Dublin Array Offshore Wind Farm Project

Foreshore Licence Application for Site Investigation and Ecological Monitoring

Supporting Information Report

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1.1. Project Background

1.1.1 RWE Renewables Ireland Limited (RWE) are applying for authorisation to undertake a geotechnical and geophysical site investigation for the proposed Dublin Array offshore wind farm development, in addition to ecological and wind, wave and current monitoring. The site is located immediately south of Dublin City in the foreshore adjoining the functional areas of Dublin City Council, Fingal County Council. Dun Laoghaire and Rathdown County Council, WIcklow County Council and extends approximately 17 km offshore and includes the vicinity of the Kish and Bray Banks. To secure the necessary consent to carry out the proposed works RWE are applying for a Foreshore Licence from the Department of Housing, Local Government and Heritage.

1.1.2 This document has been prepared to support the Foreshore Licence application and provides a description of the proposed activities, an analysis of environmental sensitivities in the area and the mitigation measures that RWE is committed to implementing. A number of Annexes to this report are provided including:

- Annex A - the co-ordinates of the proposed Foreshore Licence Area;
- Annex B - a suite of drawings showing the location of individual activities which are the subject of this Foreshore Licence Application;
- Annex C - an Environmental Impact Assessment Screening and Environmental Report;
- Annex D - a Marine Archaeological Assessment;
- Annex E – a report to inform Appropriate Assessment Screening ;
- Annex F – the Applicant's Natura Impact Statement

1.1.3 The Dublin Array project was initially developed by Saorgus Energy Ltd a privately-owned Irish company specialising in the development of large wind energy sites in Ireland. In March 2018 innogy Renewables Ireland Ltd (a wholly owned subsidiary of innogy SE) entered into a 50:50 partnership with Saorgus Energy to take the project forward. In July 2020 the global renewable energy portfolios of E.ON and innogy combined to form RWE Renewables.

1.1.4 RWE Renewables (including RWE Renewables Ireland Limited) is wholly owned by RWE AG. It is one of four subsidiary companies which also include RWE Generation, RWE Power and RWE Supply and Trading. RWE Renewables is a leading global renewable energy company, with more than 3,500 employees and activities in 15 countries globally. RWE Renewables has considerable experience in developing, constructing and operating renewables assets both independently and together with project partners and investors. It invests in a broad range of technologies and has experience with onshore and offshore wind, hydro power, solar, battery storage and research and development (R&D) phase technologies. RWE Renewables is one of the largest offshore wind generators in the world.

1.2. Site Location

1.1.5 The Foreshore Licence application area lies within the 12 nautical mile limit and includes the proposed wind farm array area in the vicinity of the Kish and Bray banks and potential export cable route corridors and buffer zones as described below. The cable route corridors extend from within the array area towards shore to Mean High Water (MHW) at three potential landfall options, one at Poolbeg / Shellybanks and two options at Shanganagh.

1.1.6 The Foreshore Licence application area includes an buffer around the proposed wind farm array area, extending 16 km to the north and to the south and to the limit of territorial waters to the east and adjoining the coast to the west in the counties of Fingal, Dublin City, Dun Laoghaire-Rathdown and Wicklow. This buffer area is inclusive of the extent of one tidal excursion (14 km) along the tidal axis to enable ecological monitoring and an area extending to the north-east for the deployment of static acoustic monitoring devices which may form part of a marine mammal monitoring strategy. The ecological monitoring surveys will be undertaken prior to construction works commencing. It is intended that these surveys will be replicated post-construction to document any changes to the environment.

