Fuinneamh Sceirde Teoranta

Sceirde Rocks Offshore Wind Farm Foreshore Licence Application

Report to Inform AA Screening

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1 Introduction

Green Investment Group Ltd (GIG) are the new owners of Fuinneamh Sceirde Teoranta (FST) and are progressing the development of the Sceirde Rocks Offshore Wind Farm.

Xodus Group Ltd (Xodus) has prepared this report on behalf of FST in support of an application for a Foreshore Licence under Section 3 of the Foreshore Act 1933, as amended, to carry out a site investigation campaign within the Foreshore Licence Area of the Sceirde Rocks Offshore Wind Farm. The Foreshore Licence Area of Sceirde Rocks Offshore Wind Farm is set out and described in Figure 1 and Figure 2 below.

1.1 Background and Objectives

This report is part of the Foreshore Licence Application to the Foreshore Section of the Department of Housing, Local Government and Heritage (DHLGH) and includes information to support the Minister undertaking Appropriate Assessment Screening as required under the European Communities (Birds and Natural Habitats) Regulations 2011 to 2021 (the "Habitats Regulations"), to ensure compliance with the Habitats Directive (92/43/EEC).

This report provides the necessary information to the competent authority to enable the Minister to determine the potential for likely significant effect from the proposed site investigation activities on the Special Protection Areas, Special Areas of Conservation and their designated Annex I and Annex II features during the proposed site investigation surveys at Sceirde Rocks Offshore Wind Farm.

In line with these requirements, this Report to inform Appropriate Assessment Screening presents a screening assessment of the proposed Sceirde Rocks Offshore Wind Farm site investigation activities (as applied for in this Foreshore Licence Application) in accordance with the requirements of Regulation 42 of the Habitats Regulations. Its purpose is to assist the competent authority to determine whether, in view of best scientific knowledge, there is potential for the site investigations, individually or in combination with another plan or project, to have a Likely Significant Effect (LSE) on a European site (i.e. SAC or SPA, including draft, candidate and proposed sites).

European Community (EC) Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna, commonly known as the Habitats Directive, affords protection to habitats and species of community interest through the designation of a European Union (EU)-wide network of protected sites known collectively as European sites. These sites are Special Areas of Conservation (SAC) designated under the Habitats Directive and Special Protection Areas (SPA) designated under the Birds Directive (Directive 2009/147/EC).

Under Article 6(3) of the Habitats Directive, 'any plan or project which is not directly connected with or necessary to the management of a European site but would be likely to have a significant effect on such a site, either individually or in-combination with other plans and projects, shall be subject to an appropriate assessment of its implications for the European site in view of the site's conservation objectives.' The requirement for Appropriate Assessment was transposed into Irish law inter alia by European Communities (Birds and Natural Habitats) Regulations 2011 to 2021.).

For those sites where it cannot be concluded that there will be no LSE, the Minister for Housing, Local Government and Heritage is required to carry out an Appropriate Assessment of the site investigations to ascertain whether or not they would have an adverse effect on the integrity of a European site. Such an Appropriate Assessment would be informed by information provided in a Natura Impact Statement (NIS).

Further information addressing the specific requirements of the Habitats Directive and the European Communities (Birds and Natural Habitats) Regulations 2011 to 2021 is provided in Section 3 of this report.

1.2 Foreshore Licence Area

This Foreshore Licence Application seeks consent to conduct site investigation activities for the Sceirde Rocks Offshore Wind Farm located approximately 5km off the west coast of Ireland (off the coast of county Galway). Following completion of the site investigations, it is the intention of FST that an application to construct the Sceirde Rocks Offshore Wind Farm will be submitted under 1wthe Maritime Area Planning (MAP) Act 2021.

This Foreshore Licence Application covers the wind farm array area of the Sceirde Rocks Offshore Wind Farm. The Investigative Foreshore Licence Area relevant site area measures 141 km^2.

Figure 1 Foreshore Licence Area

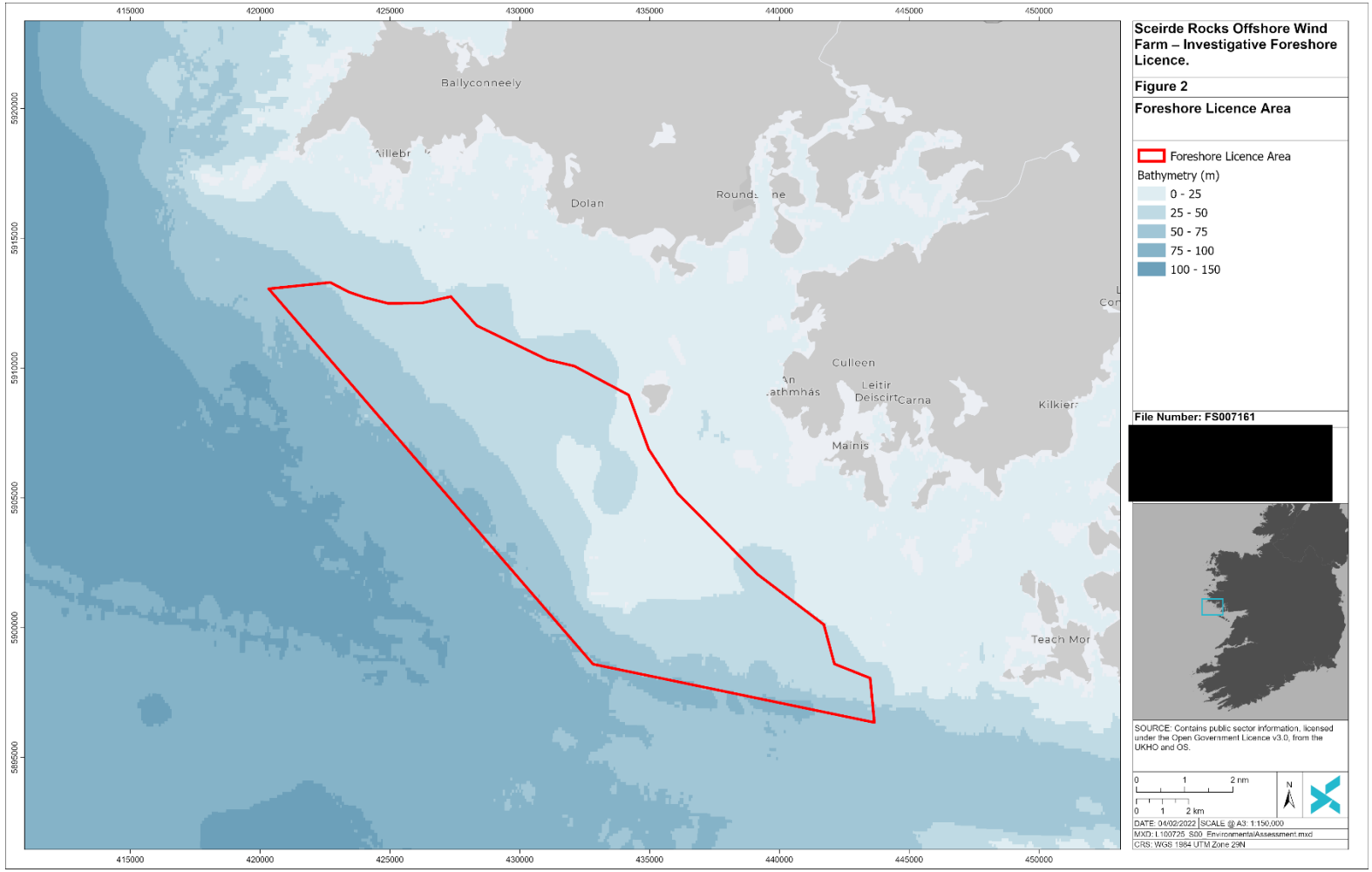

Figure 2 Foreshore Licence Area

1.3 Site Investigation Activities

The objective of the proposed Sceirde Rocks Offshore Wind Farm survey campaign is to determine geotechnical, geophysical, metocean, wind resource and benthic characteristics within the Foreshore Licence Area. The data obtained will provide a greater and more detailed understanding of the existing seabed and sub-seabed conditions within the Foreshore Licence Area. The obtained data and subsequent analysis will be used to engage with stakeholders, inform the design of Sceirde Rocks Offshore Wind Farm and begin the process of preparing the Environmental Impact Assessment Report and the Natura Impact Statement for the Project.

Full details of the scope and methodologies for each type of survey can be found in Section 2. A summary of the proposed surveys is given below in The information provided in this report is based on the equipment required and activities undertaken during the site investigations.

Table 1-1. Following a decision to grant the foreshore licence, it is the intention that surveys will commence as soon as practicably possible with a staged programme of site investigations taking account of suitable weather conditions. It is currently anticipated that surveys will begin in late 2022 or early 2023. It is possible that the investigations may be undertaken simultaneously and this is considered in the assessment provided in Section 4.

The information provided in this report is based on the equipment required and activities undertaken during the site investigations.

Table 1-1 Summary of proposed site investigations

Survey	Methods	Purpose and scope
Geotechnical	Borehole Sampling	Provide geotechnical data to aid with preliminary engineering, foundation design and array layout. Up to 60No. boreholes will be required using Cable Percussive Sampling and/or Rotary Coring techniques (depth of borehole will not exceed 70m).
	Down-hole Acoustic Imaging	Imaging of rock structure within boreholes to determine the nature, orientation and spacing of rock discontinuities and assess zones of core loss.
	Shallow sampling	Shallow sampling (60No. locations) may be used to determine the near surface sediment properties. This could utilise a combination of grab samples, Vibrocores, and gravity cores. These techniques would range from 0.5 to 6m penetration and would extract a shallow sample for further lab testing and visual descriptions.
	Cone Penetration Tests (CPT)	CPTs are used to derive in-situ geotechnical parameters. CPTs will be targeting Quaternary and pre-Quaternary sediments, where present. Up to 60No. CPT locations using Seafloor CPT methodology.
Preliminary bathymetric	Contiguous acquisitions	Multi-sensor survey to include some of the following: multibeam echosounder (MBES), side scan sonar (SSS), magnetometer, sub-

Survey	Methods	Purpose and scope
and geophysical		bottom profiler (SBP) and a seismic survey using Ultra High Resolution Seismic (Boomer/Sparker).
Metocean	Metocean measurement devices (e.g. Wave buoys)	Up to three metocean measurement devices (for example, wave buoys may be deployed at three different locations covering an extreme case and a site representative case to define wave height and direction).
Wind resource	Floating LiDAR Buoy	Floating LiDAR used to measure the wind resource within the Foreshore Licence Area. Up to two measurement locations considered due to the size of the area.
Benthic Ecology	Drop Down Video/Camera	Drop down video surveys provide visual data on environment epibiota and sediment type, this will be used to provide an overview of the seabed habitat. In addition, dive surveys may be required where a potential reef environment is identified.
	Water Sampling	Used to provide data on suspended sediment concentrations within the water column. This information will be used to inform decisions regarding coastal processes and sediment dynamics assessment. Data will be collected throughout the water column and over different tidal cycles
	Grab Sampling	Used to investigate sediment habitat types and determine physico-chemical characteristics (such as organic content and particle size) and macro-faunal analysis. Grab sampling conducted using 0.1 m^2 day grabs. Up to 40 grab sample stations (using day grab or van Veen grab) will be acquired across the site

1.4 Structure of report

This Report to Inform Appropriate Assessment Screening is presented in the following sections:

Section 1	*Introduction* – provides a background to the Sceirde Rocks Offshore Wind Farm Foreshore Licence Application and the purpose of this report.
Section 2	*Site Investigation Description* – describes the activities of the proposed site investigations.
Section 3	*Approach to Meeting the Requirements of the Habitats Regulations and Habitats Directive* – describes the requirements of the Habitats Directive and the relevant Irish transposing legislation with respect to the site investigations and describes the methodology used.
Section 4	*Appropriate Assessment Screening:* describes the environmental baseline in the context of protected sites, and identifies whether, in view of best scientific knowledge and in view of the conservation objectives of the relevant sites, the site investigation activities individually or in combination with another plan or project are likely to have a significant effect on a European site.
Section 5	*Conclusions*
Section 6	*References*
Appendix A	*Details of SACs determined to have connectivity with the Foreshore Licence Area and site investigations and evaluated in the Appropriate Assessment Screening*

2 PROPOSED SITE INVESTIGATIONS

2.1 Geotechnical Site Investigations

It is currently proposed that geotechnical surveys are phased to account for uncertainty and to allow the preliminary investigation to inform future surveys. Phasing will consist of:

- A preliminary investigation for general ground conditions and potential hazard assessment;
- A main investigation for specific ground conditions; and
- An infill survey covering additional locations or to investigate newly identified hazards.

A foreshore license with a timeline of 5 years. is being requested to allow phases of survey activity. This phasing is the industry accepted approach to obtaining geotechnical data. It is likely that the main investigation and infill survey phases will be undertaken over several years as the data requirements for the project evolves.

The primary objectives of the geotechnical investigations are to inform the project engineering, consenting requirements and generally reduce project uncertainty with respect to site characterisation. The data collected through these surveys will facilitate decision making on engineering, foundation design and array layout optioneering.

During the geotechnical investigations, included in this foreshore licence application, the following methods (described below in Section 2.1.1, Section 2.1.2 and Section 2.1.4) will be used in collaboration to ensure that a comprehensive understanding of the subsurface environment of the Foreshore Licence Area is obtained.

The preliminary geotechnical sampling may comprise:

- Up to 60No. boreholes, which may include cable percussive or rotary coring techniques, for example. The borehole depths will not exceed 70m;
- Up to 60No. seafloor CPTs undertaken across the site; and
- Shallow sampling (potentially using Vibrocore techniques at up to 60 locations).

Final borehole locations within the Foreshore Licence Area will be confirmed following appointment of a suitable qualified survey contractor. Borehole locations will be chosen to obtain site-wide coverage and will be determined based on the best locations to help define geological boundaries and obtain samples in all the anticipated geological units. Final borehole locations and CPT locations can be provided to the Department of Housing, Local Government and Heritage prior to survey mobilisation if requested.

2.1.1 Borehole Sampling

The geotechnical surveys will be performed at various water depths by either a Dynamic Positioning (DP) controlled and heave-compensated drillship, a Jack-up vessel, or by means of seabed drilling equipment.

Vessels will be fully equipped with ultra-short baseline (USBL) system for accurate positioning of boreholes. Vessel selection will depend on the water depth, environmental conditions and seabed soils. At this stage, the potential for challenging seabed conditions means that a jack up vessel may be required. The survey methodology will comprise a combination of drilling techniques, such as cable percussive drilling, with follow-on rotary coring techniques. The boreholes will provide in-situ information on sediment and rock type and distribution and provide samples for laboratory testing. The data collection will support decision making on engineering, foundation design and array layout optioneering.

2.1.1.1 Cable Percussive Drilling

Cable percussive drilling is one drilling technique to target seabed and sub-seabed sediments which overlie rock. This includes coarse-grained sediments such as sand and gravel, and fine-grained sediments such as clay and silt. Casing will be utilised to stabilise the borehole walls through the superficial sediments.

Within coarse-grained sediments, percussive sampling, such as hammer samples, will be undertaken at regular intervals. In-situ standard penetration testing (SPT) will also be undertaken, generally alternating with percussive sampling. Bulk-disturbed and small-disturbed samples will be undertaken, where appropriate.

