MERC Consultants
environmental and conservation services

EU Habitats Directive: Annex IV Risk Assessment

Saoirse Wave Energy Project

Document control			
Document reference: ANNEX_IVRA_11042025			
Version	Date	Issue	Author
Final	11/04/2025	0.4	[redacted]

Contents

LIST OF TABLES

List of Figures

1. Introduction

Saoirse Wave Energy Limited is seeking a Marine Usage Licence (MUL) to undertake marine site investigations off the Clare coast (Figure 1) to progress the Saoirse Wave Energy project. The site investigation works, which constitute the proposed project, include geophysical, geotechnical, metocean, archaeological and environmental surveys which are required to facilitate the future design of the wave energy site, define the location of the array site, export cable corridor and landfall location options; and support the project planning application.

This report provides an assessment of the potential impact the proposed project might have on Habitats Directive (92/42/EEC) Annex IV species, identified as having the potential to be present within the MUL area. Under Article 12 of the Habitats Directive, Annex IV species are protected wherever they occur. If they occur within the Zone of Influence of the plan or project, a risk assessment of the effects of the project on the Annex IV species must be completed.

The EC (Birds and Natural Habitats) Regulations 2011-2021 provide strict protection for all of the Irish species listed on Annex IV of the EU's Habitats Directive. It does this by prohibiting certain activities which could impact on the conservation status of those species. Those activities may only be permitted by way of a derogation licence.

In the case of the Saoirse wave energy project the following Annex IV species have been identified as having the potential to be within the ZoI of the proposed project and as such have been considered in this report:

- Selected bat species
- Otters
- Dolphins, Whales and Porpoises
- Marine turtles

Where the risk assessment indicated the potential for effects mitigation has been proposed as outlined in section 9.

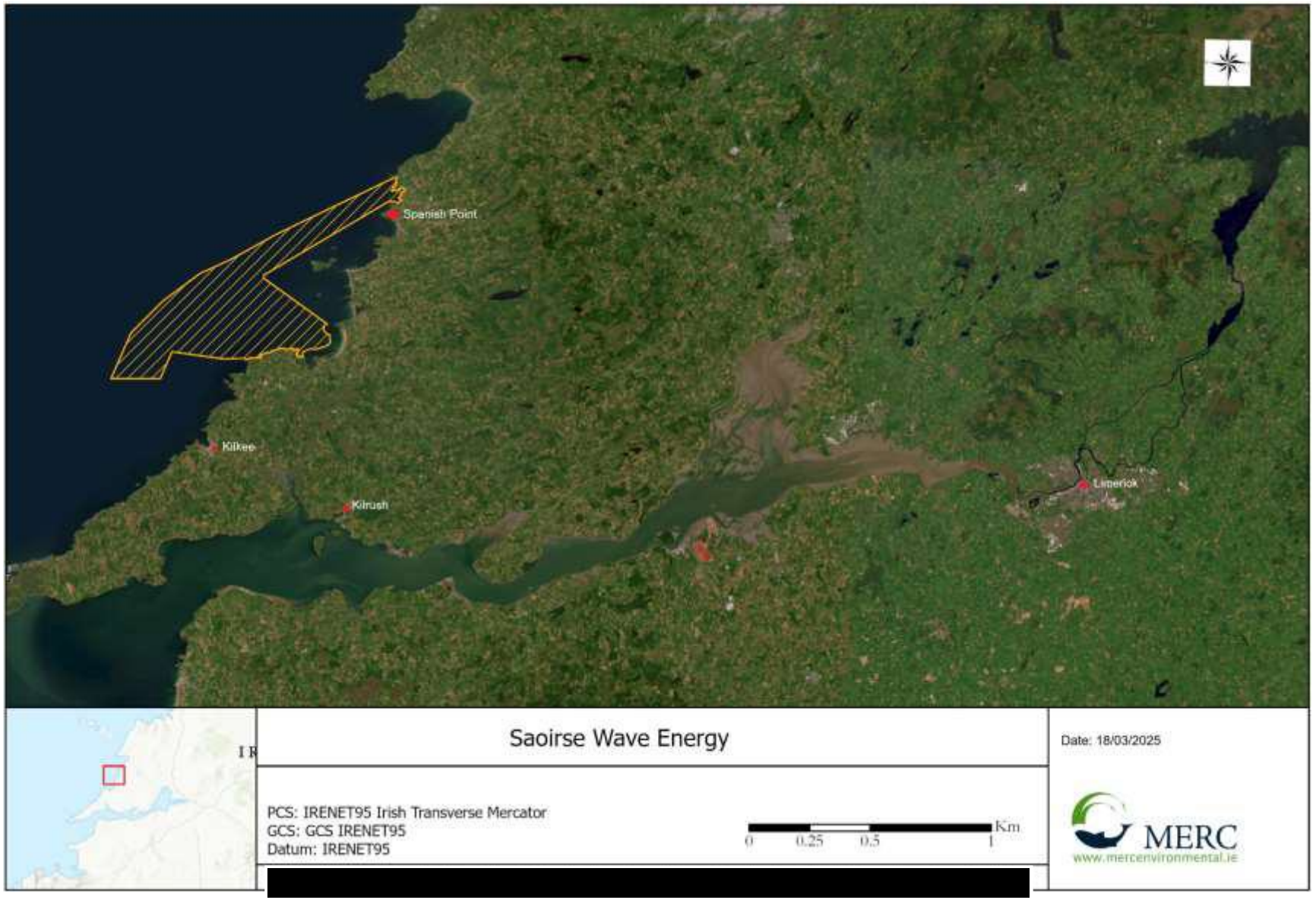

Figure 1. MUL Area

2. Legislation

Article 12 of the EU Habitats Directive states:

1. Member States shall take the requisite measures to establish a system of strict protection for the animal species listed in Annex IV (a) in their natural range, prohibiting:
(a) all forms of deliberate capture or killing of specimens of these species in the wild;
(b) deliberate disturbance of these species, particularly during the period of breeding, rearing, hibernation and migration;
(c) deliberate destruction or taking of eggs from the wild;
(d) deterioration or destruction of breeding sites or resting places.

2. For these species, Member States shall prohibit the keeping, transport and sale or exchange, and offering for sale or exchange, of specimens taken from the wild, except for those taken legally before this Directive is implemented.

3.The prohibition referred to in paragraph 1(a) and (b) and paragraph 2 shall apply to all stages of life of the animals to which this Article applies.

4. Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV (a). In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned.

3. Scope of work

3.1 Overview

Saoirse Wave Energy Ltd. is planning geophysical, archaeological, geotechnical, metocean and environmental surveys to provide the required information to establish the future design and operation of the wave energy demonstration site. The proposed survey area which corresponds to the MUL application area, is 114.57 km^2. It encompasses an area extending from Freagh point County Clare, south to Ballard Bay and out to a maximum distance of 10km from shore (Figure 1).

It is intended that surveys will commence in the spring of 2025 with a staged programme of investigations over the subsequent four years (2026, 2027, 2028, 2029), capitalising on suitable weather windows over the total period of five years. A high level programme, including indicative numbers of samples, durations and timings is outlined in Table 1 and described in section 3.2.

Table 1. Survey activity and duration.