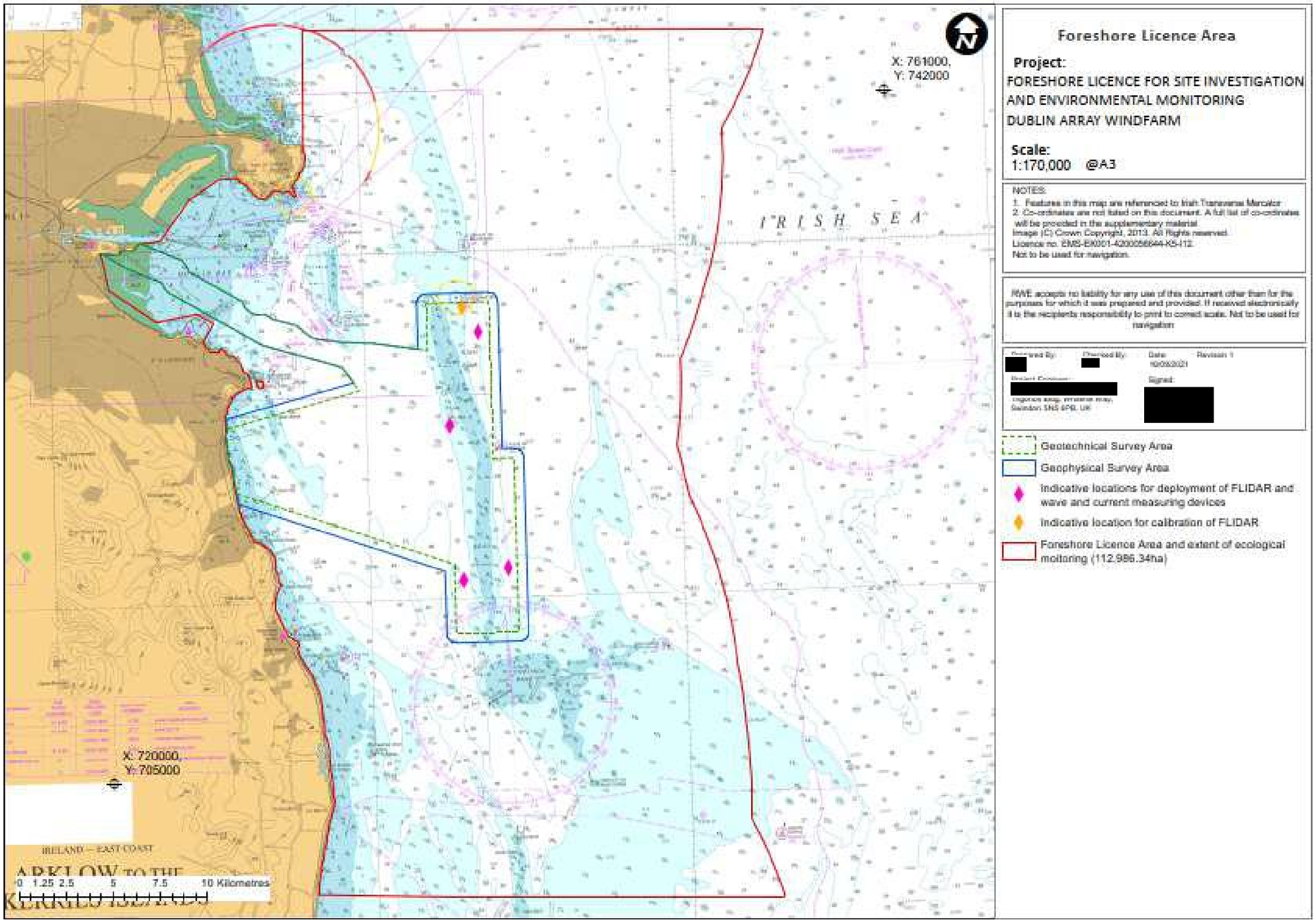

Figure 1 Foreshore Licence Application Area

1.3. Proposed Work

1.3.1 RWE is applying for a licence to complete the surveys shown in Table 1. The surveys have been grouped into four types:

- Geotechnical surveys - to provide further information on ground conditions including soil stability to refine the foundation design, sizing and installation methodology and to finalise cable route and landfall detailed design and installation methodology.
- Geophysical surveys - to provide further detail regarding seabed feature variability and seabed mobility across the site to inform detailed foundation and cable burial design and installation methodologies.
- Wind and metocean monitoring – to provide additional data regarding wind, wave and currents across the proposed site to assist with detailed wind farm design and layout optimisation.
- Ecological monitoring – to collate data on the pre-construction baseline against which to monitor change in the environment.

Table 1 Proposed work elements

Survey Ref	Location	Survey Technique
Geotechnical Survey		
1	Array Area, proposed foundation locations	Up to 61 geotechnical boreholes with wireline logging to an approximate depth of 80m below seafloor and an outside diameter of up to 254 mm
2	Array Area, proposed foundation locations	Up to 61 Deep push seafloor Cone Penetration Tests (CPT) to an approximate depth of 80m below seafloor, with a diameter of approximately 40mm.
3	Along proposed export cable routes extending into the array	Up to 31 Seafloor CPTs with a diameter of approximately 40mm and 48 vibrocores with a diameter of approximately 150 mm diameter. The target depth of each technique will be approximately 6 m below seafloor. Up to five of each type may be located within the intertidal area.
4	Proposed export cable landfall locations extending into the array	Up to 12 nearshore geotechnical boreholes with wireline logging and Rotary Cored Drilling , approximately 100 mm diameter to target depth of 45 m below seafloor (4 at each landfall option).
Geophysical Survey		
5	Proposed export cable landfall locations	Refraction survey in nearshore & intertidal

Survey Ref	Location	Survey Technique
6	Array Area, to cover proposed foundation locations	2D UHR & geophysical survey including Bathymetric Survey, Side Scan Sonar, Shallow Reflection Seismic (Sub-bottom Profiling) and Marine Magnetometer
7	Along proposed export cable routes	Geophysical survey including Bathymetric Survey, Side Scan Sonar, Shallow Reflection Seismic (Sub-bottom Profiling) and Marine Magnetometer;
Wind and metocean monitoring		
8	Array Area	Up to two buoy mounted Floating Lidar (FLiDaR) Units and up to two buoys incorporating wave and current measurement devices.
Ecological Monitoring		
9	Foreshore Licence Area	Up to 10 static acoustic monitoring devices (SAM)
10	Foreshore Licence Area	Up to 3 annual subtidal benthic ecology surveys comprising drop down video, grab sampling and epibenthic trawls
11	Foreshore Licence Area	Up to 3 annual potting survey and 12 seasonal trawl surveys (4 per year for up to 3 years)
12	Intertidal area at landfall locations	Up to 3 annual benthic ecology survey

1.4. Proposed Schedule

1.4.1 The Licence is requested for a duration of 5 years. Subject to award of licence it is anticipated that the works will commence during Summer 2022, however the specific commencement date will be subject to other matters such as successful appointment of a suitable contractor, availability of vessels and suitable weather conditions.

1.4.2 Estimated durations of the survey works are provided below however the work is weather dependent and may also be extended if unforeseen ground conditions are discovered. There may be pauses between different elements of the work resulting in a longer overall duration from commencement to completion.

- Offshore geotechnical survey - approximately 2 – 3 months;
- Nearshore geotechnical survey – approximately 2 months;
- Offshore geophysical survey - approximately 2 – 3 months;
- Intertidal refraction survey - approximately 2 – 3 weeks;
- Wind measurement – temporary validation deployment 6 - 8 weeks, long term deployment between 12 – 24 months;
- Wave and current measurement – 12 – 24 months;

- SAM deployment will take approximately 2 weeks, the equipment will remain on site for the duration of the Foreshore Licence, to provide a long term data set of pre-construction monitoring of marine mammals;
- Fish and shellfish surveys - approximately 1 – 2 weeks;
- Subtidal benthic ecology survey - approximately 1 – 2 months;
- Intertidal benthic ecology survey -approximately 1 – 2 weeks.

1.5. Previous Foreshore Lease/Licence Applications

1.5.1 In August 2000 Foreshore Licences were issued to the Kish Consortium for site investigations on the Kish and Bray banks respectively. The licenced works included:

- Drilling and sampling of seabed sediments;
- Geophysical measurements;
- Deployment of wave, tide current and silt load measurement equipment.

