratified the various elements of the MARPOL Convention through the Sea Pollution Act 1991, the Sea Pollution (Amendment) Act 1999 and the Sea Pollution (Miscellaneous Provisions) Act 2006. It was given further legal effect through several Statutory Instruments under these Acts. The Acts place a legal obligation upon operators of vessels to implement measures to prevent both operational and accidental discharges from ships of substances, which may damage the marine environment as well as human health.

While the site investigation activities will result in a temporary increase in vessels using the area, which would therefore theoretically increase the risk of accidents and resultant fuel spills, in light of the legal obligations outlined above an incidence of pollution, whether from operational activities or from an accidental occurrence, is considered not likely.

All vessels used during the survey campaign shall, as required by law, be MARPOL compliant and fully certified by the Maritime Safety Office. This is standard practice for all survey activities irrespective of the survey operator and as it is required by law is built into the survey design. Therefore, it is considered not likely that there would be any occurrence of a pollution event either accidental or otherwise that could directly or indirectly affect any Annex IV Species. It is not considered further as an impact to Annex IV species in this report.

5 Risk Assessment for the protection of Annex IV species under Article 12 of the Habitats Directive

The purpose of this section is to examine the possible impacts of the proposed activities on those Annex IV species identified as having the potential to be present in the area, and address protective measures aimed at reducing any impact to these species. According to Wall *et al*. (2013) and Berrow *et al*. (2010), these species have been recorded in the area previously, therefore it is assumed for the purpose of this appraisal that they could be present in the area at any time of the year.

5.1 Identification of Relevant Annex IV Species

According to Wall *et al*. (2013) and Berrow *et al*. (2010), the area subject to the activities proposed under this application for a Foreshore Licence is known to be within the range of the following Annex IV Species:

- Common dolphin
- Bottlenose dolphin
- Harbour porpoise
- Fin whale
- Minke whale
- Humpback whale
- Northern right whale
- Northern bottlenose whale
- Sowerby's beaked whale
- Gervais's beaked whale
- Killer whale
- Risso's dolphin
- Atlantic white-sided dolphin
- White-beaked dolphin
- Eurasian otter
- Leatherback turtle

5.2 Impact Assessment

The species listed above may be impacted by disturbance from underwater noise associated with surveys and through injury due to collision with survey vessels/sampling equipment.

Considering the information presented in section 4.1, all proposed site investigation activities either emit noise that is inaudible to Annex IV species or of lower Sound Pressure Level than is required to cause injury.

Noise emitted by SBP equipment can be detected by some of the Annex IV species, with the potential for Temporary Threshold Shift onset in individuals near the sound source. This could cause localised

short-term behavioural impacts such as temporary avoidance. However, injury effects are not anticipated, as an animal would need to remain in the highly localised zone of ensonification for a prolonged period, which is unlikely (JNCC *et al*., 2010; JNCC, 2020). Thomson *et al*. (2013) suggest that short-term disturbance by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises.

As such, Annex IV Species are considered unlikely to be disturbed by noise emitted by the proposed site investigation activities.

There is a risk of injury to Annex IV species in the Foreshore Licence Application Area through collision with survey vessels and/or equipment. These vessels will be moving at slow speeds, in a predefined trajectory, while engaged in the survey activities, allowing for animals to predict movement of the vessels and avoid collisions. During transit times, the survey vessels will be travelling at speeds greater than 5 knots. However, these movements are not considered to deviate from normal vessel traffic in the Foreshore Licence Application Area. Annex IV species in the area are exposed to marine traffic on a regular basis and should therefore be accustomed to vessel movements. The limited number of vessels that will be required for these surveys will not significantly increase vessel traffic in the area. Accordingly, it is predicted that collisions between survey vessels and Annex IV species are extremely unlikely and there is no risk of significant effects to any of the species considered.

It is considered that standard mitigation measures, such as pre-works survey and soft start as detailed in the DAHG (2014) guidance, will prevent individual animals from suffering physical or auditory injury. Protection measures proposed in relation to these surveys are outlined in the section 6 below.