Within fine-grained sediments, hammer or push samples will be undertaken at regular intervals, alternating with SPT testing. Undisturbed, bulk disturbed and small disturbed samples are anticipated to be taken to enable a range of laboratory tests.

Samples will be appropriately preserved and stored prior to transportation to onshore laboratories for geotechnical testing. An offshore laboratory will also be provided on the vessel to enable classification and index testing to be undertaken, along with preliminary core and sample logging.

2.1.1.2 Rotary Coring Techniques

Rotary coring is anticipated to comprise double or triple-tubed coring depending on the nature of the rock. The drilling operations typically utilise a drilling fluid to help flush drill cuttings from the bore, cool the drill bit and generally aid drilling performance; drilling fluids are typically certified for offshore use and may comprise biodegradable, miscible guar gum, or similar, and seawater.

The retrieved core is anticipated to be approximately 100mm in diameter but may potentially be reduced to 70mm. The majority of the underlying rocks are anticipated to be high-strength granitoid rocks, with minor zones of limestone around the southern margin.

The extracted rock core will be photographed, logged and sub-sampled offshore. Samples will be appropriately preserved and stored prior to transportation to onshore laboratories for geotechnical testing. Classification and index testing of the rock to be undertaken in the offshore laboratory.

2.1.2 Down-hole Testing including Acoustic Imaging

It is anticipated that some level of down-hole testing may be undertaken which could include video imaging, acoustic imaging, dilatometer testing, etc... For example, the purpose of down-hole acoustic imaging is to provide an image of the rock structure to determine the nature, orientation and spacing of any rock discontinuities within the Foreshore Licence Application Site.

The process involves sending an acoustic imaging camera down the borehole, which takes a 360° image of the rock face. This can show features such as voids or fractures and can also give an indication of the orientation of discontinuities. This is important for understanding the in-situ fracture spacing and orientation of beds, which can then be used to develop three-dimensional models of the rock. The images can also be used to assess zones of core loss and adjust borehole logs accordingly.

Acoustic imaging requires a stable borehole and therefore requires casing through unstable surficial sediments and extension of casing to support deeper unstable zones. Acoustic imaging cannot be undertaken through the cased section of a borehole and therefore the strategy for performing the survey may require modification based on the general nature of the rock encountered.

2.1.3 Shallow Sampling (eg. Vibrocores)

Shallow sampling may be used to determine the near surface sediment properties. This could utilise a combination of grab samples, Vibrocores, and gravity cores for example. These techniques would range from 0.5 to 6m penetration and would extract a shallow sample for further lab testing and visual descriptions.

2.1.4 Cone Penetration Tests (CPT)

Seabed CPTs consist of a self-contained and automated CPT test unit, housed within a seabed frame and connected to the DP vessel via a lift wire and data transfer umbilical. The frame is kept on deck of the DP vessel and deployed over the side using a dedicated Launch Recovery System (LARS) or through a moonpool. Once positioned on the seafloor, the cone is pushed at a constant rate into the seabed until either target penetration is achieved or refusal reached. Refusal may be due to maximum thrust reached, excessive load experience on the tip or the sleeve, or excessive cone inclination.

The configuration of the CPT unit used for the preliminary survey will be defined by the target penetration depth. The maximum penetration depth anticipated for this Foreshore Licence Area is circa 50m, however final selection of the CPT unit will be determined on the basis of sediment thicknesses estimated from the geophysical survey data. This preliminary depth places this CPT site investigation within the category of deep seabed CPT testing, which would require a 20 to 25 tonne CPT unit. CPT testing to this sort of depth takes a few hours from unit deployment to recovery back on deck. Where the technical requirements are not met at a location, the CPT unit may be lifted a small distance from the seabed and repositioned horizontally so that another test can be attempted.

2.1.5 USBL Specification and Use

USBL systems are used to determine the position of subsea survey items, including Remotely Operated Vehicles (ROVs), towed devices, grab samplers, etc. This involves the emission of sound from a vessel-mounted transducer to a subsea transponder, thereby introducing sound into the marine environment. A USBL system consists of a transducer, which is mounted on the vessel and a transponder attached to the ROV. The transducer transmits acoustics through the water and the transponder sends a response which is detected by the transducer. The USBL calculates the bearing and time taken for the transmissions to be completed and thus the position of the subsea unit / sampling equipment is determined. These systems can either be used continuously or intermittently through the operation they are supporting.

The survey vessel will visit each individual borehole location in turn. Accurate positioning of the boreholes will be achieved using an ultra-short baseline (USBL) system. These systems include a transceiver which is mounted on the hull of the survey vessel and a transponder or beacon which will be mounted on the seabed frame during deployment. Transponders emit pulses of medium frequency sound. The peak sound pressure level (SPL) was estimated as 207 dB re 1 µPa at 1 m for the Kongsberg HiPap 500 (Austin *et al.*, 2012).

Transmissions are not continuous but consist of short 'chirps' with a duration that ranges from 3 to 40 milliseconds. Transponders will not emit any sound when on standby. For general positioning and when lowering the seabed frame, they will emit one chirp every five seconds. When required for precise positioning, they will emit one chirp every second. Use of the USBL and beacon is expected to take from a few minutes to 1.5 hours per station depending on the water depth. Once the seabed frame is on the seabed, stationary and a final fix has been recorded, the USBL will be turned off.

2.1.6 Coring Fluids and Discharges

Borehole coring may be conducted with seawater only, with no added chemicals. It is possible that coring fluids may be used when required. The most likely fluid in this case would be an organic, biodegradable, high performance water-based mud (HPWBM). Bentonite will also be carried onboard in case it is needed and this may sometimes be mixed with soda ash. All proposed coring fluid products are rated as PLONOR (posing little or no risk to the environment) and contain only OCNS Gold/Silver, E or D rated chemicals. Final details of the coring fluids to be used will be known upon appointment of the survey contractor.

Only minimal amounts of cuttings will be discharged because 80 - 90% of the core is recovered for analysis. Cuttings are discharged and will settle close to the seabed and are estimated to amount to <0.25 m^3 per borehole.

2.1.7 Summary

Activity	Activity time	Total number of SI locations	Total SI duration	Footprint per SI location [m^2]	Total SI footprint [m^2]	Affected area as a % of the foreshore license area
Borehole	48 – 96 hours per location	60	1 – 2 months over several phases over a 5 year window	1 – 2	60 – 120	8.5e-5%
Jack up vessel	-	60	-	20	1200	8.5e-4%
CPT	2 – 6 hours per location	60	1 – 2 months over several phases over a 5 year window	4-8	240-480	3.4e-4%
Shallow sampling	3 hours per location	60	1 – 2 months over several phases over a 5 year window	0.1	6	4.3e-6%

2.2 Geophysical Survey Investigations

The proposed geophysical survey programme involves a multi-disciplinary approach that is designed to acquire a full suite of data which includes a multibeam echosounder, side scan sonar, magnetometer, sub-bottom profiler and a seismic survey using a slightly higher energy source (only if sufficient depth data cannot be obtained using the sub-bottom profiler). The collected data will be used to better understand the water depths, topography and relief structure of the seabed and the subsurface structure, in particular the sub-surface stratigraphy, determining sediment strata and the elevation of competent bedrock. To inform the suitability of a cable corridor area, understanding the top ~5m is crucial. The process is non-intrusive and at no point will the equipment used make contact with the seafloor. The exact equipment to be used will be confirmed following a tender process to procure the site investigation contractor however the operating frequencies outlined in Table 2-3 represent the operating frequencies employed in site investigations for offshore wind.

The objectives of the geophysical survey shall be:

- To obtain up to date high-resolution water depth measurements across the site;
- To obtain information on the seabed surface (type, texture, variability, etc.) and in particular, to identify any seabed features that may be of interest to the overall project;
- Identify any shallow geohazards and man-made hazards (including but not limited to outcropping rock, boulders, shallow gas, wrecks, debris etc.);
- Determine the stratigraphy across the site and quantify the variability in the lateral and vertical extents to depths greater than foundation depth, if necessary;
- Identify the presence of bedrock within the site boundary and the thickness of the overburden deposits;
- Identify any magnetic anomalies;
- Identify marine habitat areas as the basis for a benthic survey to be carried out;
- Identify sensitive marine habitats which will need to be avoided during geotechnical and environmental sampling.
- Provide information for identification of archaeological targets.

During the geophysical investigations, included in this foreshore licence application, the following methods (described below in Sections 2.2.1, 2.2.2, 2.2.3, 2.2.4 and 2.2.5) will be used in collaboration to ensure that a comprehensive understanding of the subsurface environment of the Foreshore Licence Area is obtained.

2.2.1 Multibeam Echosounder (MBES)

A Multibeam Echosounder (MBES) system will be used to provide detailed bathymetric mapping throughout the survey area.

MBES dual head system will be hull mounted. The exact equipment used will be confirmed following the appointment of a survey contractor. The R2 Sonic 2024 or the Kongsberg EM2040 may be taken as an example (Plate 1). Operating frequencies for offshore wind are in the regions of 200kHz (minimum) and can be up to 700kHz.

MBES is non-intrusive therefore does not interact with the sea floor. MBES may be undertaken across the site to a suitable percentage coverage.

Plate 1 Echosounder (EM2040)

2.2.2 Side Scan Sonar (SSS)

Side Scan Sonar (SSS) is a towed sensor which is towed behind the vessel on an armoured tow cable, although some models can be pole mounted on the side of the vessel. SSS will be a dual frequency hydrographic sonar used to produce seabed imagery. A Side Scan Sonar (SSS) system will be used to provide detailed imagery of the seabed throughout the survey area which will aid with seafloor sediment/bedrock and geomorphology mapping as well as for identifying any shallow geohazards.

Side scan systems are available from a number of manufacturers. These units vary in size, working and technical characteristics and acquisition configuration (towed or vessel mounted). Presently, dual frequency digital systems are available in the market which allows more survey flexibility; some systems can acquire and record both frequencies swaths independently and simultaneously. Using these systems, operator may use a higher frequency to produce sharper images and narrow swath or use the lower frequencies to obtain wider seabed coverage at lower resolutions. The exact equipment used will be confirmed following the appointment of a survey contractor. The operating frequency range for offshore wind purposes is between 300 to 900 kHz.

The system will be adequate to the depth range of the study area and the seabed discrimination level required. The design of transects will consider the geographic and depth extent of the study area, seabed coverage ratio, overlap coverage desired, priority areas to survey, prevailing winds and currents, etc. Often, the complete coverage of the seabed is the ultimate goal of an acoustic survey design, to enable the creation of full mosaics. In these cases, theoretically, parallel transects should be run to produce up to 100% ensonification of the seafloor. When complete coverage is not necessary to define seabed boundaries, consecutive swaths may not overlap can be adequate. However, in some cases, transect spacing of is less than the swath width can provide reasonable overlapping to compensate any loss in data quality at the outer range limits. This is very dependable on metocean conditions and the survey will be planned accordingly by an experienced survey team.

SSS is non-intrusive therefore does not interact with the seafloor. SSS may be undertaken across the site to a suitable percentage coverage.

Plate 2 Example of a Towable Side Scan Sonar Data Device (EdgeTech)

2.2.3 Magnetometer

A magnetometer is a passive device that is towed behind a survey vessel. It is used to detect ferrous objects on the surface or in the subsurface. Magnetometer surveys are widely used prior to intrusive works to highlight any obstruction or potential risk such as existing infrastructure, shipwrecks and unexploded ordnance.

The vessel will tow a submerged pod (Magnetometer) piggy-backed to the side scan sonar. The exact equipment used will be confirmed following the appointment of a survey contractor. The marine magnetometer will be of the Caesium Vapour type and capable of recording variations in magnetic field strength during survey to an accuracy of ±0.5nT.

A Magnetometer is non-intrusive therefore does not interact with the sea floor. It may be undertaken across the site to a suitable percentage coverage and the parameters of the survey may be determined by the requirements of the Underwater Archaeology Unit of the National Monuments Service. Their requirements are set out in Table 2-1

Table 2-1 Underwater Archaeology Unit Requirements for Magnetometer Survey

Activity	Requirements for Archaeological Purposes
Side Scan Sonar	• Operational frequency of 200 to 700kHz. • 50m survey line spacing • 100% site coverage (overlap of areas may be required)
Magnetometer	• Caesium or proton magnetometer • 50m side spacing

Plate 3 Magnetometer Example (Geometrics)

2.2.4 Sub-Bottom Profiling (SBP)

Shallow Sub-Bottom Profiling aims to create a 2-D image of the subsurface up to potential depths of approximately 10-50 m below seabed, depending on the geological conditions encountered and the choice of system used greater penetration can be achieved. Different types of SBP are available including chirp, pinger and parametric chirp systems. The most appropriate system will be decided depending on the seabed, anticipated geological environment and the objectives of the survey.

A Sub-Bottom Profiling (SBP) system may be used to determine the stratigraphy across the site and quantify the variability in the lateral and vertical extents to a depth of at least 50m below seabed.

The Seatronics Edgetech 3300 may be taken as an indicative example of a hull-mounted pinger system and would have an expected operating frequency range of approximately 2-16 kHz with sound pressure levels of 200dB re1µPa at 1 metre range. This survey is non-intrusive therefore does not interact with the sea floor. It may be undertaken across the site to a suitable percentage coverage.

Plate 4 Example of Boomer Sub-Bottom Profiler

Plate 5 Example of Pinger Sub-Bottom Profiler

2.2.5 Ultra High Resolution Seismic

Higher energy seismic sources (boomer and sparker) may be used to determine the stratigraphy across the site and quantify the variability in the lateral and vertical extents to a depth of at least 50m below seabed, depending on the geological conditions encountered and the choice of system used greater penetration can be achieved..

The Applied Acoustics may be taken as an indicative example of a boomer source and would have an expected operating frequency of approximately 2.5 kHz with sound pressure levels in the range of 208-215dB re1µPa at 1 metre range. The Geo-Source 200 or the Applied Acoustics Squid 500 may be taken as an indicative example of a towed sparker system, with sound pressure levels in the range of 204-216dB.

Multi-channel acoustic surveys using higher energy sources are used to image the subsurface and categorise sediment strata. These surveys can create ultra-high resolution 2D or 3D images of the subsurface whilst achieving greater depths than sub-bottom profiling systems. The intensity of the source can vary depending on the requirements of the survey. These surveys will only be used if sufficient depth data is not achieved with the use of the SBP method in Section 2.2.4.

This survey is non-intrusive therefore does not interact with the seafloor. It may be undertaken across the site to a suitable percentage coverage.

Plate 6 Example of Sparker sub-bottom profiler

2.2.6 Summary

Activity	Activity time	Coverage	Total SI duration
Bathymetric and Geophysical surveys	2-3 months	100%	2-3 months of activity in different phases over the 5 year licence period

2.3 Metocean Site Investigations

Metocean site investigations are necessary to evaluate the wave and current conditions across the Foreshore Licence Area. The data will be used to help define the design parameters of the Sceirde Rocks Offshore Wind Farm foundations, as well as the conditions to be expected during the installation and maintenance of the project. The site investigations will require the use of two wave buoys with a minimum 12 month but possibly up to 24 month measuring campaign to reduce the uncertainty of the final metocean assessment.