1.5.2 In January 2006, Kish Offshore Wind Limited and Bray Offshore Wind Limited submitted two Foreshore Lease applications (FS006462 and FS00643) to the Department of Communications, Marine and Natural Resources, pursuant to Section 2 of the Foreshore Act 1933, as amended, for proposed wind farm development in the vicinity of the Kish and Bray Banks.

1.5.3 In September 2019 innogy (now RWE) submitted a Foreshore Licence application (FS007029) for permission to conduct site investigations, including geophysical survey, associated seabed sampling and deployment of buoy mounted metocean equipment. The scope of the works under FS007029 included:

- Geophysical survey, including Multibeam Echosounder; Side Scan Sonar; Shallow Reflection Seismic (Sub-bottom Profiling); and Marine Magnetometer;
- 48 sub-tidal vibrocores;
- 15 cone penetration tests (CPT) in intertidal areas;
- 3 boreholes on the shorelines;
- Drop down video and grab sampling (benthic) at up to 30 sampling locations;
- Up to two buoy mounted Floating Lidar (FLiDaR) Units and up to two metocean buoys incorporating wave and current measurement devices.

1.5.4 RWE completed a successful geophysical and benthic survey campaign between February and May 2021. Having completed the geophysical survey fieldwork it has been determined that, due to the limited scope and geographical extent of the geotechnical investigations authorised by the licence, and the need for a more comprehensive geotechnical investigation to inform the detailed design and assessment of the project, a more comprehensive geotechnical investigation is warranted. The revised scope is included within this foreshore licence application.

1.5.5 Two metocean buoys and a FLiDaR have been deployed in accordance with a Statutory Sanction as received from the Commissioners of Irish Lights and an Automatic Identification System Licence issued by the Commission for Communications Regulation. This metocean and wind survey campaign is authorised for a period up to August 2023 (two years post successful calibration). A further metocean and wind campaign is included within this foreshore licence application.

2 DESCRIPTION OF PROPOSED SURVEY WORKS

2.1 Geotechnical Survey

2.1.1 The purpose of the geotechnical survey is to provide an understanding of ground conditions to refine the foundation design, sizing and installation methodology and to finalise cable route and landfall design and installation methodology.

2.1.2 Survey techniques will comprise:

- Cone Penetration Tests;
- Vibrocores;
- Boreholes.

2.1.3 The final geotechnical sampling locations will target proposed turbine locations and cable routes and will be selected with the benefit of available geophysical, environmental, engineering and construction data which will be reviewed to optimise engineering design and to avoid anomalies of potential archaeological origin and the presence of sensitive ecological features such as subtidal reef. The sampling locations will be micro-sited where necessary to avoid archaeological or ecological impacts. Should the review of the geophysical data identify areas of paleoarchaeological interest which require further archaeological investigation the sampling locations will be micro-sited to achieve this aim. Indicative sampling locations are shown in Figure 2.

2.1.4 Access to the intertidal zone will be required for a tracked rig and ancillary equipment to carry out the geotechnical sampling. Existing public access routes in the vicinity will be utilised to access the coring locations at the two Shanganagh landfalls, with due consideration for any environmental or other relevant constraints. Alternatively a landing craft may be used to bring the rig via the sea.

2.1.1 At Poolbeg access to the beach by track machine has the potential to impact areas of *Zostera noltii*, marram grass (*Ammophila arenaria*) and Annual vegetation of drift lines. Machinery is planned to be lowered to the beach by crane from Shellybanks Road, or brought to shore by barge, and therefore there would be a small corridor (approximately 3m) of disturbance by the machinery tracks between the point of access and sampling station. Access arrangements will be agreed with the relevant local authority once the survey contractor has been appointed and the equipment specification has been finalised.

Cone Penetration Tests (CPTs)

2.1.2 In-situ cone penetration tests will be carried out across both the array area and the export cable corridor. Up to 61 seafloor CPTs up to an approximate geologically shallow depth of 80m below seafloor are proposed within the array area and 31 CPTs to an approximate depth of 6m below the seafloor in the export cable corridors which extend into the array as shown in Figure 2. . Five of the 31 cable route CPTs may be located within the intertidal areas.

2.1.3 In the subtidal locations a CPT rig will be lowered to the seafloor from a suitable vessel by a deck mounted crane or A-frame. An instrumented cone, with a diameter of approximately 40mm, will then be pushed into the seabed at a constant speed. Continuous measurement of the cone end resistance, the friction along the sleeve of the cone and the pore water pressure will be recorded. The cone will then be recovered to the rig and the rig returned to the vessel. The duration of operation at each CPT location within the array area is expected to be up to 6 hours. In the intertidal area a similar process will be undertaken from a tracked vehicle.

Vibrocores

2.1.4 Vibrocores will be taken across the export cable routes which extend into the array as shown in Figure 2. Up to 48 vibrocores, approximately 150 mm diameter and penetration depth of up to approximately 6 m will be taken. Five of the 48 vibrocores may be located within the intertidal areas.

2.1.5 A vibrocore rig will be lowered to the seafloor from a suitable vessel by a deck mounted crane or A-frame. A vibrocore head will be attached to the core barrel and will induce high frequency vibrations in the core liner. The sediment in immediate contact with the core barrel forms a 'liquefied' boundary layer enabling the core barrel to penetrate the sediment strata. A core catcher is attached to the end of the barrel which holds the sediment inside the barrel when withdrawn from the sediments. Each core would have a sediment sample volume of approximately 0.05 m3. The expected duration of the vibrocoring operation at each location is less than 5 minutes. In the intertidal a similar process will be undertaken from a tracked vehicle.

Boreholes

2.1.6 Up to 61 subtidal boreholes to a geologically shallow depth of 80 m below seafloor are proposed within the array area to target proposed foundation locations.