Activity	Equipment	Timing and duration
Geophysical surveys	Multibeam echosounder (MBES) with acoustic backscatter; Side scan sonar (SSS). Magnetometer. Gradiometer.	Initial reconnaissance geophysical surveys in summer 2025 (with support from the National Marine Survey Programme). Detailed surveys in summer of 2026.

Activity	Equipment	Timing and duration
	Sub-bottom profiler (SBP); Ultra-high resolution Seismic (UHRS). Potentially a sparker (single and multi-channel) and mini-air gun. USBL system.	Total duration of up to 6 months (weather permitting).
Geotechnical surveys	Up to 30nr. boreholes to depths of up to 50m below seabed (BSB) in subtidal areas; Up to 40nr. cone penetration tests (CPTs) in subtidal areas; and Up to 40nr. vibrocores in subtidal areas. Up to 5nr. trial pits at proposed landfall locations	Reconnaissance geotechnical campaign in summer 2026. Potentially a refined detailed survey in summer of 2027. 15 - 25 hours of drilling time in any one location CPT - 30min – 2 hours in any one location Vibrocores 30mins-2 hours in any one location Trial pits – 30mins-2 hours in any one location Total duration of up to 6 months (weather permitting) The exact locations of boreholes, vibrocores and CPTs will be informed by the data derived from the geophysical surveys and cannot be confirmed at this stage. However, it is considered likely that they will be spread across the entire area of the MUL where suitable bathymetry is present.
Benthic ecology survey	Benthic grab sampling (up to 50 sampling locations). Camera and video sampling (up to 50 sampling locations). Video transects over potential Annex I habitats and protected features e.g. reef habitats (If required; number of locations to be confirmed by geophysical survey results). Diving activities may be applied for inspection and sampling in areas with restricted access. Intertidal walkover surveys to record biotopes and species present.	Subject to availability of geophysical survey results. A part of summer survey 2026 campaign. Up to 3 hours at any one location. Total duration of up to 3 weeks. (weather permitting). The exact locations of grab stations will be informed by the data derived from the geophysical surveys and cannot be confirmed at this stage. However, it is considered likely that they will be spread evenly across the entire area of the MUL where suitable soft sediments are present.
Metocean	Up to 2 Acoustic Doppler Current Profilers (ADCPs) are likely to be deployed on the seafloor in a trawl resistant mooring frame. Up to 2 waverider buoy are likely to be deployed with a mooring system. Up to 2 LiDAR buoys with a mooring system may be also deployed.	Maximum 36 months.
Marine mammal acoustic monitoring	Up to 4 acoustic monitoring devices (i.e. CPoDs and/or AMAR) are likely to be deployed across the site at any one time.	Up to 2 years of monitoring.

Activity	Equipment	Timing and duration
	Assume deployment of up to six deployments of CPoDs/AMAR devices, as contingency for lost equipment, at the same locations as the original deployments.	
Intertidal ecology surveys	Walkover surveys to map intertidal habitats and species. Likely to include transects, quadrats and core sampling (e.g. hand coring). Up to 12 sampling locations per landfall considered.	1-2 days per landfall. Summer 2025 (weather and tide permitting).
Offshore bat surveys	Offshore bat surveys may be considered for the project.	To be confirmed.
Water Quality	Sample collection may be undertaken with a rosette of water bottles and in situ sampling (i.e. with CTD probe)	There may be maximum of 20 nr. water quality sampling locations within the MUL Licence Area. As a part of summer survey 2026 campaign.
Archaeological Surv (Undertaken as part geophysical survey)	Underwater Archaeology Intertidal archaeology	Identification and assessment of metallic and other targets recorded during the magnetometer survey (as part of the geophysical survey specification above). This will be conducted in advance of geotechnical survey to inform the UXO and archaeological risk assessment. Undertaken as part of geophysical survey (2025/2026). Intertidal archaeological survey is also considered to be carried out during summer 2025.

3.2 Survey vessel

For the geophysical, environmental, and possibly geotechnical (CPTs and vibrocore) surveys it is proposed to use the Irish multi-purpose marine research vessel, the *RV Tom Crean,* (Figure 2) or similar vessels available at time of survey mobilisation. For follow-on geotechnical surveys, it is proposed to use vessels similar to Fugro Voyager and Fugro Aran 120 and a Jack Up Barge as shown in Figure 3 to Figure 5.
Fugro Voyager is an example of typical, purpose built offshore geotechnical vessel. The vessel has been specifically designed for operating in water depths up to 3,000m metres for both drilling and seabed sampling and in situ testing. The vessel has a twin tower type drilling derrick over a central moonpool.
Fugro Aran 120 is an example of Jack Up Barge, designated for acquisition of sub-seabed data using borehole, vibrocore and cone penetration techniques in nearshore area.

For follow-on nearshore geophysical, geotechnical, and environmental surveys smaller vessels are likely to be employed.

Uncrewed surface vehicle (USV) and/or autonomous surface vehicle (ASV) may also be used for the provision of geophysical survey.

The RV Tom Crean was commissioned in 2022 and was designed as a silent research vessel, in order to meet the stringent criteria of the ICES 209 noise standard for fisheries research. The vessel technical specification is outlined in Table 2.

A suitable support vessel will be contracted to enable to deployment and recovery of any metocean survey equipment throughout the project duration. A suitable small to medium sized multicat support vessel with an appropriately rated crane or A-frame system would be required for the tow-out, deployment and mooring, and recovery operations. A vessel such as the AMS Retriever (as shown in Figure 5) or similar would be required for these operations.

Other vessels supporting project works, have yet to be identified, as their availability will be subject to grant of MUL licence.

All vessels will be fit for purpose, certified and capable of safely undertaking all required survey work. Marine vessels will be governed by the provisions of the Sea Pollution Act 1991, as amended, including the requirements of MARPOL. In addition, all vessels will adhere to published guidelines and best working practices such as: the National Maritime Oil/HNS Spill Contingency Plan (NMOSCP), Marine Pollution Contingency Plan (MPCP), Chemicals Act 2008 (No. 13 of 2008), Chemicals (Amendment) Act 2010 (No. 32 of 2010) and associated regulations. Vessels shall have a Health, Safety and Environmental Managements system which should conform to the requirements of the latest International Maritime Organization (IMO), Safety of Life at Sea (SOLAS) and environmental requirements for their classification and with any national requirement of the territorial or continental / EEZ waters to be operated in.

The vessels to be considered for the provision of survey works will be represented by small and medium size vessels. Acoustic broadband source pressure levels with smaller vessels (<50 m) having source pressure levels 160-175 dB (re 1µPa at 1m) and medium size vessel (50-100 m) 165-180 dB (re 1µPa at 1m) (DECC, 2011). The survey works will be undertaken from vessels in accordance with the relevant guidelines required to manage the risk to marine mammals from man-made sound sources in Irish waters.