2.3.1 Metocean Measurement Devices (e.g. Wave Buoys)

Metocean site investigation will require the installation of up to three metocean devices, such as wave buoys. Wave buoys are designed to follow movement at the water surface and gather the relevant wave data. Each wave buoy is anchored to the sea floor using a length of highly elastic rubber chord and suitably sized anchor structure. The elasticity of this chord allows the buoy to ride and follow the movement of the water surface. A real time data feed with a GSM and satellite communication system transmits the collected data from the buoy to a receiver station onshore. The wave buoy specifications include: an LED light for detection, an integrated datalogger for backup data storage, GPS position, a solar powered battery and an internal backup battery pack.

At this stage, exact locations of the metocean devices within the Foreshore Licence Area will be confirmed following appointment of a suitable qualified survey contractor. Final device locations can be provided to the Department of Housing, Local Government and Heritage prior to survey mobilisation if requested.

The data to be collected from the metocean site investigations of the Foreshore Licence Area include:

- Location (latitude, longitude)
- Significant wave height (Hs)
- Maximum wave height (Hmax)
- Peak wave period (Tp)
- Mean wave period (Tz)
- Wave direction
- Directional spreading
- Sea temperature

2.3.2 Survey Summary

Activity	Activity time	Total number of SI locations	Total SI duration	SI affected footprint [m^2]	Total footprint [m^2]	Affected area as proportion of the foreshore license area
Metocean Measurement Devices	12 – 24 months per location	3	12 – 24 months	10	20	1.4e-5%

2.4 Wind Resource Site Investigations

Wind resource measurements are required to accurately estimate the wind conditions across the Sceirde Rocks Offshore Wind Farm site. The data collected will be used to assess the energy production from the wind farm including daily and seasonal patterns. The wind data is also used as one of the inputs for the engineering design of the wind turbine, turbine layout and foundation structures.

The wind resource measurement campaign will last a minimum of 12 months but could last more than 24 months (depending on project development programme) in order to gather more data to reduce uncertainty of the future wind resource and energy yield estimates, as well as to provide contingency for any unforeseen issues with data measurements.

2.4.1 Proposed wind resource measurement campaign locations

It is expected that up to two wind measurement locations (using floating LiDAR) will be situated within the Foreshore Licence Area. eThe final deployment locations of the floating LiDAR devices within the Foreshore Licence Area will be confirmed following appointment of a suitable qualified survey contractor. Final device locations can be provided to the Department of Housing, Local Government and Heritage prior to survey mobilisation if requested

2.4.2 Floating LiDAR systems

A floating LiDAR system (FLS) is usually a small (2 m to 3 m across) buoy moored using a gravity anchor. It houses a LiDAR (Light Detection And Ranging) device which uses laser to measure wind speed and direction at a range of heights, up to 100 m to 200 m above the device. The buoy also houses all the necessary processing equipment, power supply systems (solar panels, small scale wind turbine generators, and batteries), additional measurement systems required for the data monitoring (such as key metocean and atmospheric characteristics), as well as auxiliary systems for marine navigation safety. The data is stored on the device, as well as uploaded to a remote storage via a GSM or satellite link.

There are several FLS providers, and the final design used for the measurement campaign at Sceirde Rocks Offshore Wind Farm will be known following appointment of the survey contractor. FLS would be deployed, serviced, and decommissioned using an installation vessel.

Two FLS buoys will be deployed in the Foreshore Licence Area in order to improve the accuracy of the wind resource estimates, as well as provide additional contingency should one of the devices experience any issues.

2.4.3 Summary

Activity	Activity time	Total number of SI locations	Total SI duration	SI affected footprint [m^2]	Total footprint [m^2]	Affected area as proportion of the foreshore license area
Floating LiDAR system	12 – 24 months per location	2	12 – 24 months	10	20	1.4e-5%

2.5 Benthic Ecology Site Investigations

The purpose of the benthic ecology site investigations is to identify the extent and distribution of marine benthic communities and habitats within the Foreshore Licence Area.

At this stage, exact benthic sample locations within the Foreshore Licence Area will be confirmed following appointment of a suitable qualified survey contractor. The sample locations will be selected to ensure that samples are collected from different habitats to generate a representative overview of the Foreshore Licence Area benthic habitat. Final benthic sample locations can be provided to the Department of Housing, Local Government and Heritage prior to survey mobilisation if requested.

The survey data acquisition for assessing benthic ecology and sediment dynamics will include drop down camera/Remotely Operated Vehicle (ROV), water column sampling and grab sampling.

An indicative overview of the habitats encountered across the proposed project site can be determined from the offshore component of the adjacent Kilkieran Bay and Islands SAC. The expected habitats may include:

- Sediment dominated communities.
- Subtidal reef communities of varying exposures; and
- Intertidal reef communities (associated with rocky outcrops within the project site).

Of these, it is the sediment dominated communities present within the Foreshore Licence Area that will be subject to the benthic grab sampling regime. While there is expected to be subtidal rocky/stony substrata across the area, the exact positions of these will be confirmed from analysis of geophysical data prior to final selection of the benthic sampling locations. Where a benthic grab sample station is confirmed to be rocky substrata, only drop down camera/ROV visual data will be acquired for habitat assessment (possibly supplemented by diver survey in littoral zone).

It is proposed that up to 40 grab sample stations (using day grab or van Veen grab) will be acquired across the site. The proposed benthic grab sample stations will coincide with the proposed geotechnical borehole locations outlined in Section 2.1, with additional benthic stations selected to fill in gaps to ensure a comprehensive coverage of the habitats present, which will capture the range of depths and exposures. It is expected that the seabed will be comprised of mixed sediments which may range from pebbles, gravels to finer sands which will be determined by the acoustic data acquisition. A stratified random sampling regime across the Foreshore Licence Area has been adopted to determine the baseline environment.

The number of sample stations has been selected in order to ensure that sampling is representative and sufficient and that any species that occur in low densities or are locally rare are identified.

The benthic sampling acquisition will include up to 4 replicate grabs at each station. Three replicates will be used for macro-faunal analysis, and the fourth will be sub-sampled for physico-chemical analysis (i.e. Particle size analysis (PSA) and organic content). The replication of samples is proposed to provide a statistically robust macro-faunal data set to inform the environmental baseline and future monitoring.

Assuming all grab stations are acquired, a total of up to 160 grabs would be taken, each disturbing an area of 0.1 m^2. Therefore, the total area of seabed that would be directly affected by the gab sampling regime will be 16 m^2.

In any case where benthic sampling is not possible, drop down video/camera analysis would be sufficient to establish the benthic ecology present.

2.5.1 Summary

Activity	Activity time	Total number of SI locations	Total SI duration	SI affected footprint [m^2]	Total footprint [m^2]	Affected area as proportion of the foreshore license area
Benthic grab sample	3 hours per location	40 (x 4 grabs at each location = 160 grabs)	2-3 weeks	0.1	16	1.1e-5%

2.6 Survey Vessels

Each of the proposed site investigation surveys included in this foreshore licence application will require the use of a small number of vessels for the efficient deployment, execution and recovery of the site investigation activities. Given the nature of the survey activities, all vessels will be slow moving.

The survey contractor vessels will comply with international and national statute as appropriate including but not limited to:

- Sea Pollution Act 1991 and International Convention for the Prevention of Marine Pollution from Ships (MARPOL 73/78);
- Sea Pollution (Amendment) Act 1999 and International Convention on Oil Pollution Preparedness, Response and Co-operation 1990;
- S.I No. 372/2012 Sea Pollution (Prevention of Pollution by Garbage from Ships) Regulations 2012;
- S.I. No. 492/2012 Sea Pollution (Prevention of Pollution by Sewage from Ships) (Amendment) Regulations 2012; and
- SI. No. 507/2012 Merchant Shipping (Collision Regulations) (Ships and Water-Craft on the Water) Order 2012

The largest vessel to be used is the geotechnical survey vessel. Indicative parameters are provided in Table 2-2.

Table 2-2 Geotechnical investigation vessel indicative parameters

PARATMETER	VALUE
Registered tonnage	5,400 – 7,000 tonnes
Length	80-110m
Breadth	20-25m

PARATMETER	VALUE
Draft	6-8m

2.7 Noise Sources From Survey Works

The range of likely noise frequency and sound pressure associated with the survey methodologies identified in this document is summarised in Table 2-3 below.

Noise emissions associated with the survey vessels are continuous in nature. Use of a DP system constitutes the greatest noise source for this type of vessel. Hartkin *et al.* (2011) found that source pressure levels reached a maximum of 170 dB within 1 m of the thrustors, whilst the vessel was on DP.

Source noise levels for rotary coring of 165dB re 1µpa @1 m (Subacoustech Environmental Ltd, 2018) and source noise levels for percussive drilling of 185dB re 1µpa @1 m (Subacoustech Environmental Ltd, 2018).

Details of the exact equipment to be used will not be known until completion of survey contractor procurement, however the ranges provided below in Table 2-3 are considered a worst case not to be exceeded by chosen equipment and are applicable for consideration of potential impacts on the environment which is presented in the following documents also submitted with this foreshore licence application:

- Environmental Assessment and Environmental Impact Assessment Screening Report (including Annex IV species risk assessment); and
- Natura Impact Statement.

Table 2-3 Summary of Indicative Survey Methodology Operating Sound Pressures

Noise source	frequency	sound pressure level (db re 1µpa @1 m)
USBL	19.5 – 33.5 kHz	207
Geotechnical Drilling	2 Hz – 50 kHz	160-185
Shipping Noise	<1kHz	160 – 185
Multi-beam echo sounder	200 – 700 kHz	200 – 228
Side scan sonar	300 – 900 kHz	228
SBP (Pinger, Chirp, Parametric)	2-16 kHz	200-226
UHRS (Sparker/Boomer)	2.5 kHz	204-216 / 208-215

Further detail on the equipment specifications used in underwater noise modelling to inform the assessment of potential impacts is provided in Section 4.4.5.

2.8 Timeline For Site Investigations and Summary

Following grant of the foreshore licence, it is the intention that surveys will commence as soon as practicably possible with a stage programme of site investigations taking account of suitable weather conditions. It is currently anticipated that surveys will begin in late 2022 or early 2023. A foreshore license with a timeline of 5 years is being requested to allow surveys to be undertaken in phases across the licence period.

3 APPROACH TO MEETING THE REQUIREMENTS OF THE HABITATS REGULATIONS AND THE HABITATS DIRECTIVE (92/43/EEC)

This section of the report summarises the requirements of the Habitats Directive (specifically in terms of Article 6) and the relevant Irish transposing legislation with respect to the site investigation activities. It details the approach undertaken for the assessment of the potential of the site investigation activities to have a likely significant effect on the relevant protected sites and species, as required as part of Appropriate Assessment screening.

3.1 Overview of the Habitats Directive and Transposing Legislation

European Community (EC) Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna, commonly known as the Habitats Directive, was established by the EC to meet its obligations under the 1979 Convention on the Conservation of European Wildlife and Natural Habitats, commonly known as the Bern Convention, and to complement the provisions of the already established EC Directive 79/409/EEC on the conservation of wild birds (now replaced by EC Directive 2009/147/EC). The main aim of the Habitats Directive is to 'contribute towards ensuring biodiversity through the conservation of natural habitats of wild fauna and flora' by way of actions taken to 'maintain or restore, at a favourable conservation status, natural habitats and species of wild fauna and flora of Community interest'. Habitats and species of Community interest are defined in a number of Annexes of both the Habitats and Birds Directives.

As part of the Habitats and Birds Directives, protection must be afforded to appropriate sites to assist in fulfilling the aims of the Directives. Specifically, SACs must be designated under the Habitats Directive for habitats and species listed on Annex I and Annex II of the Habitats Directive, whilst under the Birds Directive, SPAs must be designated for species listed on Annex I of the Directive. Collectively, these sites are referred to as European sites.

The Habitats Directive and the Birds Directive have been transposed into Irish law inter alia by the European Communities (Birds and Natural Habitats) Regulations 2011 to 2021. Under these Regulations, the likely significant effect of plans or projects on a European site are assessed and evaluated; the process by which this screening takes place is described below.

3.2 Article 6 Obligations

Under Article 6(3) of the Habitats Directive, an Appropriate Assessment of a plan or project is required where the plan or project is not directly connected with or necessary to the management of the site as a European site and if it cannot be excluded, on the basis of objective scientific information, that the plan or project, individually or in combination with other plans or projects, will have a significant effect on a European site. Article 7 of the Habitats Directive makes the provisions of Article 6(3) applicable to European sites designated under the Birds Directive (i.e. SPAs).

The Habitats Directive applies the precautionary principle to European sites, and projects can only be permitted when it is ascertained that there will be no adverse effect on the integrity of the site(s) in question. Where adverse

effects on integrity are identified, a project may only be permitted in the absence of alternative solutions if there is an Imperative Reason of Overriding Public Interest for the project to go head. Where this is the case, Member States are required to take all compensatory measures necessary to ensure that the overall coherence of the European network is protected.

The approach to meeting Article 6 obligations for the Sceirde Rocks site investigations is described below. It complies with with Article 6 of the Habitats Directive, European and Irish Case Law, the requirements of Irish legislation (The European Communities (Birds and Natural Habitats) Regulations 2011 to 2021) and is in accordance with best practice guidance, e.g.:

- The Department of Environment, Heritage and Local Government, DEHLG, 2010 guidance on Appropriate Assessment of Plans and Projects in Ireland;
- The EC guidance document "Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC" (EC, 2002); and
- Commission notice C (2018) 7621 "Managing Natura 2000 sites, The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC" (EC, 2018); and
- Commission notice (2021) "Guidance document on the strict protection of animal species of Community Interest under the Habitats Directive".

Since the site investigations proposed are not directly connected with or necessary to the management of the site as a European site, it is necessary to carry out Appropriate Assessment Screening to identify whether, on the basis of objective scientific information, the site investigations individually or in combination with other plans or projects will have a significant effect on a European site. As defined in the regulations, this includes consideration of:

- a candidate site of Community importance;
- a site of Community importance;
- a candidate special area of conservation;
- a special area of conservation;
- a candidate special protection area; or
- a special protection area..

Appropriate Assessment Screening is based on a consideration of associated European sites and their respective qualifying interests in a phased process based on:

- Identifying the range of impacts that the site investigation activities could have on qualifying interest(s) of a site (impact pathways).
- Determining connectivity with European sites based on:
  - Evidence that qualifying interest(s) that could be adversely affected by the site investigation activities are present in the site investigation activities zone of impact and likely use of the area (e.g. for foraging and breeding);
  - Whether there is connectivity between the site investigation activities and the qualifying interests of a European site based on:
    1. Foraging distances from breeding colonies (seabirds) (e.g. Thaxter *et al.*, 2012);
    2. Proximity to foraging and breeding sites (marine mammals and fish);

3. Migration routes (migratory wildfowl, marine mammals and fish);
4. Influence of tidal flow/sediment dynamics on benthic/intertidal Annex I habitats; and
5. Indirect connectivity with other qualifying interests (e.g. fresh-water pearl mussel due to life cycle ecology of salmonids); and

- Whether that qualifying interest(s) would, by virtue of its behavioural and foraging characteristics, be affected by a particular impact (species sensitivity).