2.1.7 A borehole is a method of drilling into the seabed to recover samples and enable downhole geotechnical testing to be completed. A drilling head is lowered to the seabed via a drill string with an outside diameter of up to 254 mm and stabilised using a seabed frame. The drill string is then rotated to commence boring. Tools are lowered into the drill string to recover samples or conduct in-situ soil testing. The drilling flush and drill cuttings are largely returned to the vessel and re-used or returned to shore for disposal, however some loss of flush and cutting should be expected. All drilling fluids will be fit for purpose and where possible selected from the 'OSPAR List of Substances/Preparations Used and Discharged Offshore which are considered to Pose Little or No Risk to the Environment'. The offshore boreholes will be left to back-fill naturally. The duration of the operations at each borehole location within the array area is expected to be approximately 48 hours.

2.1.8 Four boreholes are also planned at each of three possible landfall locations (i.e. 12 in total). The nearshore boreholes will be in water depth of 0 to 7 m and will be to a target depth of 45 m below seafloor. The external diameter of the drill pipe will be approximately 100 mm. The nearshore boreholes would either be backfilled or grouted to within 2m of surface of the base of mobile sediment typically using a 2:1 bentonite cement mix. The surface will be reinstated to previous condition as the investigations at each location are completed. Pre and post investigation site photographs will be taken. The duration of the operations at each borehole location within the intertidal area is expected to be approximately 36 hours.

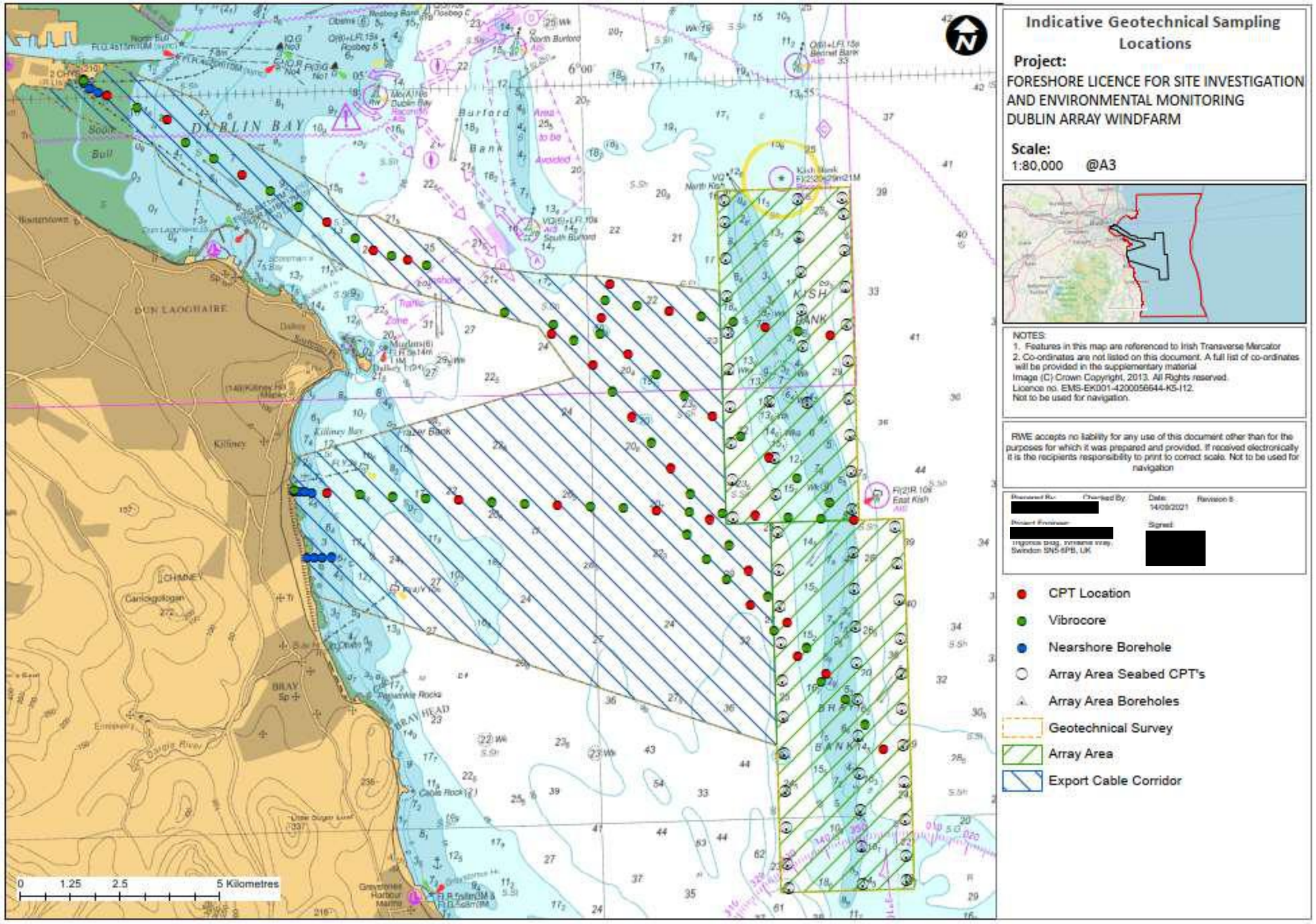

Figure 2 Indicative Geotechnical Sampling Locations

2.2 Geophysical Survey

2.2.1 The geophysical survey area is shown in Figure 1, page 8. Survey techniques will comprise:

- Bathymetric Survey, (Multibeam Echosounder);
- Side Scan Sonar;
- Shallow Reflection Seismic (Sub-bottom Profiling);
- Marine Magnetometer and gradiometer;
- 2D Ultra-High Resolution Seismic; and
- Refraction (landfalls only).