6 Protection measures to prevent harm to Annex IV species

In line with Irish best practice guidelines 'Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters' from DAHG (2014), which will be incorporated into the standard operating procedures of the proposed survey works, and international best practice, the measures detailed in sections 6.1– 6.8 below will be applied where possible to prevent and if not reduce injury and disturbance to Annex IV species during all noise emitting site investigation activities.

Please note the DAHG (2014) protocol is considered sufficient by the competent authority (NPWS) to mitigate for disturbance to marine mammal species. While the measures outlined in DAHG (2014) are not specifically aimed at leatherback turtle, the mitigation proposed for cetacean species, in particular the soft-start procedure, will also be relevant to leatherback turtles, who have a small maximum sensitivity range for sound detection (100 - 400 Hz in water, Piniak et al, 2012).

6.1 Marine mammal monitoring

A qualified and experienced Marine Mammal Observer (MMO) will be appointed to monitor for marine mammals and to log all relevant events using standardised data forms provided by the DAHG. During daylight hours the MMO(s) will carry out visual observations to monitor for the presence of cetaceans before the soft-start commences and will recommend delays in the commencement of the site investigations should any species be detected within the relevant monitored zone as per the DAHG 2014 guidance (see below).

6.2 Pre-start monitoring

Visual (MMO) will be conducted for a pre-soft-start search of 30 minutes i.e. prior to the commencement of marine operations (MBES, SSS, sub-bottom profiling, geotechnical seabed sampling). This will involve a visual observation (during daylight hours) to determine if any cetaceans are within the relevant zone of the activities as per the DAHG 2014 Guidance.

6.3 Monitored zone

Should any Annex IV species be detected within a radial distance of the relevant zone of the survey vessel (as per the DAHG 2014 Guidance), commencement of site investigation activities will be delayed until their passage, or the transit of the vessel, results in the cetaceans being of sufficient distance from the vessel to satisfy the DAHG 2014 Guidance. In both cases, there will be a 30-minute delay from the time of the last sighting within the relevant zone of the survey vessel (as per the DAHG 2014 Guidance) to the commencement / recommencement of the operations. The MMO will use a distance measuring stick or reticule binoculars to ascertain distances to Annex IV Species. Note: once started, site investigations will not cease should cetaceans approach the survey vessel.

6.4 Soft start

A soft start is the gradual ramping of power over a set period of time, to give any Annex IV species adequate time to leave the area.

Once the soft start commences, there is no requirement to halt or discontinue the procedure at night-time, if weather or visibility conditions deteriorate, or if Annex IV species enter the monitored zone (as per the NPWS 2014 Guidance for monitored zones – activity dependent).

In commencing a seismic survey operation, including any testing of seismic sound sources, where the output peak sound pressure level exceeds 170 dB re: 1µPa @1m, the following ramp up procedure will be undertaken in line with the DAHG (2014) guidance:

a) Energy output will commence from a low energy start-up and be allowed to gradually build up to the necessary maximum output over a period of 20-40 minutes (the exact time period will be dependent on survey parameters and equipment and will be designed in consultation with an experienced marine ecologist).

b) This controlled build-up of energy output will occur in consistent stages to provide a steady and gradual increase over the ramp-up period.

c) If marine mammals enter or are detected within the monitored zone while the ramp-up procedure is under way but incomplete, the energy output will not be increased until the marine mammals are no longer within the monitored zone.

6.5 Line changes

Where the duration of a survey line or station change is greater than 40 minutes, the activity will, on completion of the line/station being surveyed, either cease (i.e., shut down) or preferably undergo a reduction in energy output to a lower state where the peak sound pressure level from any operating source is =<170 dB re 1 µPa @ 1 m. Prior to the start of the next line/station, if the power was shut down, all pre-survey monitoring measures and soft start procedures will be followed as for start-up. If there has been a reduction in power, a soft start will be undertaken gradually from the lower output level. The latter sound reduction measure will be applied to line changes at night-time or in daytime conditions of poor visibility. Where the duration of a survey line/station change is less than 40 minutes the activity will continue as normal (i.e. under full output).

6.6 Breaks in survey periods

If there is a break in sound output from survey equipment for a period greater than 10 minutes (e.g., due to equipment failure, shut-down, survey line/station change) then all pre-start monitoring measures and ramp-up procedures will recommence prior to re-starting.