- Evaluation of potential for likely significant effects
  - Where impact pathways and connectivity with European sites are identified, further evaluation is undertaken to determine whether, in view of best scientific knowledge and the conservations objectives of the European site, the site investigation activities, individually or in combination with another plan or project is likely to have a significant effect on those European sites.
  - In light of recent case law interpreting Article 6(3) of the Habitats Directive (Case C-323/17) of the Court of Justice of the European Union, which determined that it is not appropriate to take into account measures intended to avoid or reduce the harmful effects of a plan or project on the site European concerned (mitigation measures) at the Appropriate Assessment Screening stage, mitigation measures have not been taken into account in this Appropriate Assessment Screening.

4 APPROPRIATE ASSESSMENT SCREENING

4.1 Introduction

This section of this Report to Inform Appropriate Assessment Screening Report presents the results of the assessment undertaken to fulfil the obligations of Regulation 42 of the Birds and Habitats Regulations, and Article6 of the Habitats Directive (detailed in Section 3.2). This section is structured as follows:

- Section 4.2 - Description of potential impacts
  - The potential sources of impact from the site investigations are described alongside the potential receptors.
- Section 4.3 - Determining connectivity with protected sites
  - The potential for all receptors belonging to relevant protected sites to experience any of the potential impacts described in Section 4.2 is assessed (i.e. the 'connectivity' between European sites and potential impact zones is considered). Where there is no mechanism of impact to a protected site or its features (i.e. no connectivity exists), a conclusion that the site investigations are not likely to have a significant effect on a European site is reached and the site is screened out For the remaining sites where there is a potential for a likely significant effect that requires further consideration (i.e., connectivity may exist), further consideration and assessment is provided in Section 4.4equired.
  - This section is structured to consider each of the potential impacts outlined in Section 4.2.
- Section 4.4 - Evaluation of potential for likely significant effects
  - For European sites where the potential for the site investigations to have a likely significant effect on a European site requires consideration due to connectivity or impact pathways, further assessment is presented to determine, in view of best scientific knowledge and in view of the conservation objectives of a site, if the site investigations, individually or in combination with another Plan or Project are likely to have a significant effect on those European sites.

The Irish shelf on the west coast of Ireland is a biologically productive area which supports numerous fish, seabird and cetacean species. An extensive network of SACs and SPAs is present along the west coast of Ireland (see Figure 3). The coastal SACs protect a variety of coastal and marine Annex II species and Annex I habitats including reefs, caves, cliffs, offshore islands, sand dunes, salt marshes, intertidal bays, beaches and rivers. The SPAs protect a range of seabirds with extensive foraging ranges.

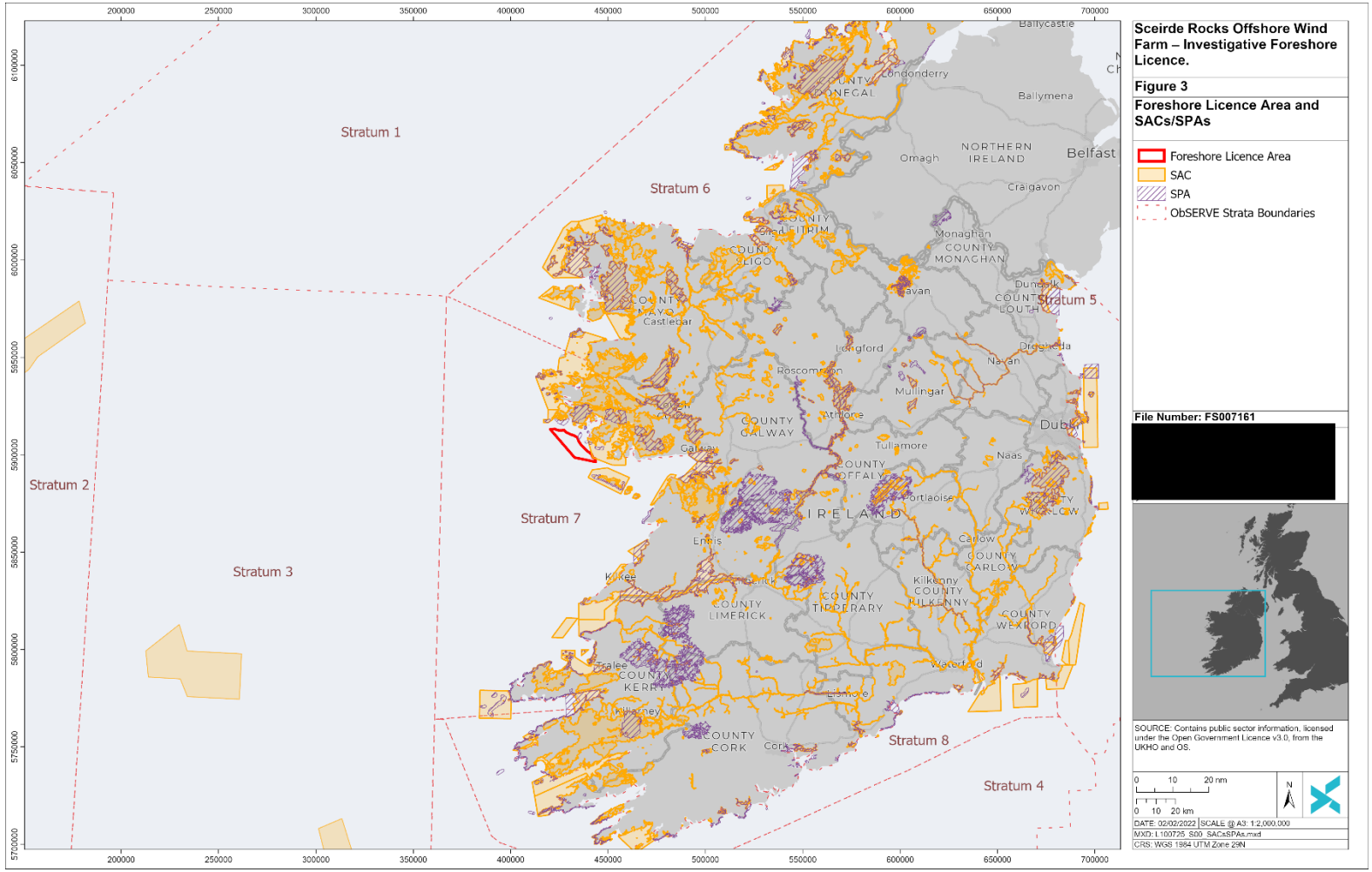

Figure 3 Foreshore Licence Area and SACs/SPAs

4.2 Description of potential impacts

Details of the site investigations included in the Sceirde Rocks Offshore Wind Farm foreshore licence application are provided in Section 2. Based on the activities presented, Table 4-1 presents a summary of the potential impacts from the proposed site investigations.

Table 4-1 Potential environmental impacts from proposed site investigations

SOURCE OF IMPACT	DESCRIPTION OF POTENTIAL IMPACT MECHANISM	RECEPTORS RELEVANT TO SPAS AND SACS
Underwater noise	Acoustic disturbance / injury resulting from USBL, SSS, MBES, SBP and UHRS equipment, shallow coring and vessel noise	Birds, marine mammals, fish, otters
Physical presence	Physical damage to benthic habitat and species	Birds, fish, marine mammals, marine habitats, otters
Atmospheric emissions	Gaseous emissions affecting local air quality, emission of greenhouse gases, and resource use	None
Routine marine discharges	Discharge of oily water to sea (e.g. bilge water), organic enrichment from grey and black water	Fish, marine mammals, otters
Operational discharges	Discharge of cuttings and water-based muds, leading to an increase in turbidity and physical effects on benthic species and habitats.	Fish, marine mammals, marine habitats
Solid wastes	Waste generation and disposal	None

As there are no relevant receptors potentially impacted by atmospheric emissions and solid waste generation (as any solid waste is removed and disposed onshore at suitable identified authorised facilities), these impact mechanisms are screened out of this Report to Inform Appropriate Assessment Screening. Water column impacts relate to both the physical and chemical effects predominantly experienced by planktonic species, which could have indirect impacts on species higher in the food chain such as fish and marine mammals.

The remaining sources of potential impact on receptors relevant to European sites are discussed in the following sections.

4.3 Determining connectivity with European Protected Sites (SACs and SPAs)

The Foreshore Licence Area does not directly overlap with any SAC or SPA (see Figure 3) and therefore none of the proposed site investigation locations (geophysical survey, borehole, floating LiDAR, wave buoy or benthic grab) will have a direct impact on any European site. The following sections therefore examine whether there is a potential indirect impact from the proposed site investigations with European sites, due to connectivity.

4.3.1 Underwater noise

The potential connectivity of acoustic disturbance or injury resulting from USBL, SSS, MBES, SBP, UHRS, coring and/or vessel noise to Annex II species is considered in this section.

4.3.1.1 SACs – marine mammals

4.3.1.1.1 Seals

There are two Annex II seal species for which SACs have been designated in Ireland: harbour seal (*Phoca vitulina)* and grey seal (*Halichoerus grypus)*.

With regard to underwater noise emissions, harbour seals normally forage within 40 – 50 km around their haul-out sites (SCOS, 2020). The proposed site investigation locations are located within 50 km of the shoreline or SACs designated for harbour seals. Therefore, the potential for likely significant effect needs to be considered further and the SACs along the west coast of Ireland within 50km of the Foreshore Licence Area with harbour seals as a designated feature are evaluated further in Section 4.4 to determine whether likely significant effect can be screened out..

Grey seals may forage up to 200 km from haul-outs (e.g. McConnell *et al.*, 1999) and mainly on the seabed at depths of up to 100 m (SCOS, 2020). However, after breeding, most grey seals disperse away from their haul-out sites, making it very difficult outside of the breeding season to assign any individual to a particular SAC. Grey seal usage of a particular SAC is therefore very time and location specific. On this basis and considering available data on grey seal movements (e.g. Cronin *et al.*, 2011; SMRU Ltd, 2011; Russell and McConnell, 2014), there may be potential for interactions between grey seals and projects within a 200 km radius around SAC boundaries. The proposed site investigation locations are located within 200 km of the shoreline or SACs designated for grey seals. Therefore, the potential for a likely significant effect needs to be considered further and the SACs along the Irish coast within 200km of the Foreshore Licence Area with grey seals as a designated feature are evaluated further in Section 4.4 to determine whether likely significant effects can be screened out.

Based on the above assessments, the following SACs are subject to further assessment (Appendix A):

- Kilkieran Bay and Islands (harbour seal);
- Galway Bay Complex (harbour seal)
- Slyne Head Islands (grey seal).
- Inishbofin and Inishshark (grey seal);
- Duvillaun Islands (grey seal);

- Inishkea Islands (grey seal);
- Blasket Islands (grey seal);
- Slieve Tooey/Tormore Island/Loughros Beg Bay (grey seal); and
- Roaringwater Bay and Islands SAC (grey seal).

4.3.1.1.2 Cetaceans

There are two Annex II cetacean species for which SACs have been designated in Ireland, bottlenose dolphin *Tursiops truncatus* and harbour porpoise *Phocoena phocoena*.

4.3.1.1.2.1 Bottlenose dolphin

The IAMMWG (2015) sets out the locations of Management Units (MU)[1] for the seven most common cetacean species in UK waters. The Foreshore Licence Area lies within the West Coast of Ireland MU between the Offshore Waters MU and the coastline, within the boundary set at 12 nautical miles (approximately 22 km) offshore.

At this stage the potential for likely significant effect needs to be considered further therefore all SACs within 50km of the Foreshore Licence Area with bottlenose dolphin as a qualifying feature are evaluated further in Section 4.4 to determine whether likely significant effects can be screened out. Therefore, the following SACs are subject to further assessment (shown on Figure 4 and listed in Appendix A):

- Slyne Head Islands;
- Slyne Head Peninsula; and
- West Connacht Coast.

4.3.1.1.2.2 Harbour porpoise

Given the difficulty in determining the presence of individuals (i.e. by employing photo identification techniques) that may have travelled from a coastal European site to the Project area, it is not possible to eliminate underwater noise as a potential impact mechanism with respect to harbour porpoise SACs on the Irish coast. Therefore, as a precautionary approach, the potential for likely significant effect needs to be considered further and the SACs along the Irish coast with harbour porpoise as a designated feature are evaluated further in Section 4.4 to determine whether likely significant effects can be screened out. These sites (listed in Appendix A) are:

- Blasket Islands SAC; and
- Roaringwater Bay and Islands SAC.

4.3.1.2 SACs – Otters

Otter populations in coastal areas utilise shallow, inshore marine areas for feeding. Therefore, the zone of influence for otters around the coastal European sites is expected to be the same as the SAC site boundaries themselves. The Foreshore Licence Area does not overlap with any SAC and the closest SAC designated for otters (Galway Bay Complex SAC) is over 40km from the Foreshore Licence Area which means there is highly unlikely to be any significant interaction between the site investigations and otters from SACs in terms of underwater noise emissions and it is concluded that likely significant effects can be excluded. In addition, given the very small number of vessels

[1] *MU typically refers to a geographical area in which the animals of a particular species are found to which management of human activities is applied.*

associated with the site investigation activities, any survey vessel movement leaving their port/harbour base locations and transiting to the Foreshore Licence Area are not considered to give rise to any potential disturbance to otters from underwater noise emissions.

4.3.1.3 SACs – Fish

There are several Annex II fish species for which SACs have been designated and which have the potential to be found in marine waters west of Ireland: the sea lamprey (*Petromyzon marinus)*, river lamprey (*Lampetra fluviatilis*), allis shad (*Alosa alosa)*, twaite shad (*Alosa fallax)* and Atlantic salmon (*Salmo salar)*. The Lower Shannon River SAC, which extends from Aill Na Brun in County Clare and north of Ballyheige in County Kerry inland to the Slievefelim and Silvermines Mountains in County Tipperary, is the closest protected site to the Foreshore Licence Area which has been designated for the protection of river and sea lamprey. The site also protects Atlantic salmon, as well as brook lamprey (*Lamptera planeri*), a non-migratory freshwater species. This inland SAC is over 70 km from the Foreshore Licence Area. Additionally, the Glenamoy Bog Complex SAC is a terrestrial SAC located in Carrowteige in County Mayo, approximately 100 km from the Foreshore Licence Area, which is the closest protected site designated for the protection of Atlantic salmon. Finally, the Blackwater River (Cork/Waterford) SAC, which protects twaite shad as well as salmon and all three species of lamprey, is located over 200 km from the Foreshore Licence Area and is the closest site designated for the protection of shad. The distance of the Foreshore Licence Area from these designated sites protecting migratory fish species precludes the creation of barrier effects at river mouths as a result of the proposed activities. Rather, individuals will disperse in the marine environment to varying degrees as they adapt to environmental pressures such as predation and increased metabolic requirements during their marine migration. Given the distance of the designated sites (closest at 70km) from the Foreshore Licence Area, and in view of the behavioural and movement patterns of the protected fish species under consideration, it is anticipated that these species are highly unlikely to utilise the Foreshore Licence Area or use will be in extremely low densities of fish. Therefore, there is not considered to be a mechanism for potential adverse effects on fish and it is concluded that significant effects can be excluded.

4.3.1.4 SPAs – Birds

There is very limited information on the underwater hearing abilities of diving birds or the impacts of underwater noise generate by human activities.