2.2.2 These geophysical surveys are non-intrusive in that they do not cause any disturbance of the sea-bed. They will comply with the requirements as set out in "Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters" (DAHG, 2014) or other updated guidance as agreed with the National Parks and Wildlife Service (NPWS) and with the general requirements of the Underwater Archaeology Unit of the Department of Housing, Local Government and Heritage for a geophysical survey for archaeological purposes.

2.2.3 Detail of the survey equipment operating frequencies, estimated sound levels and mounting arrangements are provided in Table 2.

2.2.4 The geophysical survey will cover a dedicated, narrow corridor over turbine foundation locations, inter-array, and export cable routes to the selected landfall location(s). Survey coverage will be restricted to narrow corridors estimated to be 50 m to 500 m in width, depending on project requirements. These will be confirmed prior to survey commencement.

2.2.5 The 2D UHRS[1] survey will cover the proposed array area over the Kish and Bray Banks. Several lines will be run aligned with turbine locations, in a pattern that is most efficient to capture data directly at turbine locations but also considering local metocean conditions.

2.2.6 A refraction survey will be carried out at the selected landfall, with a very shallow marine element, and onshore element. This survey will be carried out over defined survey lines at the selected landfall(s) only; the orientation and position of these survey lines will be confirmed closer to survey commencement.

[1] 2 Dimension Ultra High Resolution Sonar

Table 2 Details of proposed geophysical survey equipment

Survey technique	Operating frequency (kHZ)	Estimated sound level at 1m over frequency band 10 Hz to 10kHZ Sound Pressure Level (dB re1µPa$_{Peak}$)	Typical length of towed equipment (m)
Side-scan sonar (SSS)	300-500 (low) 500-900 (high)	228	<300
Multi-beam Echosounder (MBES)	190 -420	200-235	Hull- or Pole-mounted
Magnetometer (MAG)	Passive[2]	Passive	300
Single-beam Echosounder (SBES)	200	200	Hull- or Pole-mounted
Sub Bottom Profiler (pinger)	2-200	200-225	Hull- or Pole-mounted, or 150
Sub Bottom Profiler (boomer)	5	200-225	150
UHR Seismic Sparker	4	200-225	150
Refraction	5-150Hz	230	50 - 100 A sensor string of length 100m to 235m will be laid on the seabed to record the response.

[2] Does not emit a signal

Multibeam Echosounder (MBES)

2.2.7 A Multibeam Echosounder (MBES) uses acoustic technology to provide detailed bathymetric mapping of the seabed. The MBES is typically hull or pole mounted on the survey vessel and is used in conjunction with a Global Navigation Satellite System (GNSS) aided inertial positioning and orientation system, specifically designed for geo-referencing and motion compensation in hydrographic surveying.

Side Scan Sonar

2.2.8 Side Scan Sonar (SSS) uses acoustic technology to image the surface of the seabed for the detection of objects or structures. The SSS is typically towed astern of the survey vessel and used in conjunction with high accuracy GNSS positioning. To obtain images of the seafloor the SSS digitises a sound pulse sent out from two transducers mounted on each side of the SSS towfish. Images are based on the amount of reflected sound energy and presented on a time basis resulting in a continuous, highly detailed image of the seafloor. Seabed sediment classification can also be interpreted from the side scan data according to the intensity of the acoustic return.

Marine Magnetometer

2.2.9 Marine magnetometers are used to locate and identify ferrous objects on or buried in the seabed. The device precisely measures the Earth's magnetic field and detects any anomalies, which represent ferrous objects such as lost anchors, abandoned fishing gear, shipwrecks and buried pipelines or cables. The magnetometer is a passive system (does not emit a signal) and is typically towed behind a survey vessel.

Sub Bottom Profiler (SBP) and 2D Ultra-High Resolution Seismic (UHRS)

2.2.10 Sub Bottom Profiling (SBP) is proposed throughout the cable route corridors and array area with different sub-bottom profiling equipment likely to be required in each. SBP uses reflection seismology to give a 2D image of the sub-seabed geology. It is typically towed behind the vessel during survey works or affixed to the vessel's hull.

2.2.11 Across the cable corridors shallow investigation, which is usually achieved with a hull mounted pinger or chirp operating in single channel mode will be sufficient to provide the required data. In the array area acquisition of information to greater depths is needed for turbine location-specific foundation design. Ultra-high resolution multi-channel seismic technology such as a sparker or boomer system would likely be used to provide good quality data suitable for engineering works in the shallow (<80 m) subsurface.

Refraction

2.2.12 Refraction surveys are a method of understanding key geological boundaries by measuring the acoustic velocity through geological units. Seismic waves are generated by an acoustic source which can be hand held when surveying on land or towed approximately 50 m behind a vessel when offshore. The seismic waves are refracted along geological boundaries and reradiated back to a string of receivers which are placed on the seabed or ground surface. The string of receivers is between 100m to 235 m in length. This is a useful method in the intertidal area as it can be performed as an onshore or offshore activity, where it is usually conducted from a RIB, and does not have the same limitations of other shallow water survey methods e.g. interference from the multiple frequencies in pinger data.

2.3 Wind, Wave and Current Measurement

2.3.1 The FLiDaR (floating light detection and ranging) and wave and current measurement devices selected will be robustly designed and constructed for deployment in hostile marine environments. These devices may be the current devices which are in situ or replacement devices. The devices will be inspected and maintained as a minimum in accordance with manufacturers recommendations. Service visits are likely to be made at 6 month intervals for cleaning of sensors and replacement of consumables.

2.3.2 Marking, lighting and other navigational safety requirements will be agreed with Irish Lights and the Department of Transport, Tourism and Support, Marine Survey Office prior to deployment and will be compliant with International Association of Aids to Navigation (IALA) requirements.

2.3.3 Navigation safety features typically include:

- Unit colour – RAL 1023 Yellow
- Radar reflector
- Marine lantern
- Redundant GPS Location
- Drift alarm
- Automatic Identification System (AIS)

2.3.4 Statutory Sanctions from Irish Lights [under Section 653(2) of the Merchant Shipping Acts 1894 to 2015] will be obtained to establish Aids to Navigation and licences to operate AIS [under the Wireless Telegraphy (Radiodetermination, Air Traffic and Maritime Services) Regulations, 2009] will be. obtained from the Commission for Communications Regulation as appropriate.

