



Fuinneamh Sceirde Teoranta

Sceirde Rocks Offshore Wind Farm Foreshore Licence Application Schedule of Activities

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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.

Sceirde Rocks Offshore Wind Farm is a fixed bottom offshore wind farm off the West Coast of Ireland and under the Transitional Protocol is recognised as a Relevant or Phase One project. As such, Sceirde Rocks Offshore Wind Farm is a high priority project and it is anticipated that this project will be prioritised through the Foreshore License process, the MAC award process and subsequently will be one of the first projects eligible for the first ORESS-1 auction. Sceirde Rocks Offshore Wind Farm will be targeting an accelerated delivery programme for this offshore project to meet government renewable energy targets pre-2030. This application specifically relates to a foreshore license for site investigation activities in the wind farm array area only.

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 below.

Sceirde Rocks Offshore Wind Farm Limited intends to undertake a survey campaign at the proposed Foreshore Licence Area in order to inform the location and design of the proposed offshore wind farm.

1.1 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 the new consenting regime for offshore renewable energy being legislated for through the Maritime Area Planning (MAP) Bill.

The Foreshore Licence Area site measures 141 km², and covers the intended area required to deliver a 450MW offshore wind farm project. This Foreshore Licence Area covers only the offshore array area. An additional foreshore licence application for the required offshore export cable route will be submitted separately in early 2022.

The Foreshore Licence Area is shown in Figure 1 with detailed site coordinates shown on Figure 2. This Sceirde Rocks Offshore Wind Farm Foreshore Licence Application consists of the following documentation:

- Investigative Foreshore Licence Application (Offshore Renewable Energy) Form;
- Schedule of Activities (this document);
- Report to inform Appropriate Assessment Screening (Document Reference L100725-S00-A-REPT-005);
- Environmental Assessment and Environmental Impact Assessment Screening Report (including Annex IV species risk assessment) (Document Reference L100725-S00-A-REPT-006); and
- Natura Impact Statement (Document Reference L100725-S00-A-REPT-007).