Popper and Hawkins (2012) report that, on average, birds' hearing is most sensitive at 2 – 5 kHz in air, with sensitivity dropping off greatly below 1 kHz and above 4 kHz (Crowell *et al.*, 2015). Underwater, auditory sensitivity testing on cormorants and auks has also indicated elevated sensitivity to sound frequencies of 1 – 4 kHz (Hansen *et al.*, 2017; Hansen *et al.*, 2020). Very high amplitude low frequency underwater noise may result in injury to diving seabirds but only in very close proximity (i.e. tens of metres) to underwater noise sources, primarily explosions (Yelverton et al. 1973, Danil & St Leger 2011). Explosions which are percussive in nature would be many magnitudes greater than any of the site investigations activities proposed in the Sceirde Rocks Offshore Wind Farm foreshore licence application.

McCauley (1994) inferred from vocalisation ranges that the threshold of perception for low frequency seismic noise in some species (e.g. penguins, considered as a possible proxy for auk species) would be high, hence individuals might be adversely affected but only in very close proximity to the noise source (i.e. the survey vessel). Impacts from underwater seismic surveys on diving birds would only occur with sufficient exposure to high amplitudes. This is considered to be extremely unlikely in relation to the Sceirde Rocks Offshore Wind Farm site investigations as the

presence of the survey vessels would be expected to displace diving seabirds from close proximity to the survey vessel or any towed equipment therefore limiting their exposure to the highest sound pressures generated.

Considering the evidence of low hearing sensitivity and minimal evidence reporting injury to diving birds from underwater noise associated with the proposed site investigation activities, combined with the high likelihood of seabirds avoiding the immediate underwater vicinity around the survey vessels therefore avoiding any close proximity exposure to noise sources, it is concluded that likely significant effects on seabirds from underwater noise can be excluded. Behavioural disturbance from physical presence of survey vessels is considered further in Section 4.3.2.4.

4.3.2 Physical Presence

The site investigation activities will involve the use of a small number of vessels and each site investigation activity (geophysical survey, borehole, benthic grab, Floating LiDAR, wave buoy) will have a limited footprint of interaction with the seabed as detailed in Section 2. The potential connectivity of the physical presence of survey vessels and interaction with the seabed (from site investigation activities) to SACs and SPAs is considered further in the following sections.

4.3.2.1 SACs – Fish and marine mammals

The site investigations will involve a very small number of vessels. Such vessel presence represents a very small increase for a very small time period against the current baseline levels across the west coast of Ireland, particularly in proximity to the approach to Galway Bay. This means that the potential for physical disturbance including collision risk or interference with the pathways of migratory fish will be extremely limited and likely to present no significant increment on top of that already posed by existing shipping activities. It is concluded that significant effects to fish and marine mammals through physical presence of a very small number of slow moving vessels and for a very small time period, can be excluded.

4.3.2.2 SACs - Marine habitats

The use of a DP system to maintain position over each borehole or benthic grab location removes the requirement to anchor the vessel to the seabed. However, at this stage, the potential for challenging seabed conditions means that a jack up vessel may be required for some borehole locations. Different jack-up vessels have differing operational limitations which governs their suitability at a given site and this requires site specific assessment to ensure its technical viability. An example jack-up platform is Fugro's Excalibur, which is an eight-legged jack-up potentially capable of working in water depths of up to 37m, with a total seabed footprint of approximately 20m^2. For the purpose of this assessment, conservatively it has been assumed a jack up will be required at all boreholes, although in reality given site water depths, it is likely to be only a small number (5-10) of the closer to shore boreholes that may use a jack up vessel.

A summary of the area of seabed potentially affected by each site investigation activity is provided below in

Table 4-2 Summary of area of seabed potentially affected

SITE INVESTIGATION	NUMBER OF LOCATIONS	Footprint per SI location [m^2]	Total SI footprint [m^2]
Geotechnical Investigation (Borehole)	60	1 – 2	60 - 120
Jack up vessel for boreholes	60	20	1200
Geotechnical Investigation (CPT)	60	4 – 8	240 – 480
Shallow sampling	60	0.1	6
Benthic	40 (x 4 grabs at each location = 160 grabs)	0.1	16
Wind Resource	2	10	20
Metocean	3	10	30

The following SACs are within 20km the Foreshore Licence Area and are designated for marine habitats and species, including reefs:

- Kilkieran Bay and Islands SAC (adjacent to Foreshore Licence Area);
- Inishmore Island SAC (<5km from Foreshore Licence Area);
- Slyne Head Islands SAC (<5km from Foreshore Licence Area); and
- Inishmann Island SAC (approximately 20km from Foreshore Licence Area).

There will be very small areas of seabed disturbance from the benthic ecology surveys and geotechnical investigations. Benthic surveys will require the extraction of sediment from the seabed using a grab sample. However, once the grab sampler has been removed from the soft sediment (muds, sands, gravels), any disturbance to sediment will naturally recover due to the anticipated mobile nature of the sediment type.

During the geotechnical investigations, at borehole locations, there will be seabed disturbance from the drill casing itself and the area immediately surrounding the borehole from rotary cored drilling fluids and cuttings. However, this area of disturbance is expected to be only $1m^2$ to $2m^2$ at each borehole location. Following removal of the core from the borehole, the void in the seabed will naturally recover, with minimal change from the original condition anticipated.

During the geotechnical investigations, at CPT locations, no seabed material is removed however there will be temporary disturbance of the seabed from the CPT unit which has a footprint of approximately $4m^2$ to $8m^2$. Following completion of the CPT test, the seabed will naturally recover, with negligible change from the original condition anticipated.

Benthic habitat within the footprint of sampling equipment will be impacted through disturbance, a small amount of loss (from sampling), direct displacement or smothering during sampling. However, it is expected given the very

small areas of disturbance and mobile nature of sediments, that any disturbance will quickly recover and species will recolonise the area. Any smothering will be a very thin layer due the small volumes of sediment displaced when undertaking the survey sampling.

Benthic and geotechnical survey sampling will also cause a small amount of sediment to become suspended in the water and subsequently dispersed and deposited on the seabed at a location depending on wave and tidal conditions. However, any deposition of material will be insignificant compared to baseline levels of sediment movement within the Foreshore Licence Area.

In addition, equipment required or installed as part of the site investigation activities will not cause any physical obstruction or cause any potential alteration to the natural physical processes (water and sediment movement) of any designated site.

As stated at the start of Section 4.3, the Foreshore Licence Application does not overlap with any SAC designated for marine habitats therefore there is no mechanism for direct impacts. In addition, on the basis of information provided above, particularly the low volume of dispersed/deposited seabed material and the existing high baseline levels of water and sediment movement in the region of the Foreshore Licence Area due to natural physical processes, it is concluded that any disturbance from the site investigation will not have any connectivity with the SACs within 20km of the Foreshore Licence Area.

Therefore it is concluded that there will be no connectivity with the proposed site investigation activities and likely significant effects to marine habitats within SAC designations can be excluded.

4.3.2.3 SACs - Otters

Otter populations in coastal areas utilise shallow, inshore marine areas for feeding. The closest approach of the Foreshore Licence Area to any site designated for otter is over 40 km (Galway Bay Complex SAC). In addition, given the very small number of vessels associated with the site investigation activities in an already active shipping area, any survey vessel movement leaving their port/harbour base locations and transiting to the Foreshore Licence Area are not considered to give rise to any potential disturbance to otters. On this basis there will be no direct interaction between otters from SACs on the Irish coast and the site investigations. There is not considered to be a mechanism of effect for the potential disturbance of otters resulting from the physical presence of the survey vessel or coring equipment and it is concluded that significant effects can be excluded.

4.3.2.4 SPAs – Birds

The west coast of Ireland contains an extensive coastal network of SPAs which protect a wide range of seabird species known to utilise the waters within the Foreshore Licence Area but in closest proximity (<10km away) are the Inishmore SPA and Slyne Head to Ardmore Point Islands SPA. The following bird species are listed as qualifying features of these SPAs:

- Barnacle Goose (*Branta leucopsis)*;
- Sandwich Tern (*Sterna sandvicensis)*;
- Arctic Tern (*Sterna paradisaea)*;
- Little Tern (*Sterna albifrons)*;

- Kittiwake (*Rissa tridactyla)*; and
- Guillemot (*Uria aalge)*.

Guillemot and Kittiwake are considered to have low to moderate sensitivity to disturbance by vessels (Garthe & Hüppop 2004, MMO 2008, Fleissbach et al. 2019). Sandwich Tern and Arcitc Tern are considered to have low sensitivity to vessel traffic (Fleissbach et al. 2019).

Any disturbance from survey vessels, both in transit or in situ, will be low magnitude and short duration and will represent negligible additional disturbance over other vessel movements in the vicinity of the Foreshore Licence Area. The physical presence of the survey vessels may result in temporary disturbance to individual birds present both within and in the immediate vicinity of the Foreshore Licence Area. For any birds that are temporarily disturbed or displaced from the chosen feeding grounds or resting location, there is considered to be sufficient alternative foraging locations nearby.

There is already a baseline of existing shipping activity in the region around the Foreshore Licence Area, particularly the active shipping routes in and out of Galway, therefore birds are already used to a level of physical disturbance from vessels. Therefore, the addition of asmall number of slow moving vessels associated with site investigation activities for a very short period is highly unlikely to cause any significant effect.

Although birds associated with several SPAs may be present in the vicinity of the Foreshore Licence Area, given the open-water locations and very short duration of the activities and the existing levels of vessel presence in the vicinity of the Foreshore Licence Area, particularly the approach to Galway Bay, the potential for disturbance resulting from the physical presence of survey vessels is considered not to be a mechanism for potential significant effects from the site investigations. It is concluded that any likely significant effects can be excluded.

4.3.3 Routine marine discharges

Marine discharges have the potential to impact upon the environment, depending upon the quantity discharged, the duration of discharge and the ecotoxicity of the chemicals it contains. During site investigations (primarily the preliminary geotechnical investigations) oily water that may be generated during routine cleaning and maintenance operations (called bilge water) will be either shipped to shore for onshore disposal or disposed of in line with MARPOL requirements, typically through the use of an approved oil/water separator. Routine vessel discharges from the site investigations are not expected to differ from those from typical shipping. Given the short duration of activities and the open sea environment conducive to rapid dilution and dispersion, coring discharges and routine vessel discharges to the water column are screened out as an impact mechanism with respect to fish, marine mammals and otters.

As such, marine discharges are considered not to be a mechanism for any potential significant effect from the site investigations with respect to marine mammals, fish and otters and it is concluded that significant effects can be excluded.

4.3.4 Operational discharges

This potential impact relates only to the proposed preliminary geotechnical investigations. Drill cuttings are fragments of seabed material that are broken off during cable percussive or rotary coring drilling techniques. As set out in Section 2.1.6 above, only minimal amounts of cuttings will be discharged in the immediate vicinity of each borehole because 80 - 90% of the core is recovered for analysis. Cuttings are discharged and will settle close to the seabed and are estimated to amount to <0.25 m^3 per borehole. Coring will be conducted using seawater only, or with Pure-Bore coring fluid (possibly in conjunction with bentonite mixed with soda ash), if required.

4.3.4.1 SACs - Fish and marine mammals

Water column impacts relate to both the physical and chemical effects predominantly experienced by planktonic species, which could have indirect impacts on prey species for both fish and marine mammals. As described in Section 2.1.6, coring fluids may be used if required. These consist of fine particulate material mixed in water and would be discharged close to the seabed together with very small quantities of cuttings.

Given the small size of the boreholes, the very low toxicity of the coring fluids (PLONOR or OCNS Gold/Silver, E or D rated) and the very small quantities of cuttings generated, there are no likely significant effects on marine water quality, seabed sediments or biological receptors from cuttings or coring fluid discharges. Overall plankton productivity is not likely to be affected and there are not likely to be any indirect effects to organisms higher in the food chain. Coring discharges to the water column are therefore not considered to be a mechanism for likely significant effects from the site investigations with respect to fish or marine mammals and it is concluded that the potential for likely significant effects can be excluded.

4.3.4.2 SACs - Marine habitats

Whilst there are a number of SACs in close proximity to the Foreshore Licence Area designated for marine habitats (see Section 4.3.2.2), given the low volume of drill cuttings combined with existing dynamic marine physical processes in this marine region, the very localised deposition of coring discharges at each site investigation location is not considered to be a mechanism for likely significant effects on any marine habitats within the European sites and it is concluded that likely significant effects on such sites from the site investigations (specifically the shallow borehole coring discharges) can be excluded.

4.3.5 Summary of connectivity determination

The findings of the above connectivity determination are summarised in Table 4-3. Based on the information presented above in Section 4.3, the only impact mechanism that needs to be considered in the determination of likely significant effects is underwater noise.

Table 4-3 Summary of source of impact with potential connectivity to qualifying features

SOURCE OF POTENTIAL IMPACT	RECEPTORS RELEVANT TO SPAS AND SACS							
	Marine habitats	Fish	Marine mammals				Otters	Birds
			Bottlenose dolphin	Harbour porpoise	Grey seal	Harbour seal		
Underwater noise								
Physical presence								
Atmospheric emissions								
Routine marine discharges								
Operational discharges								
Solid wastes								

Key

	No relevant receptors
	Potential impact mechanism but no connectivity with site investigations (excluded from further consideration)
	Potential impact mechanism with potential for connectivity with site investigations requiring further evaluation

Based on their connectivity to the Foreshore Licence Area and proposed site investigation activities, the European sites that require an further consideration to determine whether any significant effects are likely or can be excluded consist of 11 SACs. Each SAC and its designated features are presented in Appendix A.

As presented above in Section 4.3, the following criteria have been used to select designated sites where the potential underwater noise impact with connectivity to the Foreshore Licence Area is to be assessed further:

- SACs (including proposed and candidate sites) with cetaceans as qualifying features within 50 km of the Foreshore Licence Area; and
- SACs (including proposed and candidate sites) with harbour seal features within 50 km of the Foreshore Licence Area and grey seal within 200 km of the Foreshore Licence Area.

An assessment to determine whether any significant effects are likely or can be excluded is presented in Section 4.4 below.

4.4 Further evaluation of potential for Likely Significant Effect

4.4.1 Overview

Based on impact pathways and connectivity with a zone of influence, the 11 SACs in Table 4-4 have been determined as requiring further evaluation to determine whether the Sceirde Rocks Offshore Wind Farm site investigations in view of best scientific knowledge and in view of the conservation objective of each site, individually or in combination with another plan or project is likely to have a significant effect on harbour porpoise, bottlenose dolphin, harbour seal and/or grey seal Annex II populations with respect to underwater noise. Of the SACs listed below in Table 4-4, those within the immediate vicinity of Foreshore Licence Area are labelled on Figure 4.

Table 4-4 SACs and features requiring further evaluation

SITE NAME	RELEVANT FEATURE			
	Harbour porpoise	Bottlenose dolphin	Harbour seal	Grey seal
Blasket Islands	Y	-	-	Y
Duvillaun Islands	-	-	-	Y
Galway Bay Complex	-	-	Y	-
Inishbofin and Inishshark	-	-	-	Y
Inishkea Islands	-	-	-	Y
Kilkieran Bay and Islands	-	-	Y	-
Roaringwater Bay and Islands	Y	-	-	Y
Slieve Tooey/Tormore Island/Loughros Beg Bay	-	-	-	Y
Slyne Head Islands	-	Y	-	Y
Slyne Head Peninsula	-	Y	-	-
West Connacht Coast	-	Y	-	-

Figure 4 SACs in the immediate vicinity and with connectivity to the Foreshore Licence Area

4.4.2 Noise impact mechanisms

Noise emissions from the proposed activities constitute the greatest potential risk of injury or disturbance to cetaceans in the vicinity of the survey area. Injury and disturbance from underwater noise may impact cetaceans in the following ways:

- Injury – physiological damage to auditory or other internal organs; and
- Disturbance (temporary or continuous) – disruptions to behavioural patterns, including, but not limited to migration, breathing, nursing, breeding, foraging, socialising and / or sheltering.