6.7 Reporting

All recordings of Annex IV species will be made using standardised data forms provided by the NPWS. Full reporting on operations and mitigation will be provided to the NPWS to facilitate reporting under Article 17 of the EC Habitats Directive and future improvements to guidance (DAHG, 2014). The report will also include feedback on how successful the measures were. This requirement will be communicated to the MMOs at project start up meetings and at crew change.

6.8 Survey vessels speed and course

The project survey vessels will be moving at a maximum speed of approximately 5 knots during surveys to allow Annex IV species to move away from the vessel should they be disturbed by the vessel presence or noise emissions. During transit times, the survey vessels will be travelling at speeds greater than 5 knots. However, these movements are not considered to deviate from normal vessel traffic in the Foreshore Licence Application Area. Should an Annex IV species be found to be in the direct path of a survey vessel, during or outside of survey times, the survey vessel will slow down or, if possible, alter course to avoid collision.

7 Conclusion

The proposed activities will be short in duration and of a temporary nature and compliant with DAHG (2014) (Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters) which will ensure that the proposed site investigation activities will not have a significant effect on the species considered in this report. In addition, the survey vessels will be slow moving (c. 5 knots) and therefore any risk due to collision is unlikely.

These measures ensure that the species listed in section 3 whose range overlaps the Foreshore Licence Application Area will not be significantly affected by the activities proposed under this application for a Foreshore Licence.

Therefore, it can be concluded that the proposed site investigation activities will not result in the committing of any offence under Article 12 of the Habitats Directive towards any of the species listed in Annex IV of the Habitats Directive that are likely to occur within the site and have been considered in this report.

References

Berrow, S.D., Whooley, P., O'Connell, M. and Wall, D. (2010). Irish Cetacean Review (2000-2009). Irish Whale and Dolphin Group, 60pp.

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. OJ L 206, 22.7.1992, p. 7–50. Available online at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043

DAHG (2014). Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters. Available from https://www.npws.ie/sites/default/files/general/Underwater%20sound%20guidance_Jan%202014.pdf [Retrieved 15/09/2021]

DAHG (2009). Conservation Plan for Cetaceans in Irish Waters. December 2009. Prepared by the National Parks and Wildlife Service of the DAHG.

DAHG (2007*).* Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters. Available from https://www.iwdg.ie/downloads/AcousticSurveys.pdf [Retrieved 15/09/2021]

Dow Piniak, W. E., Eckert, S. A., Harms, C. A. and Stringer, E. M. (2012). Underwater hearing sensitivity of the leatherback sea turtle (Dermochelys coriacea): Assessing the potential effect of anthropogenic noise. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. OCS Study BOEM 2012-01156. 35pp.

Ghoul, A., & Reichmuth, C. (2014). Hearing in the sea otter (Enhydra lutris): Auditory profiles for an amphibious marine carnivore. Journal of Comparative Physiology A: Neuroethology, Sensory, Neural, and Behavioral Physiology, 200(11), 967-981. https://doi.org/10.1007/s00359-014-0943-x

Hammond, P.S., McLeod, K., Scheidat M. (2006). SCANS II estimates of abundances. Available at: http://biology.st-andrews.ac.uk/scans2/inner-furtherInfo.html

Hammond, P.S., Mcleod, K., Gillespie, D., Swift, R. and Winship, A. (2010). Cetacean Offshore Distribution and Abundance in the European Atlantic (CODA). Sea Mammal Research Unit, Gatty Marine Laboratory, University of St. Andrews, St. Andrews, Fife, KY16 2LB UK.

Ireland's Marine Atlas (2021). Species distribution data accessed through Ireland's Marine Atlas at http://atlas.marine.ie/ [Accessed 14/12/2021])

IWDG (2022a). *Harbour porpoise species information page*. https://iwdg.ie/harbour-porpoise/# [Consulted 23/03/2022]

IWDG (2022b). *Risso's dolphin species information page*. https://iwdg.ie/rissos-dolphin/ [Consulted 23/03/2022]

IWDG (2022b). *Humpback whale species information page*. https://iwdg.ie/humpback-whale/ [Consulted 23/03/2022]

JNCC, NE and CCW (2010). The protection of marine EPS from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area.