FLiDaR

2.3.5 Up to two FLiDaR units will be deployed on site. The units will be deployed in close proximity to the Kish Lighthouse to validate the data collected against the data from the LiDaR positioned on the lighthouse. The temporary deployment will be for a period of 4 – 8 weeks,

after which the units will be moved to longer term moorings, to the east and west of the Kish and Bray Banks. Indicative locations are shown in Figure 3. These devices may include the current devices which are in situ or replacement them.

2.3.6 The EOLOS FLS200 is representative of the type of FLiDaR which is may be deployed, however the actual device will be selected following a procurement process. The unit will be approximately 4 m x 4 m and the height to the top of the mast also approximately 4m. The keel will be between 1 and 2 m depth. The FLiDaR may have up to three independent sources of power, wind, solar and fuel cell. Batteries are contained within sealed compartments. Additionally, there are water intrusion sensors integrated into the battery compartments for indication of seal breach.

2.3.7 A typical mooring is shown in Figure 4. This comprises a clump weight and catenary mooring, approximately 100m of which will rest on the seabed.

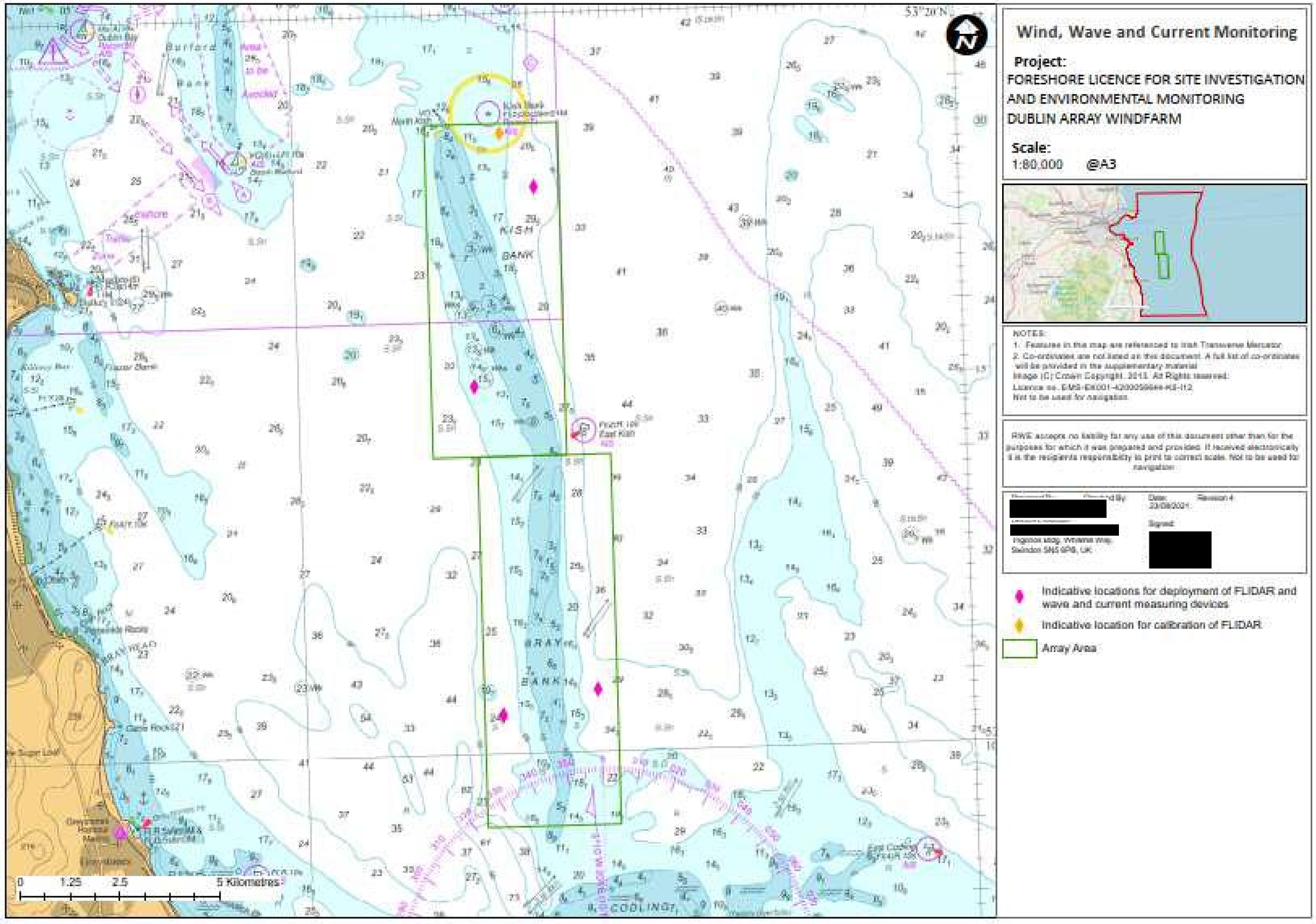

Figure 3 Indicative Location of FLiDaR and Wave and Current Measurement Buoys

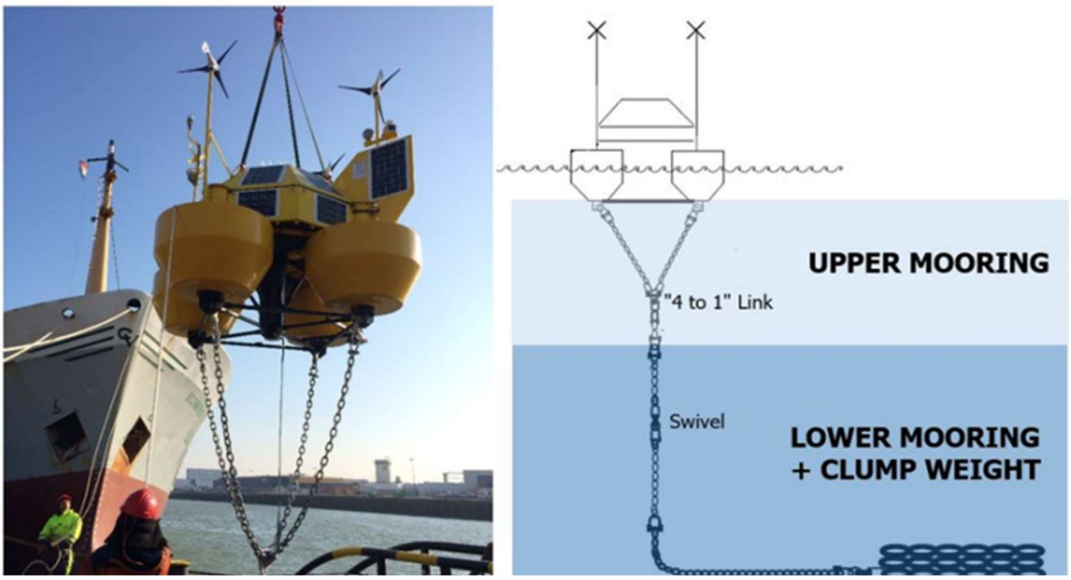

Figure 4 EOLOS FLS200 (photograph courtesy of Partrac Ltd.)

Wave and current measurement

2.3.8 Up to two buoys for the measurement of wave height, direction, surface current and water temperature will be deployed, one to the east of the Kish Bank the other to the west of the Bray Bank as shown in Figure 3. These devices may be the current devices which are in situ or replacement devices.

2.3.9 The Triaxys buoy is representative of wave and current measurement devices, which are typically smaller than FLiDaR units with a diameter of approximately 1 m. Equipment is solar powered with back up batteries. No other fuel is required. Batteries are contained within sealed compartments. Additionally, there are water intrusion sensors integrated into the battery compartments for indication of seal breach.