Figure 2. RV Tom Crean

Figure 3.Typical Offshore geotechnical drill survey vessel - Fugro Voyager

Figure 4. Typical Jack Up Barge – Fugro Aran 120

Figure 5.Typical vessel for metocean deployment and recovery – AMS Retriever

Table 2. RV Tom Crean: Vessel specifications

Vessel size	
Vessel length	52.8m
Beam	14m
Draught	5.2m (maximum)
Tonnage (GRT)	1935 Tonnes
Main diesel generators	
Make	Mitsubishi
Type	S16R-(Z3)MPTAW
Number and power	2 x ~1437kW
Speed	1500 rpm
Mounting	Double resilient
Exhaust silencers	SCR system with 45dB(A) attenuation
Auxiliary diesel generators	
Make	Scania
Type	DI 13-91 M
Power	426 kWm
Speed	1500 rpm
Mounting	Resilient
Exhaust silencers	At least 25 dB(A)
Propulsion motor	
Make	Indar
Type	Squirrel cage – Induction motor IMU-710-X/8
Power	2000 kW at 179rpm
Rated frequency	12.6 Hz

3.3 Equipment description and specifications

A suite of instruments will be used for the site investigation survey as detailed in Table 3.

Geophysical survey equipment will include a multibeam echosounder, sub bottom profiler and side scan sonar. A sparker system and, if further penetration is required, an air gun source may also be required. The type of geophysical survey equipment to be used will be determined by a number of factors including:

- Depth of interest below seafloor.
- Nature of shallow rock that is likely to be encountered.
- Desired resolution of the data that are to be used for mapping the shallow materials.

Geotechnical survey equipment to test the nature of, and/or retrieve samples on or below the seafloor will also be required. This to include vibrocore, borehole or cone penetration testing (CPT). Trial pits possibly to be collected in the intertidal zone as well.

A number of other instruments, such as a magnetometer, ADCPs, wave rider buoys and a maximum of 4 no. CPoDs, which are considered passive devices in terms of noise generation, will also be deployed. Deployment of a Day or Hammon grab will be required to collect sediment samples to inform the benthic ecology of the MUL application area.

Table 3. Indicative specifications of proposed survey equipment

Equipment	Example Model	Deployment	Company	Sound Pressure Level re 1 µPA in water @ 1m from source
Geophysical equipment				
Multibeam Echo sounder	EM2040 (200,300 & 400kHz)	Retractable hull mount	Konsberg Maritime	210dB
Side scan Sonar	4205 sidescan (300 to 900 kHz)	Towed system	Edgetech	228dB
Sub-bottom Profiler	Knudsen 3250 CHIRP (3.5-12kHz)	Vessel mount	Knudsen	223dB
Sparker	Dura-speak seismic sound source (300Hz to 1.2kHz)	Towed system	Subsea Technologies	226dB
Mini air-gun	Mini G Gun (10 and 500 Hz)	Vessel mount	Sercel	230dB
ultra-short baseline (USBL) system	Kongsberg HiPAP (Typically 20 to 50 kHz)	Equipment mounted	Konsberg	207dB
Geotechnical equipment				
Vibrocorer	HPC (high performance corer), or similar	From vessel	Fugro or similar	145-190dB
Cone penetration testing	Fugro Seascalf, G-Tec GT25 or similar	From vessel	Fugro or similar	118-145dB
Borehole testing	Geobor S or similar	From vessel	Fugro or similar	145-190dB
Trial Pitting	Tracked excavator	Tracked within foreshore area where access is possible	Fugro or similar	N/A
Passive recording equipment				
Magnetometer/ gradiometer	TBC	Towed	TBC	N/A
Wave rider	DWR-MkIII	Anchored	Datawell	N/A
CPoDs/Autonomous Marine Acoustic Recorder (AMAR)	AMAR G4	Anchored	Jasco	N/A
Acoustic Doppler Current Profiler (ADCP)	Sentinel V (300 – 1000Hz)	Static on seabed	Teledyne marine	N/A
Floating LiDAR buoy	EOLOS FLS200	Anchored	EOLOS	N/A
Benthic sampling and survey equipment				
Day Grab	N/A	Overboard	N/A	N/A
Hammon Grab	N/A	Overboard	N/A	N/A
Drop down camera	N/A	Overboard	N/A	N/A
Diver surveys	N/A	Overboard	N/A	N/A

*Note: Where the exact model to be used is yet To Be Confirmed (TBC) a worst-case scenario has been used to determine the upper-level sound pressure possible. The equipment type and model are indicative only, exact equipment to be specified by the contractor but the examples provided are consisted standard and any variations will be minor.

3.3.1 Geophysical equipment

Multibeam echosounder

A multibeam echosounder (MBES) is a type of sonar frequently used to map bathymetry. It operates by emitting an acoustic wave in a fan shape beneath the point of its transceiver attached to the hull of the vessel. The time it takes for the sound waves to bounce off the seabed and return to the transceiver is used to calculate the water depth within the arc of the fan. The proposed MBES operates at a sound pressure level of 210 dB re 1µPa at 1m with a peak frequency between 200-400 kHz.

Side scan sonar

Side scan Sonar (SSS) is another device that transmits sound pulses that provide the information required to map the seabed. It differs from MBES in that SSS has a finer beam width and smaller footprint to MBES and therefore higher resolution. It is generally towed behind the vessel very close to the seabed and emits fan-shaped acoustic pulses directed down toward the seafloor which are recorded as a series of cross-tracks. The sound frequencies used by side-scan sonar range generally range from 100 to 1000kHz; higher frequencies yielding better resolution but less range.

Sub-bottom profiler

A Sub-bottom profiler employs an acoustic signal, to provide the information required to identify and measure marine sediment layers that exist below the sediment/water interface. The proposed equipment comprises a Knudsen Chirp system which transmit a sweep of frequencies (e.g. 2-10 kHz) in a single pulse. Depending on the profile of the seabed (rock, sand, mud etc.) and level of compaction, the energy reflected back can be related to the sub-bottom composition.

Sparker system and hydrophone array

A sparker is a device used for sub-seabed investigations where deeper acoustic penetration is required. It is generally more powerful than a Sub-bottom profiler and used to explore very coarse/compacted sea beds. The sound source is generated by an electrical arc that creates a bubble. As it collapses the bubble produces a broad band (500 Hz – 4 kHz) omnidirectional pulse which penetrates a few hundred meters into the subsurface. Hydrophone arrays towed near the acoustic source receive the returning signals.

Mini airgun

A mini airgun emits a blast of compressed air resulting in an acoustic signal consisting of an initial high-amplitude pressure pulse followed by a decaying series of “bubble pulses” formed by oscillations of the resulting air bubble.

USBL system

A USBL system provide a method of positional fixing underwater. It consists of a transceiver, which is mounted on a pole under the survey vessel, and a transponder deployed on the seafloor or on the subsea instrument being used. An acoustic pulse is transmitted by the transceiver, and the pulse detected by the transponder is retuned. The time between the initial acoustic pulse and the reply is then measured by the USBL system and is analysed to allow the position to be calculated.

3.3.2. Metocean and other passive equipment

ADCP

An ADCP is a hydroacoustic current meter 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. In the present case ADCPs potentially operating in the range of 300 – 1000Hz will be used. The instrument emits “pings” of sound at a sampling rate of 1-minute average every 10 minutes.

The ADCP is contained within a trawl resistant bottom mount frame *circa* 1.8m x 1.3m x 0.6m with a weight of approximately 300kg. The frame is attached to a ground line, a clump weight and to an acoustic release system carrying a rope retrieval system. The frame also houses a recovery line attached to a small rigid buoy which is held in place by an acoustic release, which releases the buoy on command from a deck unit.
Also housed within the frame is lead ballast to secure the frame to the seabed. Additional instrumentation to collect salinity and temperature data may also be contained within the frame. An acoustic pinger is also mounted on the frame to aid in the recovery of the frame in the event of the acoustic release not firing. The frame is deployed with a grapple hook and floating nylon line to serve as a backup means of recovery.