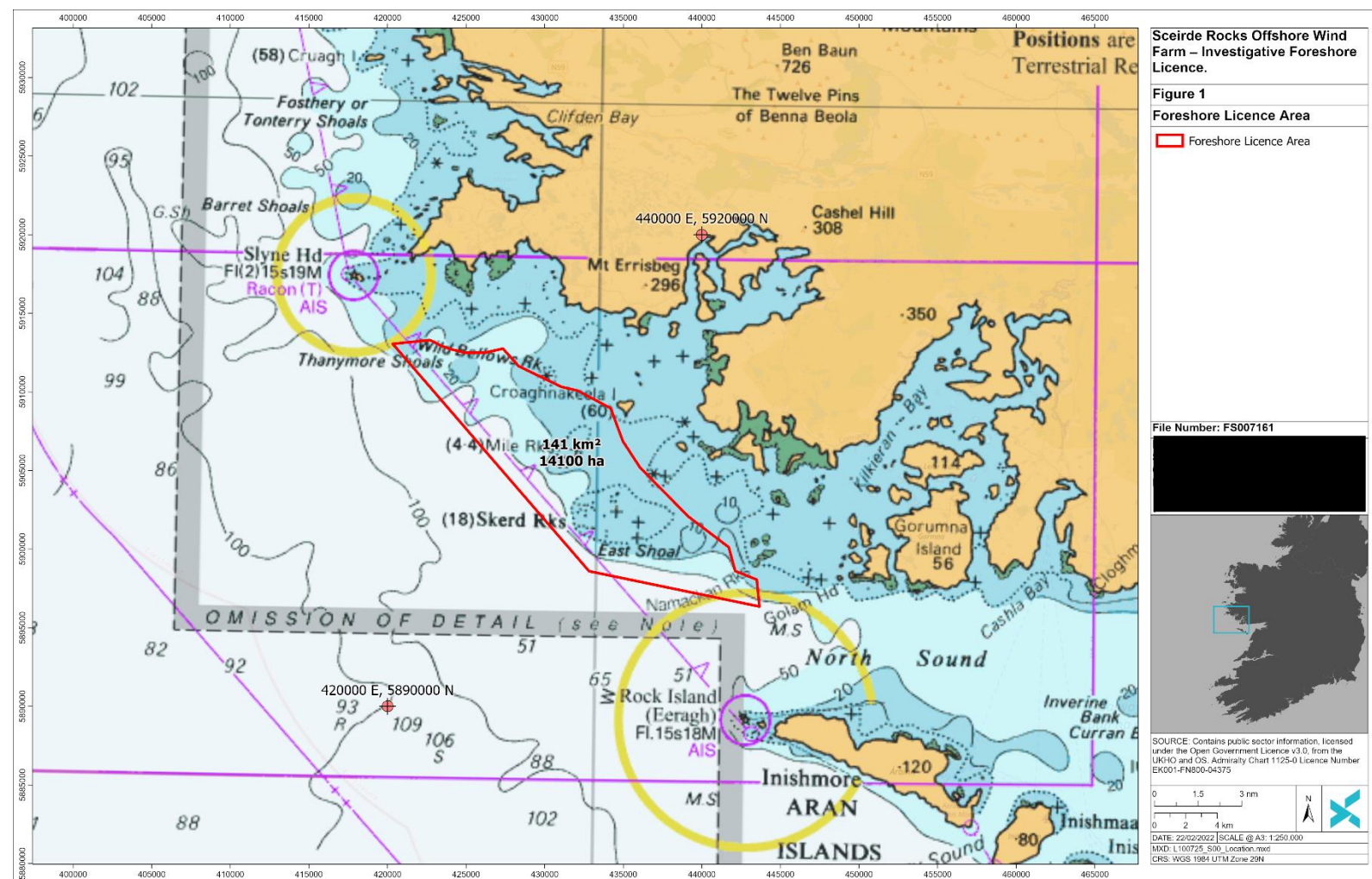


Figure 1 Foreshore Licence Area

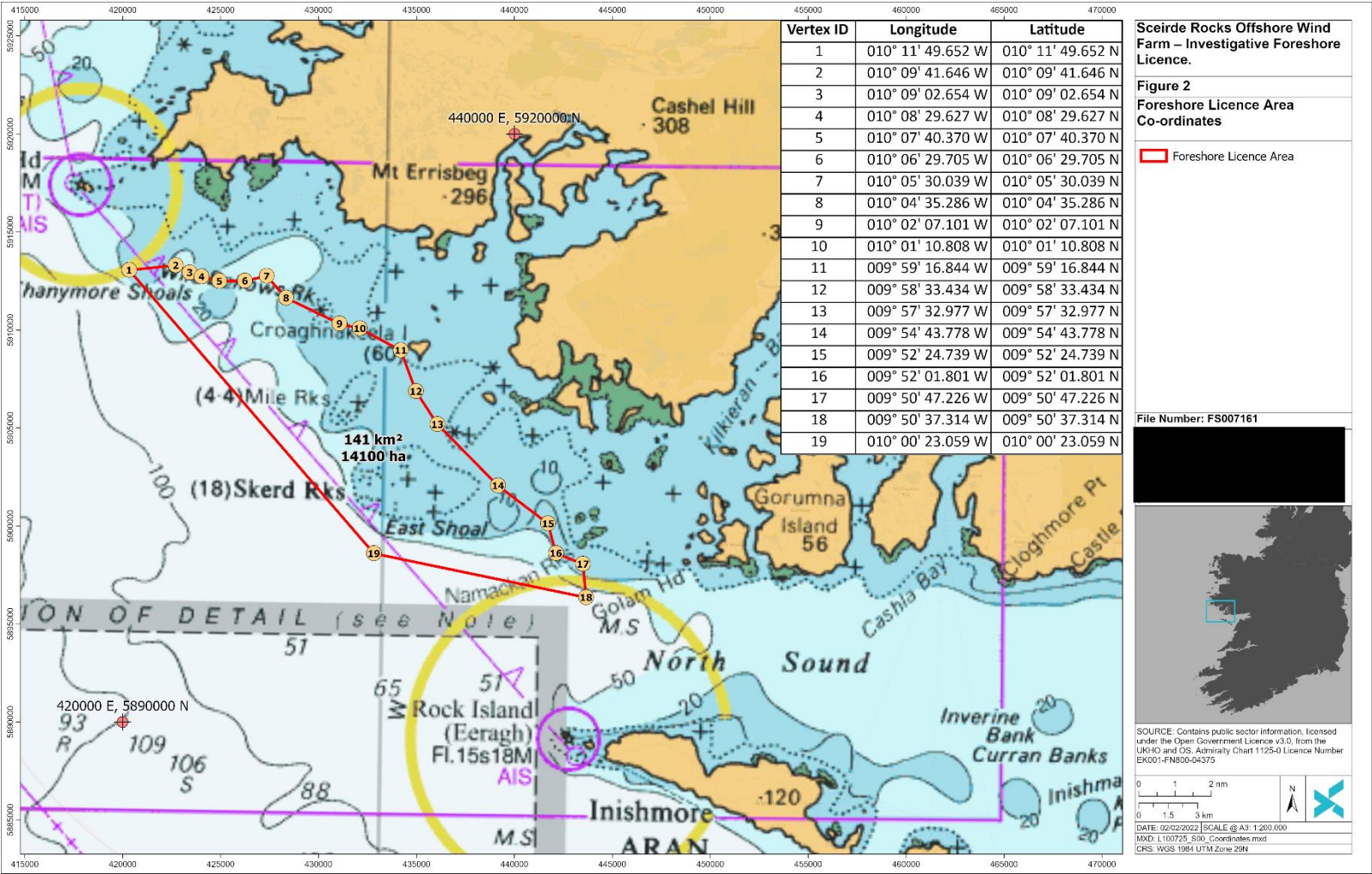


Figure 2 Foreshore Licence Area Co-ordinates

2 Site Investigation Activities

2.1 Summary of Proposed Surveys

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. A summary of the proposed programme of surveys to be undertaken within the Foreshore Licence Area can be found in Table 2-1 below and further discussed in Sections 3 to 7.

Table 2-1 Summary of Proposed Site Investigations included in Sceirde Rocks Offshore Wind Farm Foreshore Licence Application

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 typically 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 and geophysical	Contiguous acquisitions	Multi-sensor survey to include some of the following: multibeam echosounder (MBES), side scan sonar (SSS), magnetometer, sub-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



SURVEY	METHODS	PURPOSE AND SCOPE
		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 typically 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



3 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 3.1, Section 3.2 and Section 3.4) 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.
- Shallow sampling (potentially using Vibrocore techniques at up to 60 locations).

At this stage, exact 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.

3.1 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.

3.1.1 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.

3.1.2 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.

3.2 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.

3.3 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 typically range from 0.5 to 6m penetration and would extract a shallow sample for further lab testing and visual descriptions.

3.4 Cone Penetration Tests (CPT)

Seabed CPTs typically 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 typically 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.

3.5 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 typically emit pulses of medium frequency sound. The peak sound pressure level (SPL) was estimated as 207 dB re 1 μ Pa 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.

3.6 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 m³ per borehole.

3.7 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%



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
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%



4 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 9-1 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 4.1, 4.2, 4.3, 4.4 and 4.5) will be used in collaboration to ensure that a comprehensive understanding of the subsurface environment of the Foreshore Licence Area is obtained.

4.1 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 (Figure 4-1). 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.



Figure 4-1 Multibeam Echosounder (EM2040)

4.2 Side Scan Sonar (SSS)

Side Scan Sonar (SSS) is a towed sensor which is typically 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.



Figure 4-2 Example of a Towable Side Scan Sonar Data Device (EdgeTech)

4.3 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 $\pm 0.5\text{nT}$.