Physiological responses (injury) are generated when noise emissions fall within the hearing frequency-range of an individual. At the very base level, introduced sounds may impact marine mammals by causing auditory fatigue from the repeated focusing of the hearing apparatus on frequencies occurring at the limits of the individual's 'normal' hearing range. Such fatigue may cause a temporary reduction in hearing ability known as a Temporary Threshold Shift (TTS) (Finneran *et al.*, 2005; Popov *et al.*, 2013; Southall *et al.*, 2019). When anthropogenic sounds are sufficiently loud (i.e. at a large enough amplitude to generate intense pressure waves), they have the potential to cause permanent injury to hearing apparatus, through Permanent Threshold Shift (PTS) (Southall *et al.*, 2007, Southall *et al.*, 2019; NOAA, 2018).

Behavioural changes (disturbance) may include changes to movement, such as altering direction or dive pattern, whilst acoustic responses may take the form of changing vocalisation patterns or communication with conspecifics. Both of these impact mechanisms are considered "disturbance responses" to anthropogenic sounds, and they may have population-level consequences if they preclude the use of important habitat for prolonged periods or impact upon their foraging or breeding success (Lusseau and Bejder, 2007; Williams *et al.*, 2006).

To determine the potential for noise impacts to marine mammals, predicted emission levels are compared to available empirically estimated thresholds for injury and disturbance. Several threshold criteria and methods for determining how sound levels are perceived by marine mammals are available (e.g. the decibel hearing threshold (dBht) method and other hearing weighted and linear measures) and each has its own advantages and disadvantages. The DAHG Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (NPWS, 2014), alongside other guidance such as that from Marine Scotland (2014) recommend using injury and disturbance criteria proposed by Southall et al. (2007), which is based on a combination of linear (un-weighted) peak sound pressure levels (SPL) and weighted sound exposure levels (SEL). Since the publication of this seminal paper, there has been mounting evidence of marine mammal auditory abilities in novel species which has led to amendments to the auditory thresholds for injury (NOAA, 2018; Southall et al.; 2019). In accordance with recent regulator feedback, these amended hearing groups and thresholds for acoustic injury have been adopted herein; they are detailed in Table 4-5.

If a noise emission is composed of frequencies which lie outwith the estimated auditory bandwidth for a given species, then disturbance or injury is extremely unlikely. To understand the potential for noise-related impacts, the likely hearing sensitivities of different cetacean hearing groups has been summarised in Table 4-5, which is the basis for screening out MBES and SSS (Table 4-6) from further noise modelling assessment. The hearing groups relevant to the SACs with connectivity to the Sceirde Rocks Offshore Wind Farm site investigations are:

- High-frequency cetaceans (HF) = bottlenose dolphin;
- Very high frequency cetaceans (VHF) = harbour porpoise; and
- Phocid carnivores in water (PW) = grey and harbour seal

Table 4-5 Auditory bandwidths estimated for cetaceans (NOAA, 2018; Southall et al., 2019)

HEARING GROUP	ESTIMATED AUDITORY BANDWIDTH
Low-frequency cetaceans (LF): (e.g. baleen whales, such as humpback whales, minke whales, fin whales, etc.)	7 Hz to 35 kHz
High-frequency cetaceans (HF): (e.g. dolphins, toothed whales, beaked whales and bottlenose whales)	150 Hz to 160 kHz
Very high-frequency cetaceans (VHF): (e.g. harbour porpoises and other 'true' porpoises)	275 Hz to 160 kHz
Phocid carnivores in water (PW): (e.g. earless or 'true' seals, such as grey and harbour seals)	50 Hz to 86 kHz

4.4.3 Underwater noise sources from the site investigations

An overview of survey activities and their potential impacts to harbour porpoise, bottlenose dolphin and grey and harbour seal is provided in Table 4-6. While some survey techniques and activities may introduce noise to the marine environment, other activities do not operate in relevant frequency ranges or generate sufficient levels of noise to be considered as potential sources of noise-related injury or disturbance to harbour porpoise, bottlenose dolphin and grey and harbour seal, and have been screened out of further consideration, as indicated in

Based on the information provided in, the potential noise sources associated with the Sceirde Rocks Offshore Wind Farm site investigations that are considered relevant to harbour porpoise, bottlenose dolphin and grey and harbour seal are:

- Ultra Low Baseline Positioning System (USBL);
- Sub-bottom profiling SBP; and
- Ultra High Resolution Seismic (UHRS).

Table 4-6 Overview of potential impacts of marine survey equipment

ACTIVITY / EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{PEAK} (DB RE 1 1µPA)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	CONSIDERED FURTHER IN THIS ASSESSMENT?
Vessels and Vehicles						
Survey vessels	Various	Propellers, engines, and propulsion activities form the primary noise sources of survey vessels. Vessel noise is generally continuous and comes in both narrowband and broadband emissions. Potential impacts depend on the duration of the survey activities, location of the survey routes and species of cetacean potentially present in the vicinity of the Foreshore Licence Area.	Acoustic energy from vessels is strongest at frequencies <1 kHz	N/A	<50 m length vessel = 160 – 175 >50 m length vessel = 165 – 185	No –The noise source levels associated with vessels are likely to be too low to result in injury, and the presence of a small number of survey vessels in the region does not constitute a change from baseline conditions.
Remotely Operated Vehicle (ROV)	Various	Potential impacts include disturbance from noise emissions associated with movements underwater. However, these are anticipated to be limited in scale, given the small size of the submerged vehicles. Collision risk is considered an unlikely impact, given the high level of manoeuvrability and slow movement associated with ROVs.	N/A	N/A	N/A	No – the predominant noise source during such activities is the USBL, and other geophysical survey sensors deployed on the vehicle, which is expected to mask any sound generated by the vehicle itself. Noise generated by geophysical survey devices has been considered separately (see below).
Marine Survey Equipment (noise emitting)						
Ultra-Low Baseline (USBL) positioning	HIPAP 501	USBL systems involve the emission of impulsive sound from a hull-mounted transducer to a subsea transponder, thereby introducing sound into the marine environment. The potential impacts of this sound on harbour porpoise, bottlenose dolphin and grey and harbour seal depends upon the	19.5 – 33.5	170 – 207	165 – 190	Yes – The pressure levels and frequencies at which the USBL operate are not of a level where injury is expected but have the

ACTIVITY / EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{PEAK} (DB RE 1 1µPA)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	CONSIDERED FURTHER IN THIS ASSESSMENT?
system		abundance, distribution and sensitivity of the species, and the duration of the operations.				potential to cause disturbance to harbour porpoise, bottlenose dolphin and grey and harbour seal.
Side Scan Sonar (SSS)	Edge Tech 4200/4205	Side-scan sonar equipment produces impulsive sound emissions through high frequency pulses used to image the seabed habitat. Potential impacts to harbour porpoise, bottlenose dolphin and grey and harbour seal depend upon the frequency, location, and duration of the pulses.	300 – 900	190 - 230	187 – 227	No – The SSS used for the proposed survey operations will operate at frequencies above 300 kHz. This is above the hearing threshold of all marine mammals which may be present in the area (as detailed in Table 4-5. Hence no potential for injury or disturbance exists (NOAA, 2018).
Multibeam echosounder (MBES)	R2Sonic 2024; EM 2040	High frequency noise pulses created by multi-beam echo sounder equipment generate sound waves which produce impulsive underwater noise. Depending on the frequency of the pulses, location and duration of the operations, and the species present, there could be potential impacts on harbour porpoise, bottlenose dolphin and grey and harbour seal.	200 – 700	180 – 240	177 – 227	No – The MBES used for the proposed survey operations will operate at frequencies above 200 kHz. This is above the hearing threshold of all marine mammals which may be present in the area, as detailed Table 4-5 Hence no potential for injury or disturbance exists (NOAA, 2018).

ACTIVITY / EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{PEAK} (DB RE 1 1µPA)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	CONSIDERED FURTHER IN THIS ASSESSMENT?
Sub-bottom profiling (SBP)	EdgeTech 2000 series (Chirp) Innomar SBP 2000 series (Pinger)	Sub-bottom profiling involves the vertical emission of sound pulses (impulsive noise) to characterise the layers of sediment comprising the seabed. Such activities introduce noise emissions into the marine environment. The potential impacts of this sound depend upon the type of profiler technology used, as well as the abundance, distribution and sensitivity of the species, and the duration of the operations. There are numerous SBP technologies may be deployed during the survey operations including; pingers, chirpers and parametrics.	0.5 – 12 (chirp) 4 (pinger) 100 (pinger)	200 – 230 (chirp) 200 – 235 (pingers)	197 – 227 (chirp) 197 – 232 (pingers)	Yes – The frequencies of the noise emissions are within marine mammal hearing ranges and the source pressure levels may pose a risk of injury and disturbance to harbour porpoise, bottlenose dolphin and grey and harbour seal.
Ultra-High-Resolution Seismic (UHRS) System	The Dura-Spark; The Dura-Spark UHD 240/400	An Ultra-High Resolution Seismic (UHRS) system is optimised to achieve a sub-bed penetration depth focusing on the depth range of 10–1000 m below seafloor. This technology requires a controlled seismic source of energy connected by high voltage cable to a sound source (boomer or sparker) that transfers the energy through the water to penetrate the seabed. The energy reflected back from the solid seabed layers is received by hydrophones on the sea surface, recorded and processed by a data acquisition system aboard a vessel, so that visual profile of the seabed can be created.	0.1 – 6 (sparker/ boomer)	216 – 250 (sparker/ boomer)	213 – 247	Yes – The frequency of the noise emissions is within marine mammal hearing ranges and the source pressure level may pose a risk of injury and disturbance to harbour porpoise, bottlenose dolphin and grey and harbour seal.

4.4.4 Impact thresholds

4.4.4.1 Injury

The DAHG Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (NPWS, 2014), alongside other guidance such as that from Marine Scotland (2014) recommend using injury criteria proposed by Southall et al. (2007), which is based on a combination of linear (un-weighted) peak sound pressure levels (SPL) and weighted sound exposure levels (SEL). Since the publication of this seminal paper, there has been mounting evidence of marine mammal auditory abilities in novel species which has led to amendments to the auditory thresholds for injury (NOAA, 2018; Southall et al.; 2019). In accordance with recent regulator feedback, these amended hearing groups and thresholds for acoustic injury have been adopted herein.

Injury criteria proposed by NOAA (2018) are devised for two different types of sound:

- Impulsive: sounds which are short in duration (i.e. less than 1 second long) and temporary, occupy a broadband bandwidth, and have rapid rise and decay times with a high peak pressure level; and
- Non-impulsive: sounds which may occupy a broadband, narrowband or tonal bandwidth, can be brief, prolonged, continuous or intermittent in nature, and are not characterised by rapid rise and decay times or a high peak pressure level.

The geophysical, benthic and geotechnical surveys will comprise acoustic equipment which emits multiple pulsed sound, as detailed within Table 4-6.

The noise emitted from the equipment listed in Table 4-6 will disperse through the water column, with sound pressure reducing as distance from the noise source increases, hence marine mammals will be exposed to a lower source pressure further from the noise source. Therefore, for the survey equipment with potential to cause injury or disturbance to marine mammals, the dispersion of noise through the water column has been modelled to assess the appropriate mitigation zone in which the source pressure levels received by marine mammals are reduced below potentially injurious levels.

A duel-metric approach has been adopted which identifies the range of potential injury to marine mammals which have been derived from the source level including the peak pressure and cumulative SELs experienced for each equipment type identified to require consideration for noise-related injury (see Table 4-6). The thresholds above which each marine mammal and pinniped hearing group may experience noise-related injury are presented in Table 4-7. These thresholds are derived from measurements of marine mammal hearing using weighting functions which account for peak hearing abilities for each hearing group (NOAA, 2018).

Table 4-7 Criteria considered in this assessment for the onset of injury in marine mammals from impulsive noise (NOAA, 2018; Southall et al., 2019)

MARINE MAMMAL HEARING GROUP[2]	IMPULSIVE NOISE		NON-IMPULSIVE NOISE
	Peak Pressure (dB re 1 µPa)	Cumulative SEL (dB re 1 µPa^{2}s)	Cumulative SEL (dB re 1 µPa^{2}s)
Low-frequency (LF) cetaceans	219	183	199
High-frequency (HF) cetaceans	230	185	198
Very high-frequency (VHF) cetaceans	202	155	173
Phocid pinnipeds (underwater)	218	185	201

4.4.4.2 Disturbance

Significant disturbance may occur when there is a risk of a considerable proportion of animals from a population incurring sustained or chronic disruption of behaviour or becoming displaced from an area, with subsequent redistribution being substantially different from that occurring due to natural variation.

To consider the possibility of disturbance resulting from the proposed site investigations, it is necessary to consider both the likelihood that the sound could cause disturbance and the likelihood that sensitive receptors (marine mammals) will be exposed to that sound. Southall *et al.* (2007) recommended that the only currently feasible way to assess whether a specific sound could cause disturbance is to compare the circumstances of the situation with empirical studies.

Auditory thresholds for disturbance, as defined by the National Marine Fisheries Service (NMFS, 2014), coupled with behavioural response criteria detailed in Southall et al. (2007) have been adopted for the assessment of potential marine mammal disturbance from both non-impulsive and impulsive noise sources. These thresholds (provided in in SPLrms) and behavioural response severity ratings are detailed in Table 4-8.

Table 4-8 Disturbance threshold criteria for impulsive sounds (Southall et al., 2007; NMFS, 2014).

BEHAVIOURAL EFFECT	THRESHOLD CRITERIA SPL_{RMS} (DB RE 1 MPA)
Potential strong behavioural reaction (6 or more on the severity scale)	160

[2] *Hearing groups have been defined using the naming conventions provided in Southall et al. (2019), which are based on accepted frequency ranges commonly used in acoustics; however, the groupings and their respective criteria do not differ from NOAA (2018).*

4.4.5 Underwater noise modelling approach

Underwater modelling has been undertaking using Xodus' SubsoniX noise model which was developed specifically for assessing environmental impacts due to underwater noise. The SubsoniX model approach is based on an extended version of the semi-empirical model developed by Marsh-Schulkin (Marsh and Schulkin, 1962). The sound propagation model uses several concepts including:

- Refractive cycle, or skip distance;
- Geometric divergence;
- Deflection of energy into the bottom at high angles by scattering from the sea surface;
- A simplified Rayleigh two-fluid model of the bottom for sand or mud sediments; and
- Absorption of sound energy by molecules in the water.

The following inputs are required to the model:

- Third-octave band source sound level data;
- Discreet range (distance from source to receiver);
- Water column depth and sediment layer depth;
- Sediment type (sand/mud);
- Sea state; and
- Source directivity characteristics.

The model is based on a combination of acoustic theory and empirical data from around 100,000 measurements and has been found to provide good predictions.