The specifications of the ADCP and installation vessel will be confirmed by award of the tender contract. A vessel will be employed for the installation, service, and recovery of this equipment. The details of the contracted vessel will become available on award of the tender contract.

Floating LiDAR buoy

Floating LiDAR buoys may be deployed to measure the wind resource and wind speeds, understand the wave hight, heave and direction, measure current profiles to understand met conditions within MUL licence area. Deployment of buoy will include anchoring. Up to 2 LiDAR buoys may be deployed for a period of between 12 to 24 months.

The specifications of the floating LiDAR buoy, the associated mooring type, and an installation vessel will be confirmed by award of the tender contract. An installation vessel will be employed for the installation, service, and recovery of this equipment. The details of the contracted vessel will become available on award of the tender contract.

Waverider buoy

Waverider buoys may be deployed to measure wave hights and direction to support a detailed design of the project within MUL Licence area. They will be attached to a seabed with suitable mooring. Up to 2 waverider buoys may be deployed to gather wave data. The specifications of the waverider buoy, the associated mooring type, and an installation vessel will be confirmed by award of the tender contract. An installation vessel will be employed for the installation, service, and recovery of this equipment. The details of the contracted vessel will become available on award of the tender contract.

Magnetometer/Gradiometer

A magnetometer is a passive instrument that measures the Earth's magnetic field allowing magnetic anomalies to be measured. It is towed behind the survey vessel where it samples background magnetism. When the magnetometer detects an anomaly, such as ferrous objects such as fragments of a ship hull or a geological formation of basalt. This is detected as a change to the background magnetic field. This tool can detect artifacts above or below the seabed.

Gradiometer surveys are carried out using a similar methodology but with the use of two separate magnetometer sensors towed in a paired configuration. Gradiometer surveys measure the gradient of the magnetic field, allowing for a more precise measurements of magnetic variations. The use of magnetometer or gradiometer survey arrays will be determined following further site-specific assessments to ensure the most appropriate methodology.

3.3.3. Benthic sampling

Seabed imagery

Underwater camera systems or Remotely Operated Vehicles (ROVs) may be used for visual inspection of the existing environmental conditions within MUL area. Dropdown video surveys using a overboard camera may be conducted to record the subtidal habitat especially in areas where hard strata (subtidal reef) are indicated (based on bathymetry) to be present. High quality video recordings and stills will be collected for further analysis and confirmation of suitable conditions for further intrusive activities e.g. benthic sampling or geotechnical works.

Day or Hammon Grab

A Day grab is an instrument used for sampling soft seabed sediments. When deployed overboard it is lowered on a winch to the seabed where the jaws open to take a small (approx. 15L) sample of the surface sediment (top 20cm). A Hammon grab is a very similar type of sampler, but the jaw mechanism is slightly different which allows it to sample coarser sediments (e.g. gravel and shelly sediments). The samples retained can then be analysed to obtain an overview of the sediment fauna, and particle size. Both samplers are routinely used for surveillance monitoring to support a number of EU Directives such as the Habitats Directive and Water Framework Directive. Day or Hammon grabs do not introduce noise into the underwater environment other than that produced from a slight impact with the grab making contact with the seabed.

Intertidal coring and walkover surveys

For intertidal sediment assessment a 0.01m^2 hand core taken to a depth of 20cm for benthic faunal analysis will be used. Additional surveys of intertidal hard strata may also be carried out by conducting walk over surveys of the relevant hard strata to record biotopes and species present.

Diver surveys

Diver surveys, using SCUBA, may be also conducted in areas of hard strata. Both surveys are considered to be non-intrusive as they do not make contact with the seabed.

3.3.4. Geotechnical survey equipment

The aim of the geotechnical survey is to provide sufficient geotechnical data to allow the characterisation of the sub-seabed strata. As such virocoring, seabed CPT and borehole testing will be conducted at the number of locations spread throughout the MUL application area. The geotechnical survey will be undertaken from a dedicated geotechnical vessel as described in section 4.2. Drilling, resulting from geotechnical surveys, is generally acknowledged to produce moderate levels of continuous omnidirectional sound at low frequency (several tens of Hz to several thousand Hz and up to c.10 kHz). Source sound pressure levels have generally been reported to lie within the 145-190 dB re: 1 µPa range (NPWS, 2014).

Boreholes

Up to 30 bore holes with a diameter of up to 102mm and a depth of Up to 50m below the seabed will be carried out. To facilitate this, a drill head is lowered to the seabed from the vessel via a drill string and stabilised using a seabed frame. The drill head penetrates the seabed via rotation of the drill string and the application of a downward pressure. Soils and rock samples are then retrieved for laboratory testing via the drill string. Borehole drilling may be combined with *in-situ* testing such as cone penetration testing or down the hole testing at some investigative locations.

Indicative Equipment: Drilling equipment used will follow the ISO and API technical specifications for drilling equipment. Indicative equipment to be used would be traditional API drill string or a triple core barrel system (e.g., Geobor 'S') or similar.

Cone penetration testing

Up to 40 CPT with a Diameter: 50-62mm and a depth of 30m below the seabed will be carried out. This will be carried out *in situ* on the seabed via a frame or by deck-push CPT from the vessel via a moon pool. Indicative Equipment: Fugro Seascalf, G-Tec GT25 or similar. For landfall investigation within the intertidal zone, a tracked borehole / CPT rig and ancillary equipment would be used.

Vibrocoring

Up to 40 Vibrocore samples will be taken to a depth of 6m. A piston core, will be used to collect the samples. These devices are typically deployed from a crane on the vessel.
Indicative Equipment: Fugro HPC (high performance corer) & OSIL Vibro-Corer or similar.

Trial pitting

Up to 5 trial pit excavation locations will be carried within the intertidal or foreshore areas where access is possible. These excavations will be carried out using a tracked excavator to excavate a pit approximately 1m wide, 3m long and up to 4m deep depending on the ground conditions. Trial pit excavations will be used to visually inspect the ground conditions, collect samples and carry out insitu testing such as shear vane testing and plate bearing testing. Completion of a trial pit excavation will take up to two hours each and all excavations will be back filled with the excavated materials in the order in which they were excavated. Trial pit excavation is not carried out within the water body, with all works carried out above the water line or within tidal windows.

4. Receiving environment: Annex IV Species

4.1 Cetaceans

Under Article 12 of the Directive, all cetaceans receive strict protection within the Exclusive Economic Zone. A total of 26 cetacean species have been recorded in Ireland. A marine Mammal Database compiled and managed by the National Biodiversity Data Centre has collated data from numerous sources (e.g. Irish Whale and Dolphin Group, ObSERVE project) on the distribution of cetaceans off the coast of Ireland. These data sources show that the area in and surrounding the proposed MUL area are used by a wide range of cetacean species. The density and distribution of which varies over time and season.