JNCC (2020). Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (England, Wales & Northern Ireland). JNCC Report No. 654, JNCC, Peterborough, ISSN 0963-8091.

Lysaght, L and Marnell, F. (Eds) (2016) Atlas of Mammals in Ireland 2010-2015, National Biodiversity Data Centre, Waterford pp 120-172

Mirimin, L., Miller, R. & Dillane, E. & Berrow, Simon & Ingram, Simon & Cross, Tom & Rogan, E. (2011). Fine-scale population genetic structuring of bottlenose dolphins in Irish coastal waters. Animal Conservation. 14. 342 - 353. 10.1111/j.1469-1795.2010.00432.x.

NOAA (2016). Ocean Noise Strategy Roadmap. https://cetsound.noaa.gov/road-map

Nowacek, D.B., Thorne, L.H., Johnston, D.W., and Tyack, P.L. (2007). Response of cetaceans to anthropogenic noise. Mammal Review 37 (2): 81-115.

Piniak *et al* (2012), Dow Piniak W. E., Eckert, S. A., Harms, C. A. and Stringer, E. M. 2012. Underwater hearing sensitivity of the leatherback sea turtle (*Dermochelys coriacea*): Assessing the potential effect of anthropogenic noise. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. OCS Study BOEM 2012-01156. 35pp

Richardson, W.J.; Greene Jr., C.R.; Malme, C.I.; Thomson, D.H. (1995). Marine mammals and noise. Academic Press: San Diego. ISBN 0-12-588441-9

E. Rogan, P. Breen, Mick Mackey, Ana Cañadas, M. Scheidat, S.C.V. Geelhoed, Mark Jessopp, Aerial surveys of cetaceans and seabirds in Irish waters: occurrence, distribution and abundance in 2015-2017

S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011. http://www.irishstatutebook.ie/eli/2011/si/477/made/en/print

Schoeman R.P., Patterson-Abrolat C. and Plön S. (2020) A Global Review of Vessel Collisions With Marine Animals. Front. Mar. Sci. 7:292. doi: 10.3389/fmars.2020.00292

Shirihai, Hadoram & Jarrett, Brett (2006). Whales, Dolphins and Seals: a field guide to the marine mammals of the world. Bloomsbury Publishing, London.

SNCB (2017). Joint SNCB Interim Displacement Advice Note. Statutory Nature Conservation Bodies: Natural Resources Wales, Department of Agriculture, Environment and Rural Affairs (Northern Ireland), Natural England, Scottish Natural Heritage and Joint Nature Conservation Committee (UK).

Southall, B. L., Bowles, A. E., Ellison, W. T., Finneran, J. J., Gentry, R. L., Greene., C. R. Jr., Kastak, D., Ketten, D. R., Miller, J. H., Nachtigall, P. E., Richardson, W. J., Thomas, J. A., and Tyack, P. L. (2007). Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33(4): 411-521.

Southall, Brandon, Finneran, James, Reichmuth, Colleen, Nachtigall, Paul, Ketten, Darlene, Bowles, Ann, Ellison, William, Nowacek, Douglas, Tyack, Peter (2019). Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals. 45. 125-232. 10.1578/AM.45.2.2019.125.

Thompson, P.M., Brookes, K.L., Graham, I.M., Barton, T.R., Needham, K., Bradbury, G. and Merchant, N.D. (2013). Short-term disturbance by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises. Proceedings of the Royal Society B 280: 20132001.

Wall D., Murray C., O'Brien J., Kavanagh L.,Wilson C., Ryan C., Glanville B., Williams D., Enlander I., O'Connor I., McGrath D.,Whooley P. and Berrow S. (2013). Atlas of the distribution and relative abundance of marine mammals in Irish offshore waters 2005 - 2011. Irish Whale and Dolphin Group, Merchants Quay, Kilrush, Co Clare.

Wang, C., Lyons, S. B., Corbett, J. J., and Firestone, J. (2007). Using Ship Speed and Mass to Describe Potential Collision Severity with Whales: An Application of the Ship Traffic, Energy and Environment Model (STEEM) [Report by the University of Delaware].