2.3.10 The wave and current measurement buoys will be moored to the seabed with a u-mooring or single point mooring. The exact specification of the mooring arrangement is equipment specific and will be dependent on the seabed characteristics, water depth, wave, tide and current profile of the exact deployment location.

2.3.11 A typical mooring will comprise between 1 and 4 mooring lines which will be approximately three times the water depth. Lines are connected to a clump weight designed specifically for the conditions of the site. The clump weight is anticipated to have a dry weight of approximately 3 tonnes, and a footprint of approximately 1m diameter.

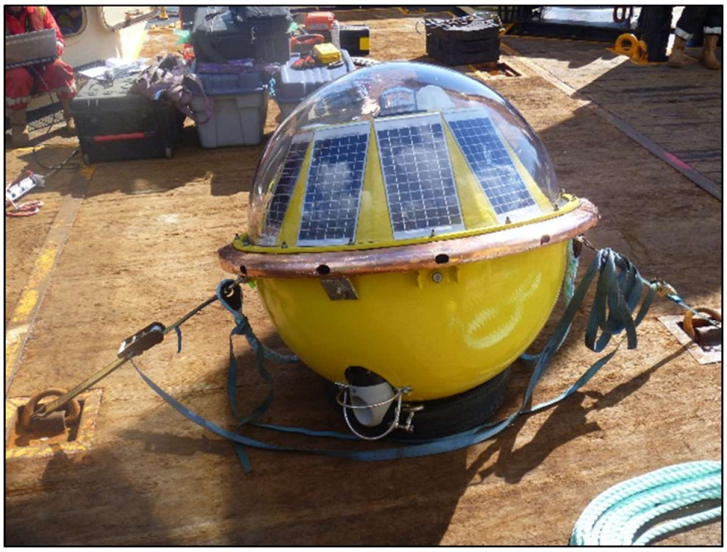

Figure 5 Triaxys Wave & Current Buoy (photograph courtesy of Partrac Ltd.)

Deployment and Recovery

2.3.12 The LiDaR and wave and current measuring units will be pre-assembled at the quayside and subsequently may be either craned to the water and towed to the deployment site or craned to the vessel and transferred to site onboard the vessel. In either case, the mooring and sinkers are craned to the vessel and are transported to the deployment site on the deck of the deployment vessel.

2.3.13 On arrival at the deployment site the vessel will use dynamic positioning to maintain position. The mooring system is first deployed with mooring chain and clump weight being lowered from the vessel by winch or crane. A temporary buoy may be attached to the mooring on deployment before subsequently being replaced by the measurement buoys.

2.3.14 When monitoring is complete a vessel winch or crane will be used to recover the unit and mooring and return it to land.

2.4 Ecological Monitoring

2.4.1 In accordance with Guidance on Marine Baseline Ecological Assessments & Monitoring Activities for Offshore Renewable Energy Projects, DCCAE[3], 2018, pre-construction ecological monitoring may be required prior to any construction of the wind farm commencing which will be subject to a separate development consent under the Marine Area Planning Act. These surveys can be repeated post construction in order to monitor any change in ecological receptors. A broad suite of activities is included within this Foreshore Licence application and the final scope of ecological monitoring will be agreed in consultation with the appropriate statutory agencies.