While twenty-six species of cetacean have been recorded in the waters around Ireland, only harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), minke whale (*Balaenoptera acutorostrata*), and Humpback Whale (*Megaptera novaeanglia*) are regularly found off the west coast of Ireland and in the vicinity of the Marine Usage Licence (MUL) Area. Others are either transitional visitors or have only been documented from stranding data (O'Brien *et al.,* 2009; Wall *et al.,* 2013). Harbour porpoise, bottlenose dolphin, common dolphin and Risso's dolphin are thought to be present year-round whilst minke whale and humpback whale are considered to be seasonal visitors during summer months (NBDC, 2025).

Site specific surveys

Aerial surveys conducted to support this project, (Intertek, 2022 and 2023) were designed to cover a slightly different project site to that proposed in the current MUL. However, the area covered was designed to include for alterations in the final MUL area and, as such, includes the area of the current MUL with the exception of a small section, approximately 10 Km^2, to the north east of the current MUL area. This is considered to be insignificant in terms of assessment of the use of the site, in particular as the survey area covered included a much wider buffer zone surrounding the MUL area.

The site data showed that site was used by high numbers of common dolphin with a range of additional cetaceans also using the site (Table 4). Species were incorporated into the density and population size estimates by apportioning them according to the proportions of their species group observed on each survey.

Table 4. Peak population estimates

Species	Peak population estimate April 21-March 22	Peak population estimate April 22-March 23
Bottlenose Dolphin	15	27
Common Dolphin	1,564	172
Harbour porpoise	38	11
Humpback Whale	5	0
Minke Whale	9	23

The survey area was used by high numbers of common dolphin during 2021-22, though less than in 2022-23. They are present in the survey area in nationally important numbers (>1% Irish population), and are an EU Habitats Directive Annex IV species.

Overview of additional data sources

This section provides an overview of additional information on the occurrence and distribution of cetaceans for the MUL area and adjacent waters and summarises the most recent information from the ObSERVE programme (Paradell, *et al*., 2024).

Harbour porpoise

Harbour porpoise are found year-round in inshore waters around the entire Irish coast, including the MUL Area, but are thought to be most abundant off the southwest coast of Ireland (Wall *et al*., 2013; O'Brien, 2016). In Irish waters, harbour porpoise are commonly found in bays, estuaries and harbours less than 20m deep. The Blasket Islands Special Area of Conservation (SAC) located approximately 80 km from the MUL Area has been identified as an important area for harbour porpoise. The MUL Area falls within the Celtic and Irish Seas (CIS) Management Unit (MU) for harbour porpoise, as defined by the Inter-Agency Marine Mammal Working Group (IAMMWG) (IAMMWG, 2015). The ObSERVE programme (Paradell, *et al*., 2024) showed interannual variability in the abundance of harbour porpoise with the Summer 2021 estimate of 20,991 decreasing to 7,510 across all sectors. Seasonal variability was also shown, with winter estimates less than the summer estimates. Greatest abundance and density estimates were recorded in the Irish Sea (stratum 5) for all seasons. Harbour porpoise was also found in increased densities throughout the coastal waters (strata 6A-6C, in particular stratum 6A in the north) and the Celtic Sea (stratum 4).

In the summer of 2021 the corrected density, for stratum 6b, which includes the MUL area, was found to be 0.153 animals per km2. In 2022 the corrected density was found to be 0.011 animals per km2 in summer and 0.046 animals per km2 in winter (Paradell, *et al*., 2024).

Bottlenose dolphin

Bottlenose dolphin are distributed throughout Irish waters, in all seasons (Berrow et al., 2018; Rogan et al., 2018), but are most abundant off the western seaboard (Berrow et al., 2016). The distribution of sightings indicates a preference for waters overlying the continental shelf and the continental slope plus adjacent deeper ocean waters and topographical basins (NPWS, 2019), but bottlenose dolphin are also encountered in enclosed bays and in close proximity to the Irish coast (Oudejans *et al*., 2010; Wall et al., 2013; Rogan *et al*., 2018). Some communities of bottlenose dolphin show a level of residency in discrete coastal areas (DEHLG, 2009). The Lower River Shannon SAC is designated for bottlenose dolphin and is located 7 km from the Foreshore Licence Application Area. During the ObSERVE aerial surveys, bottlenose dolphin was the most frequently sighted cetacean species in Irish EEZ waters, with more than twice as many sightings during winter compared to summer. Sightings also suggest that the west and southwest of Ireland are likely to be more important in terms of the distribution of this species compared to other parts of the coast. The ObSERVE programme (Paradell, *et al*., 2024) showed interannual differences in the encounter rates for bottlenose dolphins, with increased encounter rate shown for Summer 2022 reflecting a greater number of sightings recorded during this period.

For stratum 6b, which includes the MUL area, the summer 2021 corrected density was found to be 0.024 animals per km2. In 2022 the corrected density was found to be 0.063 animals per km2 in summer and 0.105 animals per km2 in winter (Paradell, *et al*., 2024).

The MUL Area falls within the Western Coast of Ireland (WCI) and the Shannon Estuary (SHE) MU for bottlenose dolphin, (IAMMWG, 2015; IAMMWG, 2021).

Risso's dolphin

Risso's dolphin are distributed throughout the entire Irish coast and highest abundance appears to be off the southwest and south coasts. Nearly all sightings in Irish waters are from the coast and around islands. Risso's dolphin are typically associated with continental shelf and slope waters (Berrow *et al*., 2016). Studies have shown some site fidelity between consecutive years off the Blasket Islands (Wall *et al*., 2013). Evidence also points to seasonality, with Risso's dolphin coming inshore in summer months, likely determined by prey movements (Berrow *et al*., 2016). The ObSERVE surveys reported sightings in all seasons, primarily distributed in deeper waters over the continental shelf and slope, with occasional sightings closer inshore. A total of 30 sightings comprising 91 Risso's dolphins (*Grampus griseus*) were recorded during the ObSERVE aerial surveys in 2021 and 2022 (Paradell, *et al*., 2024). The species was primarily sighted in strata 1 to 4, with sporadic sightings occurred in the Irish sea (stratum 5) and coastal waters off the North and South coasts.

For stratum 6b, which includes the MUL area, the summer 2021 corrected density was found to be 0.003 animals per km2. In 2022 no sightings for this sector were recorded (Paradell, *et al*., 2024). However, records for this species are available from the ObSERVE Programme for 2026 (Rogan *et al* 2018b) within sector 7, which includes the MUL area (prior to further divisions of this sector). The IAMMWG also defines the CGNS MU for Risso's dolphin (IAMMWG, 2015). The MU has a total abundance of 12,262 animals (IAMMWG, 2021).

Common Dolphin and Stiped Dolphin

The ObSERVE aerial surveys in 2021 and 2022 considered two species under a single category defined as "Small delphinids", these were common dolphins (*Delphinus delphis*) and striped dolphins (*Stenella coeruleoalba*). Common dolphins were the most sighted cetacean species across all survey seasons. In total, 812 sightings comprising 5,725 individuals occurred across the survey area in 2021 and 2022. Common

dolphin occurrence showed interannual variability, with considerably more sightings in Summer 2021 than in 2022.

Striped dolphins occurred primarily in deep waters of the Rockall and the Porcupine Basins, and sporadically in the Celtic Basin. A total of 11 sightings comprising 109 individuals were recorded in Summer 2021 and 2022. Striped dolphins were only seen in Summer across both survey years. There were insufficient sightings to generate abundance estimates or density distributions for the survey area for this species.