The duel-metric assessment approach disseminated in National Oceanic and Atmospheric Administration (NOAA, 2018) has been used to estimate injury impact range from: (1) the peak SPL; and (2) the weighted cumulative SEL criteria. The SEL represents the total energy produced by a noise-generating activity standardised to a one-second interval. This enables comparison of the total energy attributed to different activities with different inter-pulse intervals. As detailed in Table 4-5, empirically-based weighting functions (NOAA, 2018; Southall et al., 2019) have been applied to the modelling outputs to account for peak hearing sensitivity for the respective marine mammal hearing groups.

The following assumptions have been applied to the models:

- Maximum reported SPLs for all equipment have been used;
- Maximum pulse length and minimum turn around has been used where provided;
- Where data is unavailable, the time between pulses has been calculated as 1.5 times the ping length;
- Vessels are moving at slow speeds; and
- Survey equipment likely to be used in the shallow water environment (i.e. <10 m) will be very high frequency to provide better resolution and will have a lower SPL, and so does not constitute a worst-case scenario.

The directivity characteristics of the sound sources are also an important factor affecting the received sound pressure levels from noise-generating activities. In geophysical surveys, source arrays are designed so that the majority of acoustic energy is directed downwards towards the ocean floor for data collection purposes. As such,

the amount of energy emitted across the horizontal plane is significantly less (20 dB +) than that emitted directly downwards (Richardson et al, 1995). Due to the frequency-dependent nature of sound, the loss of pressure on the horizontal plane is more pronounced at higher frequencies than at lower frequencies. Directivity corrections can be applied to the model outputs, which provide broadband normalised amplitudes at varying angles of azimuth[3] and dip angle[4]. Directivity corrections have been applied to the modelling outputs under the assumption that the animal is directly in-line with the vessel.

As detailed in Section 4.4.4.2, the disturbance threshold uses the SPLrms metric, and hence needs to be evaluated against equipment source levels in SPLrms. It is important to note that the rms value associated with the SPLrms depends upon the length of the integration window used. Using a longer duration integration window results in a lower rms than produced by a shorter integration window.

An acoustic phenomenon results from the elongation of the waveform with distance from the source due to a combination of dispersion and multiple reflections. Measurements presented by Breitzke et al. (2008) indicate elongation of the T90 window up to approximately 800 m at 1 km. This temporal "smearing" reduces the rms amplitude with distance by elongating the rms window and has been included within the disturbance modelling scenarios. Since the auditory organs of most marine mammals integrate low frequency sounds over an acoustic window of around 200 ms (Madsen et al., 2006 and references therein), this duration was used as a maximum integration window for the received SPLrms.

4.4.6 Injury impacts

For the proposed site investigations, the expected frequency range of noise emissions from the SBP, UHRS and USBL operations overlap with the hearing range of all cetacean hearing groups (Table 4-5 and Table 4-6). Potential injury to cetaceans (i.e. injury which results from a permanent threshold shift in hearing abilities) is limited to impulsive noise sources which exceed the injury thresholds defined in Table 4-7.

Modelling of ranges at which injury impacts are likely to result from deployment of survey equipment has been undertaken, as described in Section 4.4.5. Example equipment has been selected to exemplify the realistic worst-case scenario for each survey technique, including the maximum SPLs across source frequencies meant to encapsulate the hearing abilities of all representative hearing groups. Impacts from noise sources which are strictly behavioural in nature (i.e. disturbance impacts) are covered in Section 4.4.7.

The hearing groups relevant to the SACs with connectivity to the Sceirde Rocks Offshore Wind Farm site investigations are:

- High-frequency cetaceans (HF) = bottlenose dolphin;
- Very high frequency cetaceans (VHF) = harbour porpoise; and
- Phocid carnivores in water (PW) = grey and harbour seal

[3] The azimuth is taken as the angle of circumference around the boat which lies parallel to the surface of the water, progressing around the boat from port to starboard.
[4] The dip angle is taken as the angle under the boat, progressing from prow to stern.

Table 4-9 Noise modelling results for injury impacts from impulsive noise sources (N/E = no exceedance of thresholds)

ACTIVITY	FREQUENCY (KHZ)	PEAK SPL (DB RE 1µPA)	DEPTH (M)[5]	INJURY RANGE (M)											
				Weighted Cumulative SEL (Static Mammals)				Weighted Cumulative SEL (Moving Mammals)				Unweighted Peak SPL			
				VHF	HF	LF	PW	VHF	HF	LF	PW	VHF	HF	LF	PW
SBP	0.5 - 12	230	100	40	38	38	38	38	38	38	38	61	3	8	9
			10	5	4	4	4	5	4	4	4	73	4	13	15
	4	235	100	9	5	9	9	9	5	6	5	255	28	68	73
			10	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E	445	98	178	188
	100	235	100	28	17	17	17	19	17	16	17	30	12	17	18
			10	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E	29	11	16	17
USBL	19.5 – 33.5	207	100	43	8	4	5	38	2	1	1	3	N/E	N/E	N/E

[5] *These depths have been identified as representative of the nearshore and offshore depths in which surveys are likely to occur across the survey area, based on available bathymetry data.*

ACTIVITY	FREQUENCY (KHZ)	PEAK SPL (DB RE 1µPA)	DEPTH (M)[5]	INJURY RANGE (M)											
				Weighted Cumulative SEL (Static Mammals)				Weighted Cumulative SEL (Moving Mammals)				Unweighted Peak SPL			
				VHF	HF	LF	PW	VHF	HF	LF	PW	VHF	HF	LF	PW
			10	4	4	2	3	4	2	N/E	N/E	3	N/E	N/E	N/E
UHRS[6]	0.1	250	100	10	N/E	44	41	2	N/E	44	13	511	17	63	70
			10	3	N/E	4	4	2	NE	4	4	559	19	71	80
	6	250	100	44	44	44	44	44	44	44	44	381	14	49	54
			10	4	4	4	4	4	4	4	4	412	15	55	62

[6] *Noise modelling for UHRS undertaken based on a ping range of 0.0003 – 0.0015 second ping length, with 0.0015s results presented to represent the realistic worst-case scenario.*

Across modelling scenarios and metrics, the injury ranges were generally highest for the VHF hearing group which is represented by harbour porpoise. Conversely, HF cetaceans seemed to constitute the hearing group with the lowest potential impact ranges for the peak SPL. Additionally, for both the SBP and USBL equipment, LF cetaceans largely displayed the lowest impact ranges for the cumulative SEL metrics, whereas HF cetaceans demonstrated the lowest impact ranges for both SEL metrics when considering use of the low frequency UHRS system.

Higher frequency sounds attenuate more quickly than lower frequency sounds such that an animal would need to be much closer to the sound source for it to cause injury. For this reason, injury ranges were of the order of metres to tens of metres for the SBP operating at 100 kHz.

The deployment of USBL in 100 m depths elevated the potential range of impact to a maximum of 43 m for VHFs, when considering cumulative SEL metric. However, in order for the cumulative SEL threshold to be exceeded, an animal would have to remain within 43 m of the source for a sustained period. The likelihood of a cetacean remaining this close to operational equipment is extremely low when considering that the source is deployed from a moving vessel travelling at more than 2ms 1 (i.e. 4 knots) and, in some cases, is being towed at depth (e.g. a USBL may be mounted on a an ROV within a few metres of the seabed). Whilst USBL may be deployed from a stationary vessel during particular activities (e.g. seabed sampling), these are anticipated to be limited in duration. As such, a realistic risk of injury is not expected from the use of USBL, and no marine mammal mitigation is proposed for USBL operations therefore USBL is not considered further.

The greatest injury ranges to harbour porpoise, bottlenose dolphin, grey and harbour seal during shallow water operations (i.e. 10m) came from both the UHRS operating at 0.1 kHz, and SBP operating at 4 kHz, wherein refraction off the seabed causes nearly immediate cylindrical spreading of noise emissions, causing the sound to travel farther along the horizontal plane of the water column more quickly. The deployment of the UHRS survey equipment in 10 m depths elevated the potential range of impact to a maximum of 559 m for VHF cetaceans. Whereby, the SBP operating at 4 kHz in shallow waters demonstrated a maximum impact range of 445 m for VHF cetaceans.

Whilst deployment of a very low frequency UHRS system and a low frequency SBP in nearshore waters constitutes a worst-case situation of the potential injury range attributable to the survey techniques, these scenarios are highly unlikely. Geophysical survey technologies generally employ higher frequency sounds in shallow waters where sound loss to absorption and transmission are much lower. As such, sound penetration below the seabed is achievable at lower powers and higher frequencies, which offer higher resolution imagery to the surveyor. Furthermore, when considering the directionality of the equipment, the impact ranges are further reduced. This is because the beam of sound generated by the equipment is directed downward towards the seabed, so the vast majority of power is contained within a roughly 40° angle from the source (the slant height of the conical noise source) to maximise penetration and the resultant imagery. Animals would need to be at the seabed below the noise source to experience the full sound levels behind the modelled impact ranges.

The majority of injury ranges were at least slightly reduced when considering animal movement during cumulative SEL estimation. Swim speeds of the species most likely to be observed in the area have been shown to be several ms- 1 (e.g. harbour porpoise may swim up to 4.3 ms-1) (Otani et al., 2000). Furthermore, SNH (2016) has provided standard values for mean swimming speeds of various marine mammal species likely to occur in the project area,

including harbour porpoise (1.4 ms-1; Westgate et al., 1995) and harbour / grey seal (1.8 ms-1; Thompson, 2015). To offer a representative model of the predicted noise exposure ranges of marine mammals moving away from the sound source, a mean swim speed of 1.5 ms-1 has been used in the calculations. Considering that the surveys themselves will take place while the vessel is moving, the cumulative SELs of all equipment types are expected to be even lower based on the premise that animals are likely to move away from the mobile noise source at some angle opposing the direction of vessel travel

It should also be noted that the modelling scenarios are meant to define the worst-case injury ranges associated with the deployment of the project's survey equipment. The in-situ deployment of the noise-generating survey equipment will most frequently occur in waters of intermediate depths (i.e. somewhere between 10-100 m). Moreover, the frequency ranges depicted constitute the lowest and highest reasonably practicable settings for the survey activities modelled, meaning that the spread of sound in the marine environment is also likely to fall somewhere between the modelled extremes. The injury ranges anticipated to result from equipment use are thus likely to fall within the spectrum of those defined by the model outputs, thereby reducing the impact ranges associated with the low frequency survey equipment.

4.4.7 Disturbance

In addition to physical injury, noise emissions have the potential to affect the behaviour of cetaceans and pinnipeds in the vicinity of the noise source. Significant or strong disturbance (see Table 4-8; Southall *et al.*, 2007) may occur when an animal is at risk of a sustained or chronic disruption of behaviour or habitat use resulting in population-level effects. An assessment of potential disturbance impacts from the SBP, USBL and UHRS operations is provided below. The outputs of the noise modelling assessment against the disturbance thresholds relative to SPL_{rms} values for the survey equipment are provided in Table 4-10.

Table 4-10 Noise modelling results for disturbance impacts from impulsive noise sources

ACTIVITY	FREQUENCY (KHZ)	SPL_{RMS} (DB RE 1µPA)	DEPTH (M)	RANGE OF BEHAVIOURAL CHANGE (M)
SBP	0.5 - 12	227	100	3,250
			10	2,750
	4	232	100	4,220
			10	3,120
	100	232	100	125
			10	120
USBL	19.5 – 33.5	190	100	9.0
			10	9.1
UHRS	0.1	247	100	2,100
			10	2,300

ACTIVITY	FREQUENCY (KHZ)	SPL_{RMS} (DB RE 1µPA)	DEPTH (M)	RANGE OF BEHAVIOURAL CHANGE (M)
	6	247	100	1,450
			10	1,700

SBP, USBL and UHRS survey activities have the potential to generate a strong disturbance event. The potential for a disturbance impact to result from these types of technology varies between activity type, though, the predicted disturbance range is much greater for the low frequency noise sources which travel further within the marine environment. The sounds emitted by the SBP (operating at 0.5 – 12 kHz or at 4 kHz) and UHRS (operating between 0.1 – 6 kHz) form the lower frequency sounds and have the potential to generate disturbance impacts on the order of several km, whilst those from the USBL and higher frequency (i.e. 100 kHz) SBP are on the order of tens to a hundred metres (Table 4-10).

As the survey vessel will not be stationary for prolonged periods during these activities, animals within a particular area will not be exposed to extended periods of underwater noise. Rather, individuals would have to follow the moving equipment to be subjected to lasting or prolonged periods of noise which may have detrimental effects at the individual or population level (i.e. a significant disturbance), which is highly unlikely.

The survey activities are anticipated to be completed in periods of 2-3 months, and within this time there will be periods of inactivity during weather downtime. Given the transient and short-term nature of the survey and vessel activities, it is highly unlikely that any disturbance impacts from use of the UHRS, USBL or SBP would negatively impact upon conservation objective of harbour porpoise, bottlenose dolphin, grey seal or harbour seal. This is on the basis that the modelled level of disturbance is unlikely to affect the ability of any individual animal to survive or reproduce.

4.4.8 Screening conclusion

In the absence of mitigation, all of the survey equipment modelled have the potential to cause injury and disturbance to harbour porpoise, bottlenose dolphin, grey seal and harbour seal therefore the potential for likely significant effect cannot be ruled out. The following SACs will be taken forward to a Stage 2 Appropriate Assessment to consider the likely significant effect from injury impacts from the use of geophysical survey equipment:

SITE NAME (SAC)	QUALIFYING INTEREST			
	Harbour porpoise	Bottlenose dolphin	Harbour seal	Grey seal
Blasket Islands	Y	-	-	Y
Duvillaun Islands	-	-	-	Y

SITE NAME (SAC)	QUALIFYING INTEREST			
	Harbour porpoise	Bottlenose dolphin	Harbour seal	Grey seal
Galway Bay Complex	-	-	Y	-
Inishbofin and Inishshark	-	-	-	Y
Inishkea Islands	-	-	-	Y
Kilkieran Bay and Islands	-	-	Y	-
Roaringwater Bay and Islands	Y	-	-	Y
Slieve Tooey/Tormore Island/Loughros Beg Bay	-	-	-	Y
Slyne Head Islands	-	Y	-	Y
Slyne Head Peninsula	-	Y	-	-
West Connacht Coast	-	Y	-	-

For these sites where it cannot be concluded that there will be no LSE, the Competent Authority (in this case the Minister for Housing, Local Government and Heritage) is required to carry out an Appropriate Assessment under and in accordance with Regulation 42 of the Habitats Regulations, of the Sceirde Rocks Offshore Wind Farm site investigations to ascertain whether or not they would have an adverse effect on the integrity of a European site. This Appropriate Assessment will be informed by information provided in the Natura Impact Statement (Document Reference L100725-S00-A-REPT-007) that has been produced and submitted alongside this Foreshore Licence application.

4.4.9 In-combination assessment

With regard to underwater noise in-combination effects with other offshore projects, the effects are anticipated to comprise mostly other offshore survey campaigns including those for other marine renewable energy projects, offshore cable installation projects or future surveys conducted by other marine or coastal developments. Survey campaigns associated with other offshore projects may share a common pathway of impact in terms of underwater noise from vessels, coring, and geophysical survey equipment (SBP, UHRS, USBL).