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 4-1



Table 4-1 Underwater Archaeology Unit Requirements for Magnetometer Survey

ACTIVITY	REQUIREMENTS FOR ARCHAEOLOGICAL PURPOSES
Side Scan Sonar	<ul style="list-style-type: none">Operational frequency of 200 to 700kHz.50m survey line spacing100% site coverage (overlap of areas may be required)
Magnetometer	<ul style="list-style-type: none">Caesium or proton magnetometer50m side spacing



Figure 4-3 Magnetometer Example (Geometrics)

4.4 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.



Figure 4-4 Example of Boomer Sub-Bottom Profiler



Figure 4-5 Example of Pinger Sub-Bottom Profiler

4.5 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 4.4.

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



Figure 4-6 Example of Sparker sub-bottom profiler

4.6 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

5 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.

5.1 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

5.2 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	30	1.4e-5%



6 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.

6.1 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. At this stage, exact 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

6.2 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, typically 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.

6.3 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%



7 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.

As presented in Table 2-1, 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 coincide with the proposed 20 geotechnical borehole locations outlined in Section 3, 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. Final locations of benthic grab samples will be confirmed following appointment of a suitable qualified survey contractor and review of geophysical survey data and can be provided to the DHLGH prior to survey mobilisation.

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 m². Therefore, the total area of seabed that would be directly affected by the grab sampling regime will be 16 m².

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

7.1 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%



8 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 8-1.

Table 8-1 *Geotechnical investigation vessel indicative parameters*

PARAMETER	VALUE
Registered tonnage	5,400 – 7,000 tonnes
Length	80-110m
Breadth	20-25m
Draft	6-8m

9 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 9-1 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 thrusters, 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 9-1 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:

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

Table 9-1 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 within the supporting assessment documents submitted with this application.



10 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.



References

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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

Subacoustech Environmental Ltd,(2018). Wylfa Newydd Project 6.4.91 ES Volume D – WNDA Development App D13-9 – Underwater noise baseline and modelling.