For stratum 6b, which includes the MUL area, the summer 2021 corrected density for Common dolphin was found to be 3.370 animals per km2. In 2022 the corrected density was found to be 1.375 animals per km2 in summer and 0.729 animals per km2 in winter (Paradell, *et al*., 2024).

Minke whale

Minke whale, the most frequently sighted mysticete species in Irish waters, mostly inhabit continental shelf waters in depths of less than 200 m and can often be seen close to land (Reid *et al*., 2003; Hammond *et al*., 2013). In Irish waters, the species is most abundant off the southwest coast of Ireland and localised patches in the Irish Sea, and in lower concentrations northwards towards the Isle of Man and Dublin Bay (Baines and Evans, 2012; Hammond *et al*., 2013). Minke whale have a temporal distribution, exhibiting seasonal migrations from polar feeding grounds to warm tropical breeding grounds, and are mainly sighted in Irish waters in summer months, with few sightings in winter (Baines and Evans, 2012). The IWDG cetacean sightings review found that the number of sightings around Irish waters start to increase in April and May, peaking in August, and tapering off in late autumn and early winter (Berrow *et a*l., 2010).The ObSERVE aerial surveys in 2021 and 2022 showed interannual variation was shown between Summer 2021 and Summer 2022 from both the model and design-based estimates, with Summer 2021 twice the estimate from Summer 2022. The IAMMWG also defines the CGNS MU for minke whale (IAMMWG, 2015), with this MU having a total abundance of 20,118 animals (IAMMWG, 2021).

For stratum 6b, which includes the MUL area, the summer 2021 corrected density was found to be 0.076 animals per km2. In 2022 the corrected density was found to be 0.029 animals per km2 in summer, with no winter estimates possible due to the low number of sightings. (Paradell, *et al*., 2024).

Fin Whale

Fin whale are relatively common in the northeast Atlantic and are frequently observed in offshore waters along the western seaboard of Ireland. An estimated 300 – 500 fin whale pass through offshore Irish waters each year (Charif and Clark, 2009). Although fin whale appear to prefer deeper waters, they have been sighted off headlands along the south and southwest coasts of Ireland (Whooley, 2016). Sightings suggest seasonal movements, and fin whale are recorded from May through to December in inshore waters. Sightings also suggest an eastward movement along the south coast during late autumn and winter, likely driven by prey movements (primarily herring and sprat Sprattus spp.) The ObSERVE surveys recorded 15 sightings comprising 15 individuals throughout the 2021/2022 aerial surveys. Fin whales were exclusively seen in strata 1 to 4, with the majority of sightings occurring beyond the continental slope in waters >500m, particularly in the Porcupine Basin. Fin whales were seen in all seasons, although the highest number of sightings occurred in Summer 2021 and Winter 2022.

No sightings for stratum 6b were recorded Due to low number of sightings, no model-based abundance estimates or predicted density distribution maps were generated for this species. (Paradell, *et al*., 2024).

Unidentified large whale

The ObSERVE surveys recorded several sightings of whales > 10 metres in length which were classified as unidentified large whale if the species could not be determined. This category could comprise any of the mysticete species and sperm whale. Overall, there were three sightings comprising three individuals, two in Summer 2021 and one in Winter 2022 none of which were in sector 6B. Sightings of unidentified large whale were exclusively recorded in continental slope waters of the Porcupine Basin (Paradell, *et al*., 2024).

4.2 Otter

Coastal otters are known to utilise the marine habitat for foraging, feeding on a variety of fish and shellfish species depending on the time of year. While there are no records for Otter (*Lutra lutra*) within the MUL area as documented in the National Biodiversity Data Centre database, records for otter occur in adjacent terrestrial areas along the Clare coast (NBDC, 2025). Therefore it is considered that this species is likely to use the intertidal and nearshore (<300m) in the areas of Doughmore Bay and Doonbeg Bay, adjacent to the MUL area, where freshwater enters the marine areas within these bays.

4.3 Reptiles (marine turtles)

Leathery Turtle (*Dermochelys coriacea*) are recorded occasionally from around the entire coast of Ireland. There are occasional live sightings of Leathery Turtle in the area to the north and south of Doughmore Bay within the MUL area. However all of these records are over 40 years old (NBDC, 2025).

4.4 Bats

All bat species in Ireland are listed in Annex IV of the EU Habitats Directive. These include:

- Common pipistrelle (*Pipistrellus pipistrellus*)
- Soprano pipistrelle (*Pipistrellus pygmaeus*)
- Nathusius' pipistrelle (*Pipistrellus nathusii*)
- Leisler's bat (*Nyctalus leisleri*)
- Brown long-eared bat (*Plecotus auritus*)
- Daubenton's bat (*Myotis daubentonii*)
- Whiskered bat (*Myotis mystacinus*)
- Natterer's bat (*Myotis nattereri*)
- Lesser horseshoe bat (*Rhinolophus hipposideros*)

A search of the Biodiversity data Centre database indicated records for Common pipistrelle, Soprano pipistrelle and Leisler's bat for the area near the bridge over the Doonbeg river, 2.2km southeast of the nearest boundary of the MUL area. These species are likely foraging in the area surrounding the bridge where suitable habitat is present. There are no records for the other species of bat recorded for Ireland along the west coast of Clare within 5km of the MUL area.

While bats are classed as terrestrial mammals, some evidence suggests they may follow prey insects into coastal water depending on the prevailing weather conditions. Recent evidence also notes that bats can migrate considerable distances over open marine waters (Bach *et al,* 2022). However, it is considered highly unlikely they would make use of the proposed MUL area for foraging due to its highly exposed nature.

5. Risk assessment

5.1 Cetaceans

The effects of underwater noise on marine mammals can lead to disturbance, harm or injury depending on the type and frequency of the noise and distance of the receptor.

Cetacean sensory systems are adapted to life in the water. They rely on sound to navigate, to communicate with one another and to sense and interpret their surroundings. Behavioural responses of marine mammals, including cetaceans, to a sound are known to be strongly influenced by the context of the event and individual factors such as the animal's experience, motivation, conditioning and activity (Southall *et al*, 2007). Such features and variability may also require consideration in the case-specific assessment of impact on marine mammals from introduced sound sources (DAHG, 2014). Sound waves dissipate through the water with distance from the source. While local oceanographic conditions affect the path of the sound and its transmission.

Depending on the exposure levels from underwater noise, auditory injury to marine mammals can occur. This may result in temporary loss in hearing sensitivity, known as Temporary Threshold Shift (TTS) or more permanent damage, known as Permanent Threshold Shift (PTS). The potential for auditory injury is related to the noise frequency relative to the hearing bandwidth of the marine mammal, and is also influenced by the duration of exposure. The level of impact on an individual is a function of the Sound Exposure Level (SEL) that an individual receives as a result of underwater noise.

Table 5 details the various functional groups relative to hearing for the majority of cetaceans encountered in Irish waters.

Table 5. Cetacean functional groups relative to hearing at different sound frequencies.