A review of the DHLGH Foreshore Licence Applications and Determinations search tool (Department of Housing, Local Government and Heritage (DHLGH), January 2022), was undertaken for foreshore licence applications for projects in 'County Galway' and 'County Clare'. This is considered a conservative approach in this instance, taking into account the very temporary and localised nature of the Sceirde Rocks Offshore Wind Farm site investigation activities proposed under this application.

Details of these projects, their interaction with the site investigation activities proposed under this Foreshore Licence Application and the potential for likely in-combination effects is set out in Table 4-11.

Table 4-11 Projects for consideration of likely in-combination effects

APPLICANT	FSL APPLICATION NUMBER	FORESHORE LICENCE STATUS	ACTIVITY	DISTANCE FROM SCEIRDE ROCKS FSL AREA	POTENTIAL FOR IN-COMBINATION EFFECTS	SCREENING OUTCOME
Connemara Organic Seaweed	FS006002	Consultation	Seaweed harvesting	25km	No spatial overlap and no pathway for in-combination underwater noise impacts from the site investigation activities	Screened out
Deep Sea Fibre Networks	FS007016	Consultation	Cable route survey and site investigations for subsea fibre optic cable	<5km	No spatial overlap but due to the site investigation activities under both applications there is a pathway for in-combination underwater noise impacts should they be undertaken in the same time period.	Screened in
Galway County Council	FS007056	Consultation	Emergency repairs and fortification of coastal protection works	>50km	No spatial overlap and no pathway for in-combination underwater noise impacts from the site investigation activities.	Screened out
Galway County Council	FS005977	Consultation	Re-alignment of N59	>50km	No spatial overlap and no pathway for in-combination underwater noise impacts from the site investigation activities.	Screened out
Irish Water	FS007085	Consultation	Borehole site investigations to inform design of	10km	No spatial overlap and no pathway for in-combination underwater noise impacts from the site investigation activities.	Screened out

APPLICANT	FSL APPLICATION NUMBER	FORESHORE LICENCE STATUS	ACTIVITY	DISTANCE FROM SCEIRDE ROCKS FSL AREA	POTENTIAL FOR IN-COMBINATION EFFECTS	SCREENING OUTCOME
			Roundstone Sewerage Scheme			
Marine Institute – Spiddal	FS006566	Consultation	Testing of prototype wind, wave and tidal energy devices	35km	No spatial overlap but due to the site investigation activities under both applications there is a pathway for in-combination underwater noise impacts should they be undertaken in the same time period.	Screened in
Clare County Council	FS006666	Consultation	Coastal protection works and repair of seawall	>50km	No spatial overlap and no pathway for in-combination underwater noise impacts from the site investigation activities.	Screened out
DesignPro Cahiracon Quay	FS007081	Consultation	Testing of tidal power generating devices	>100km	No spatial overlap and due to the significant distance between application areas there is no pathway for in-combination underwater noise impacts from the site investigation activities.	Screened out
ESB Moneypoint	FS007141	Consultation	Ecology surveys in the form of 9 grab samples	85km	No spatial overlap and due to the significant distance between application areas there is no pathway for in-combination underwater noise impacts from the site investigation activities.	Screened out

APPLICANT	FSL APPLICATION NUMBER	FORESHORE LICENCE STATUS	ACTIVITY	DISTANCE FROM SCEIRDE ROCKS FSL AREA	POTENTIAL FOR IN-COMBINATION EFFECTS	SCREENING OUTCOME
Shannon Airport Authority	FS007036	Applied	Refurbishment of flood defences	>100km	No spatial overlap and due to the significant distance between application areas there is no pathway for in-combination underwater noise impacts from the site investigation activities.	Screened out

Based on the evaluation provided in Section 4.4.4, at this stage it is not possible to exclude the potential for likely significant effect from underwater noise from the Sceirde Rocks Offshore Wind Farm site investigations in combination with the following projects:

- Deep Sea Fibre Networks (FS007016);
- Marine Institute – Spiddal (FS006566).

In addition, from a review of 4C offshore website (https://map.4coffshore.com/offshorewind/, visited January 2022), the following offshore wind farm projects located on the west coast of IrelandArea do not have foreshore licences available on the DHLGH website (with their distance from the Foreshore Licence Area stated):

- Ilen Offshore Wind Farm (approx. 45km);
- Inis West 2 Offshore Wind Farm (approx. 50km);
- Clarus Offshore Wind Farm (approx. 55km);
- Moneypoint Offshore Two (approx. 85km);
- Moneypoint Offshore One (approx. 90km); and
- Inis West 1 Offshore Wind Farm (approx. 95km).

Therefore, in order to take a precautionary approach, potential survey activities for these projects will also be considered further in an in-combination effect assessment.

There are no other projects of relevance which are capable of combining with the Sceirde Rocks Offshore Wind Farm site investigation activities to give rise to in-combination likely significant effects.

5 CONCLUSIONS

This document is submitted to assist the competent authority, the Minister for Housing, Local Government and Heritage (DHLGH), in undertaking an appropriate assessment screening to determine whether there is potential for the site investigation activities for the Sceirde Rocks Offshore Wind Farm, either individually or in-combination with other plans or projects, in view of best scientific knowledge and in view of the conservations objectives of a site, to have a Likely Significant Effect (LSE) on a European site (i.e. SAC or SPA, including draft, candidate and proposed sites).

Based on the best scientific knowledge and evidence provided in Section 4.3, the only source of impact from the site investigations that had a pathway with connectivity to the protected sites identified was the generation of underwater noise and potential impacts on marine mammals.

Harbour porpoise was identified as a relevant feature (receptor) of two SACs (Blasket Islands SAC and Roaring Bay and Islands and SAC) with pathways for connectivity with regard to underwater noise.

Bottlenose dolphin was also identified as a relevant feature of three SACs (Slyne Head Islands SAC, Slyne Head Peninsula SAC and West Connacht Coast SAC).

Grey seal was identified as a relevant feature (receptor) of seven SACs (Blasket Islands; Duvillaun Islands; Inishbofin and Inishshark; Inishkea Islands; Slieve Tooey/Tormore Island/Loughros Beg Bay; Roaringwater Bay and Islands and Slyne Head Island) with pathways for connectivity with regard to underwater noise.

Harbour seal was identified as a relevant feature (receptor) of two SACs (Kilkieran Bay and Islands and Galway Bay Complex) with pathways for connectivity with regard to underwater noise.

Based on the best scientific knowledge and evidence, and in the absence of mitigation measures, the potential for likely significant effect cannot be excluded as underwater noise from survey equipment have the potential to cause injury and disturbance to harbour porpoise, bottlenose dolphin, grey seal and harbour seal. The following SACs will be taken forward to a Stage 2 Appropriate Assessment:

SITE NAME (SAC)	QUALIFYING INTEREST			
	Harbour porpoise	Bottlenose dolphin	Harbour seal	Grey seal
Blasket Islands	Y	-	-	Y
Duvillaun Islands	-	-	-	Y
Galway Bay Complex	-	-	Y	-
Inishbofin and Inishshark	-	-	-	Y
Inishkea Islands	-	-	-	Y
Kilkieran Bay and Islands	-	-	Y	-

SITE NAME (SAC)	QUALIFYING INTEREST			
	Harbour porpoise	Bottlenose dolphin	Harbour seal	Grey seal
Roaringwater Bay and Islands	Y	-	-	Y
Slieve Tooey/Tormore Island/Loughros Beg Bay	-	-	-	Y
Slyne Head Islands	-	Y	-	Y
Slyne Head Peninsula	-	Y	-	-
West Connacht Coast	-	Y	-	-

For these sites where it cannot be concluded that there will be no LSE, the Competent Authority (in this case the Minister for Housing, Local Government and Heritage) is required to carry out an Appropriate Assessment of the Sceirde Rocks Offshore Wind Farm site investigations to ascertain whether or not they would have an adverse effect on the integrity of a European site. This Appropriate Assessment will be informed by information provided in the Natura Impact Statement (Document Reference L100725-S00-A-REPT-007) that has been produced and submitted alongside this Foreshore Licence application.

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APPENDIX A SAC SITES REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING (SECTION 4.4)

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
Blasket Islands [002172]	125.05 km	Harbour porpoise (*Phocoena phocoena*)	Maintain favourable condition	✓
		Reefs	Maintain favourable condition	✗
		Submerged or partially submerged sea caves	Maintain favourable condition	✗
		Grey seal (*Halichoerus grypus*)	Maintain favourable condition	✓
Duvillaun Islands [000495]	78.24 km	Grey seal (*Halichoerus grypus*)	Maintain favourable condition	✓
	25.81 km	Coastal lagoons	Restore to favourable condition	✗

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
Inishbofin and Inishshark [000278]		Oligotrophic waters with few minerals of sandy plains (*Littorelletalia uniflorae*)	Maintain favourable condition	✗
		North Atlantic wet heaths with Erica tetralix	Restore to favourable condition	✗
		European dry heaths	Restore to favourable condition	✗
		Grey seal (*Halichoerus grypus*)	Maintain favourable condition	✓
Kilkieran Bay and Islands [002111]	<1 km	Mudflats and sandflats not covered at low tide	Maintain favourable condition	✗
		Coastal lagoons	Maintain favourable condition	✗

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Large shallow inlets and bays	Maintain favourable condition	✕
		Reefs	Maintain favourable condition	✕
		Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Restore to favourable condition	✕
		Mediterranean salt meadows (*Juncetalia maritime*)	Restore to favourable condition	✕
		Machairs	Restore to favourable condition	✕
		Oligotrophic to mesotrophic standing waters with vegetation of *Littorelletea uniflorae* and/or *Isoeto-Nanojuncetea*	*Restore to favourable condition*	✕

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)	Maintain favourable conditions	✗
		Otter (*Lutra lutra*)	Restore to favourable condition	✗
		Harbour seal (*Phoca vitulina*)	Maintain favourable condition	✓
		Slender Naiad (*Najas flexilis*)	Maintain favourable condition	✗
Galway Bay Complex [000268]	43.11 km	Mudflats and sandflats not covered at low tide	Maintain favourable condition	✗
		Coastal lagoons	Restore to favourable condition	✗

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Large shallow inlets and bays	Maintain favourable condition	✕
		Reefs	Maintain favourable condition	✕
		Perennial vegetation of stony banks	Maintain favourable condition	✕
		Vegetated sea cliffs of the Atlantic and Baltic coasts	*Restore to favourable condition*	✕
		Salicornia and other annuals colonising mud and sand	Maintain favourable conditions	✕
		Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Restore to favourable condition	✕

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Mediterranean salt meadows (*Juncetalia maritime*)	Restore to favourable condition	×
		Turloughs	Maintain favourable condition	×
		Juniperus communis formations on heaths or calcareous grassland	Restore to favourable condition	×
		Semi-natural dry grassland and scrubland facies on calcareous substrates	Maintain favourable condition	×
		Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*	Maintain favourable condition	×
		Alkaline fens	Maintain favourable condition	×

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Limestone pavements	*Restore to favourable condition*	✗
		Otter (*Lutra lutra*)	Restore to favourable condition	✗
		Harbour seal (*Phoca vitulinal*)	Maintain favourable condition	✓
Slyne Head Islands [000328]	3.82 km	Reefs	Maintain favourable condition	✗
		Common bottlenose dolphin (*Tursiops truncatus*)	*Restore to favourable condition*	✓
		Grey seal (*Halichoerus grypus*)	Maintain favourable condition	✓

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
Inishkea Islands [000507]	81.41 km	Machairs	Restore to favourable condition	✗
		Grey seal (*Halichoerus grypus*)	Maintain favourable condition	✓
		Petalwort (*Petalophyllum ralfsii*)	Maintain favourable condition	✗
Slieve Tooey/Tormore Island/Loughros Beg Bay [000190]	172.99 km	Vegetated sea cliffs on the Atlantic and Baltic coasts	Maintain favourable condition	✗
		Embryonic shifting dunes	Maintain favourable condition	✗
		Shifting dunes along the shoreline with white dunes (*Ammophila arenaria*)	Restore to favourable condition	✗

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Fixed coastal dunes with grey dunes	*Restore to favourable condition*	×
		Decalcified fixed dunes with *Empetrum nigrum*	Maintain favourable condition	×
		Alpine and Boreal heaths	Restore to favourable condition	×
		Blanket bogs	Restore to favourable condition	×
		Narrow-mouthed Whorl Snail (*Vertigo angustior*)	Maintain favourable condition	×
		Atlantic decalcified dunes	Maintain favourable condition	×

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Otter (*Lutra lutra*)	Maintain favourable condition	✗
		Grey seal (*Halichoerus grypus*)	Maintain favourable condition	✓
Roaringwater bay and Islands [000101]	185.97 km	Large shallow inlets and bays	Maintain favourable condition	✗
		Reefs	Maintain favourable condition	✗
		Vegetated sea cliffs of the Atlantic and Baltic coasts	Maintain favourable condition	✗
		European dry heaths	*Restore to favourable condition*	✗

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Submerged or partially submerged sea caves	*Restore to favourable condition*	✗
		Harbour porpoise (*Phocoena phocoena*)	Maintain favourable condition	✓
		Otter (*Lutra lutra*)	Restore favourable condition	✗
		Grey seal (*Halichoerus grypusl*)	Maintain favourable condition	✓
Slyne Head Peninsula [002074]	4.84 km	Coastal lagoons	Restore to favourable condition	✗
		Large shallow inlets and bays	Maintain favourable condition	✗

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Reefs	Maintain favourable condition	×
		Annual vegetation of drift lines	Maintain favourable condition	×
		Perennial vegetation of stony banks	Maintain favourable condition	×
		Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Restore to favourable condition	×
		Mediterranean salt meadows (*Juncetalia maritime*)	Restore to favourable condition	×
		Embryonic shifting dunes	Restore to favourable condition	×

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Shifting dunes along the shoreline with white dunes	Restore to favourable condition	×
		Machairs	Restore to favourable condition	×
		Oligotrophic water containing very few minerals of sandy plains	Maintain favourable condition	×
		Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or Isoeto-Nanojuncetea	*Restore to favourable condition*	×
		Hard oligo-mesotrophic water with benthic vegetation of Chara spp.	Maintain favourable condition	×
		European dry heaths	Maintain favourable condition	×

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Juniperus communis formations on heaths or calcareous grasslands	Maintain favourable condition	✗
		Semi-natural dry grasslands and scrubland facies on calcareous substrates	Maintain favourable condition	✗
		Molinia meadows on calcareous, peaty or clayey-silt-laden soils	Maintain favourable condition	✗
		Lowland hay meadows	Maintain favourable condition	✗
		Alkaline fens	Maintain favourable condition	✗
		Common bottlenose dolphin (*Tursiops truncatus*)	*Restore to favourable condition*	✓

SAC NAME [SITE CODE]	DISTANCE FROM THE FORESHORE LICENCE AREA	MARINE FEATURES OF SITE DESIGNATION	CONSERVATION OBJECTIVE	RECEPTOR REQUIRING FURTHER EVALUATION IN APPROPRIATE ASSESSMENT SCREENING DUE TO POTENTIAL IMPACT FROM PLANNED UNDERWATER NOISE (SECTION 4.4)
		Petalwort (*Petalophyllum ralfsii*)	Maintain favourable condition	✗
		Slender Naiad (*Najas flexilis*)	Maintain favourable condition	✗
West Connacht Coast [002998]	9.84 km	Common bottlenose dolphin (*Tursiops truncatus*)	Maintain favourable condition	✓