Low frequency 7 Hz-22 kHz	**Mid-frequency** 150 Hz-160 kHz	**High frequency** 200 Hz–180 kHz
Baleen whales	Most toothed whales, dolphins	Certain toothed whales, porpoise
Species- Ireland	**Species– Ireland**	**Species– Ireland**
Humpback whale	Sperm whale	Pygmy sperm whale
Blue whale	Killer whale	Harbour porpoise
Fin whale	Long-finned pilot whale	
Sei whale	Beaked whale species	
Minke whale	Dolphin species	

After: DAHG (2014). Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters.

Southall *et al* (2007) described the sound pressure levels associated with the various functional groups as detailed in **Table 5** above. Southall *et al,* (2019) has recategorised these functional hearing groups and proposed revised criteria for the onset of TTS and PTS as given in Table 6.

Table 6. Sound pressure levels associated with TTS and PTS (Southhall *et al* (2019)

Functional group	**Impulsive**		**Non-impulsive**
	Unweighted SPLpeak(dB re 1 µPa)	Weighted SELcum (dB re 1 µPa)	Weighted SELcum (dB re 1 µPa)
	PTS		
Low frequency cetaceans	219	183	199
High frequency cetaceans	220	185	198
Very High frequency cetaceans	202	155	173
Pinnipeds (in water)	218	185	201
	TTS		
Low frequency cetaceans	213	168	179
High frequency cetaceans	224	170	178
Very High frequency cetaceans	196	140	153
Pinnipeds (in water)	212	170	181

A noise modelling and environmental risk assessment (Thomsen *et al*, 2023) was carried out for the use of a sparker and mini-air gun of the same, or similar, specification to that proposed for the Saoirse wave energy project. The results of the study (Table 7) demonstrated that the use of the proposed sparker would have a limited area of impact on minke whales, and therefore other marine mammals with a functional hearing range that includes all or part of the frequency range emitted by the sparker (e.g. other baleen whale species, Bottlenose dolphin and Harbour porpoise). The results of the study also demonstrated that the impact distance from source would be a maximum of 1.1km relative to a behavioural response and 0.9km relative to cumulative TTS.

With regard to the use of the mini-airgun, the results (Table 8) demonstrated that area of impact would increase to 1.9km relative to behavioural response and 2.9km relative to cumulative TTS with an impact area of 19.7km.

The proposed use of MBES, SSS, SBP and USBL will emit noise at the levels given in Table 3.

Table 7. Threshold distances and impact areas obtained for the minke whale, resulting from operation of sparker in the study area. (from Thomsen et al, 2023).

Impact on minke whales when the sparker is on operation			
Noise effect	**Average distance all transects [km]**	**Max. distance [km]**	**Impact area [km²]**
Behavioural response	0.9	1.1	2.7
TTS single strike	0.1	0.1	0.03
TTS cumulative	0.9	1.1	2.5
PTS single strike	0.1	0.1	0.03
PTS cumulative	0.2	0.2	0.12

Table 8. Threshold distances and impact areas obtained for the minke whale, resulting from operation of mini airgun in the study area. (from Thomsen et al, 2023).

Impact on minke whales when the mini airgun is on operation			
Noise effect	**Average distance all transects [km]**	**Max. distance [km]**	**Impact area [km²]**
Behavioural response	1.4	1.9	6.3
TTS single strike	0.1	0.1	0.03
TTS cumulative	2.5	2.9	19.7
PTS single strike	0.1	0.1	0.03
PTS cumulative	0.3	0.3	0.3

5.2 Otter

Otter hearing is not adapted for life underwater however, one study did record behavioural responses in otters in experimental trials. While otters utilise the marine environment for foraging, they would not be impacted by the site investigation surveys for the proposed project as they are known to forage close inshore, generally less than 100m. Although records for otter 2-300m from shore have been recorded in the UK this is considered to be an unusual occurrence. A search of the Biodiversity Data centre database indicated occasional records for otter at the mouth of the Doonbeg River in Doonbeg Bay and Creegh River within Doughmore Bay. It is likely these otters are foraging in the nearshore waters of both of these bays.

Vessel activities will not be within 100m of the shore. Therefore, it is considered that otters would not be effected by vessel related survey activities as otter foraging habitat would generally be closer to shore.

Personnel on foot, will be required to conduct surveys within the intertidal area. However, this area is frequently used for recreational activities and the addition of 1-2 surveyors working on to intertidal area over the coarse of 3-6 days to conduct the required surveys would not expose this area to more disturbance than normal. Therefore impacts on otters would be highly unlikely.

5.3 Reptiles (marine turtles)

Relative to the scale and scope of the project and very low (historic) recorded marine reptiles (marine turtles) sightings in the MUL area, impacts on marine reptiles are considered highly unlikely.

5.4 Bats

Vessel based acoustic surveys and intertidal survey work does not have the potential to impact bats, their habitats or roost sites in any way.

6. Conclusion

Based on the results of the noise modelling (Thomsen *et al*, 2023), and taking a worst case scenario for the use of the mini air gun and sparker and additional noise generating equipment proposed, the proposed geophysical and geotechnical site investigation surveys have the potential to lead to behavioural responses and TTS to a range of cetaceans should they be present within 1.9 to 2.9km of the MUL area when the mini airgun is being used and a lesser (0.9-1.1km) distance when the sparker is being used. Based on the review of the receiving environment (section 4) the species included with potential for impact are:

- Minke whale (*Balaenoptera acutorostrata*)
- Humpback whale (*Megaptera novaeangliae*)
- Bottlenose dolphin (*Tursiops truncates*)
- Common dolphin (*Delphinus delphis*)
- Harbour porpoise (*Phocoena phocoena*)
- Potentially other cetacean species known to occur in Irish waters

No potential for disturbance or injury to any additional Annex IV species has been identified.

Article 12 of the EU Habitats Directive requires member states to take requisite measures to prohibit "deliberate disturbance of these [Annex IV] species, particularly during the period of breeding, rearing, hibernation and migration". While the range of potential impact is relatively small (2.9km maximum distance) it is nonetheless considered that, based on the precautionary principle, mitigation to avoid disturbance to the aforementioned species should be implemented should the proposed project proceed. Impacts on any additional Annex IV species known to occur in Ireland are considered highly unlikely.

8. Assessment of residual risk

Provided the mitigation proposed in section 9 of this document is implemented in full no residual risk is considered possible.

9. Proposed mitigation

DAHG (2014) provides guidance to manage the risk to marine mammals from man-made sound sources in Irish waters. This document provides guidance and mitigation measures to address key potential sources of anthropogenic sound that may impact negatively on marine mammals in Irish waters. The mitigation methods should follow the guidance prescribed in this document. In relation to geophysical and geotechnical surveys, which have the potential to introduce noise into the marine environment, such as proposed in this project, the guidance set out, as stated below, should be fully implemented.

1. A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms (Appendix 6, NPWS, 2014).
2. Unless information specific to the location and/or plan/project is otherwise available to inform the mitigation process (e.g., specific sound propagation and/or attenuation data) and a distance modification has been agreed with the Regulatory Authority, acoustic surveying using the above equipment shall not commence if marine mammals are detected within a 500m radial distance of the sound source intended for use, i.e., within the Monitored Zone.

Pre-Start Monitoring

3. Sound-producing activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.
4. An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.
5. In waters up to 200m deep, the MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO.
6. This prescribed Pre-Start Monitoring shall subsequently be followed by a Ramp-Up Procedure which should include continued monitoring by the MMO.

Ramp-up Procedure

7. In commencing an acoustic survey operation using the proposed acoustic equipment, the following Ramp-up Procedure (i.e., "soft-start") must be used, including during any testing of acoustic sources, where the output peak sound pressure level from any source exceeds 170 dB re: 1µPa @1m:
   (a) Where it is possible according to the operational parameters of the equipment concerned, the device's acoustic energy output shall commence from a lower energy start-up (i.e., a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20 minutes.
   (b) This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period.
   (c) Where the acoustic output measures outlined in steps (a) and (b) are not possible according to the operational parameters of any such equipment, the device shall be switched "on" and "off" in a consistent sequential manner over a period of 20 minutes prior to commencement of the full necessary output.
8. In all cases where a Ramp-Up Procedure is employed the delay between the end of ramp-up and the necessary full output must be minimised to prevent unnecessary high-level sound introduction into the environment.

9. Once the Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source, i.e., within the Monitored Zone.

Line Changes

10. Where the duration of a survey line or station change will be greater than 40 minutes the activity shall, on completion of the line/station being surveyed, either

(a) shut down and undertake full Pre-Start Monitoring, followed by a Ramp-Up Procedure for recommencement, or

(b) undergo a major reduction in seismic energy output to a lower energy state[1] where the output peak sound pressure level from any operating source is 165-170 dB re: 1µPa @1m, and then undertake a full Ramp-Up Procedure for recommencement.

11. Where the duration of a survey line or station change will be less than 40 minutes the activity may continue as normal (i.e., under full seismic output)

Breaks in sound output

12. If there is a break in sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down, survey line or station change) then all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) must be undertaken.

13. For higher output survey operations which have the potential to produce injurious levels of underwater sound (see sections 2.4, 3.2) as informed by the associated risk assessment, there is likely to be a regulatory requirement to adopt a shorter 5–10-minute break limit after which period all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) shall recommence as for start-up.

Reporting

14. Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority as outlined in Appendix 6 of NPWS (2014).

[1] *It is important that this significant reduction in sound output is to a minimum point (i.e., minimum peak sound pressure level) that in theory remains audible above most ambient sound and shipping noise and yet is also consistent with the Ramp-up Procedure.*

10. References

Bat Conservation Ireland: Species distribution and account. Accessed 5/3/2025. Available at https://www.batconservationireland.org/irish-bats/species.

Bach, P., Voigt, C.C., Göttsche, M., Bach, L., Brust, V., Hill, R., Lagerveld, O.H.S., Schmaljohann, H. and Seebens-Hoyer, A. (2022). Offshore and coastline migration of radio-tagged Nathisius' pipistrelles. Conservation Science and Practice. Volume 4, Issue 10.

Baines, M. E. and P. G. H. Evans (2012) Atlas of the of Wales. CCW Monitoring Report No. 68. 2nd Edition. 139pp.

Berrow, S., Whoooley, P., Firth, L. and A. Knights (2010) Review of inshore monitoring programme. Irish Whale and Dolphin Group.

Berrow, S. (2016) Risso's Dolphin (Grampus griseus) Pp 169 – 170. In Lysacht, L. and Marnell, F. (Eds) (2016) Atlas of Mammals in Ireland 2010 – 2015, National Biodiversity Centre, Waterford.

Berrow, S.D., O'Brien, J., Meade, R., Delarue, J., Kowarski, K., Martin, B., Moloney, J., Wall, D., Gillespie, D., Leaper, R., Gordon, J., Lee, A. and Porter, L. (2018) Acoustic Surveys of Cetaceans in the Irish Atlantic Margin in 2015–2016: Occurrence, distribution and abundance. Department of Communications, Climate Action & Environment and the National Parks and Wildlife Service (NPWS), Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland, 348pp.

Charif, R. A. and C. W. Clark (2009) Acoustic monitoring of large whales in deep waters north and west of British Isles: 1996-2005 Preliminary Report. Cornell University, New York.

DHLGH (2021). Guidance on the Strict Protection of Certain Animal and Plant Species under the Habitats Directive in Ireland. National Parks and Wildlife Service Guidance Series. Department of Housing, Local Government and Heritage

Hammond, P.S., Macleod, K., Berggren, P., Borchers, D.L., Burt, L., Cañadas, A., Desportes, G., Donovan, G.P., Gilles, A., Gillespie, D. and Gordon, J., (2013) Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. Biological Conservation, 164, pp.107-122.

IAMWWG (2015) Management Units for cetaceans in UK waters (January 2015) Jncc Report No. 547, JNCC Peterborough.

IAMMWG (2021). Updated abundance estimates for cetacean Management Units in UK waters. JNCC Report No. 680, JNCC Peterborough.

National Biodiversity Data Centre, Ireland. Accessed 5/3/2025. Available at: https://maps.biodiversityireland.ie/species.

NPWS (National Parks and Wildlife Service) (2019) The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill.

Oudejans, M., Ingram, S., Englund, A., Visser, F. and Rogan, E. (2010) Bottlenose dolphins in Connemara and Mayo 2008---2009. Movement patterns between two coastal areas in the west of Ireland. Report to The National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government. 29pp.

Giralt Paradell, O., Cañadas, A., Bennison, A., Todd, N., Jessopp, M., Rogan, E. (2024). Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2021-2023. Department of the Environment, Climate & Communications and Department of Housing, Local Government & Heritage, Ireland. 260pp

Rogan, E., Garagouni, M., NykÃ¤nen, M., Whitaker, A. and Ingram, S. (2018) Bottlenose dolphin survey in the Lower River Shannon SAC, 2018. Report to the National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs. University College Cork. 19pp.

Rogan, E., Breen, P., Mackey, M., Cañadas, A., Scheidat, M., Geelhoed, S. and Jessopp, M. (2018b) Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017. Department of Communications, Climate Action & Environment and National Parks and Wildlife Service (NPWS), Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland. 297pp.

Santos, M.B., and Pierce, G.J. (2003) The diet of harbour porpoise (Phocoena phocoena) in the Northeast Atlantic. Oceanography and Marine Biology: an Annual Review 2003.

Santos, M. B., Pierce, G. J., Reid, R. J., Patterson, I. A. P., Ross, H. M., and Mente, E. (2001) Stomach contents of bottlenose dolphins (Tursiops truncatus) in Scottish waters. Journal of the Marine Biological Association of the United Kingdom, 81(5), 873-878.

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, B., Finneran, J., Reichmuth, C., Nachtigall, P., Ketten, D., Bowles, A., Ellison. W., Nowacek, D., Tyack, P. (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.

Thomsen, F., Ram, M., Chreptowicz, M., Nocoń, M., & Balicka, I. (2023) Noise modelling and environmental risk assessment of a geophysical survey and its impact on herring and minke whales in Irish coastal waters. Marine Institute, Galway. http://hdl.handle.net/10793/1872.

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., Berrow, S. (2013) Atlas of the distribution and relative abundance of in Irish offshore waters 2005 – 2011. Irish Whale and Dolphin Group, Kilrush, Co. Clare, 63pp.

Whooley, P. (2016) Fin Whale (Balaenoptera physalus) Pp 131 – 132. In Lysacht, L. and Marnell, F. (Eds) (2016) Atlas of Mammals in Ireland 2010 – 2015, National Biodiversity Centre, Waterford.