2.4.2 Pre-construction surveys are currently expected to be undertaken during the period 2023-2026.

[3] Department of Communications, Climate Action and the Environment

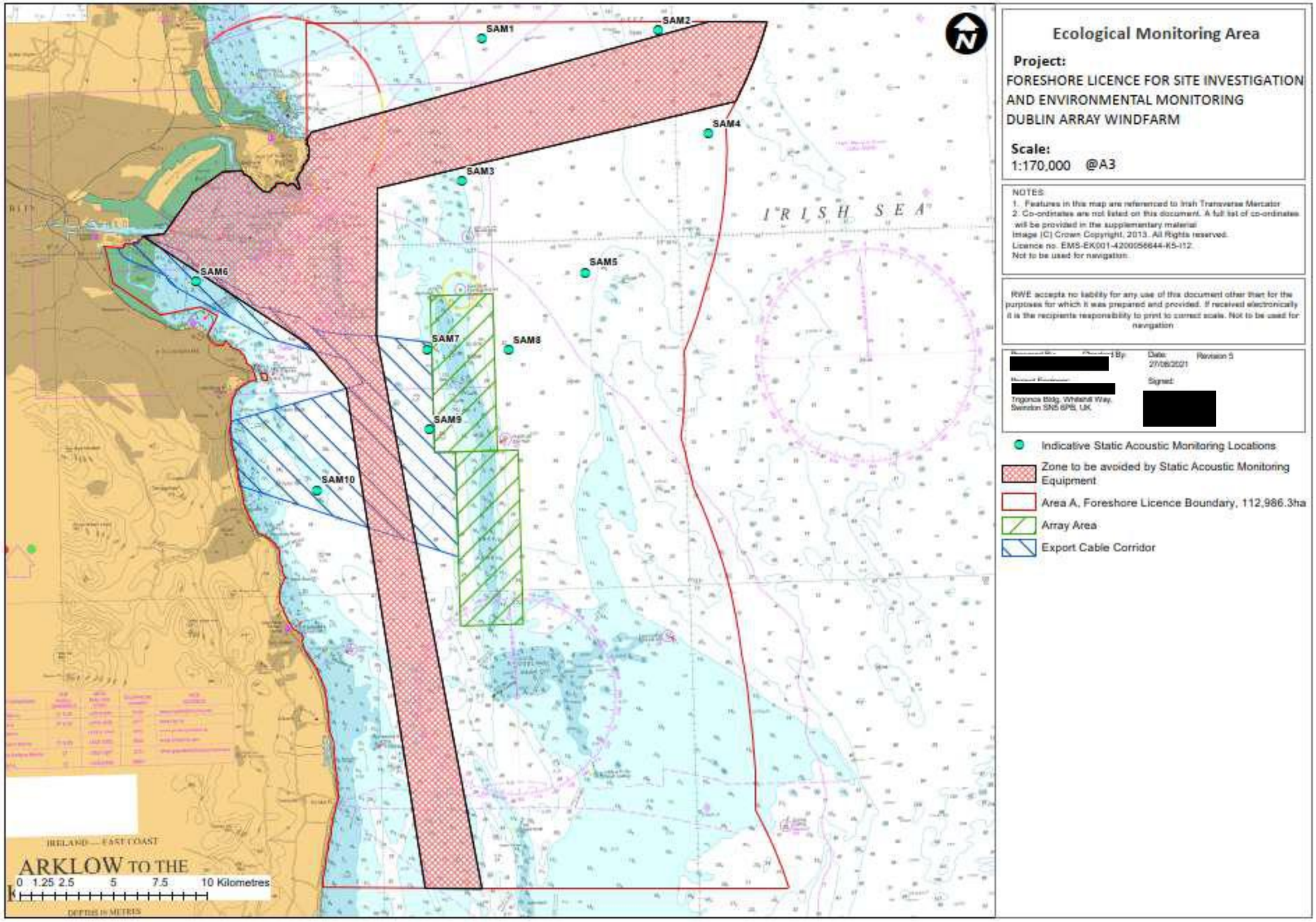

Figure 6 Ecological Monitoring Area

Static Acoustic Monitoring

2.4.3 Up to 10 SAM devices may be deployed as part of a monitoring programme to detect porpoises, dolphins and other toothed whales and may remain in position for the duration of the Foreshore Licence period. SAM would be located across the export cable corridors, array area and in locations to the north and east of the Kish and Bray Banks as shown in Figure 6. Deployment locations will avoid the main shipping channels. A planned avoidance area correlating with the main north-south and east - west shipping route is shown in Figure 6. Prior to deployment the final locations will be agreed with Dublin Port Company.

2.4.4 A commonly used SAM device is the C-Pod, which comprises a hydrophone, usually housed within a polypropylene tube to reduce surface noise and automated data logger which are deployed on seabed mooring with a surface marker buoy. The hydrophone floats within the water column with the housing facing upwards. They are passive, i.e. they do not emit sound.

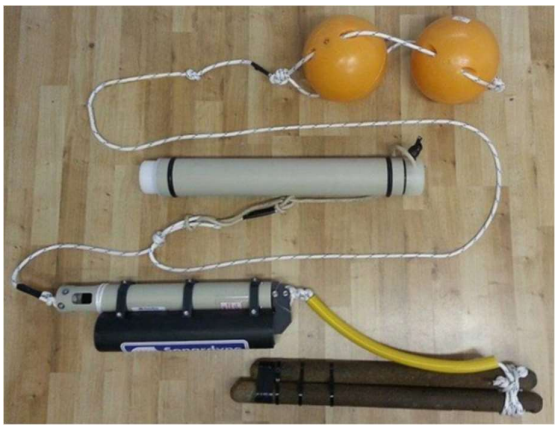

Figure 7 C-POD and marker buoys (photograph courtesy of Chelonia Ltd).

2.4.5 In shallow water, C-PODs are moored midway between the sea floor and the surface. In deep water, C-PODs are moored in any position between 10 metres above the seabed and 10 metres below the sea surface, to minimise interference of noise from seabed movement or from rain or breaking waves at the surface.

2.4.6 A typical mooring comprises a series of small clump weights which are linked together and marked by a riser attached to a buoy at the surface. The C-POD is tethered the required distance from the seabed by a rope spur and the rope spur is connected to the centre of the C-POD so that the unit is orientated vertically in the tidal stream.

2.4.7 Service visits will be made every 3 – 4 months during which the C-POD will be recovered to the deck of a vessel, marine growth will be removed, batteries and memory cards replaced and the mooring inspected.

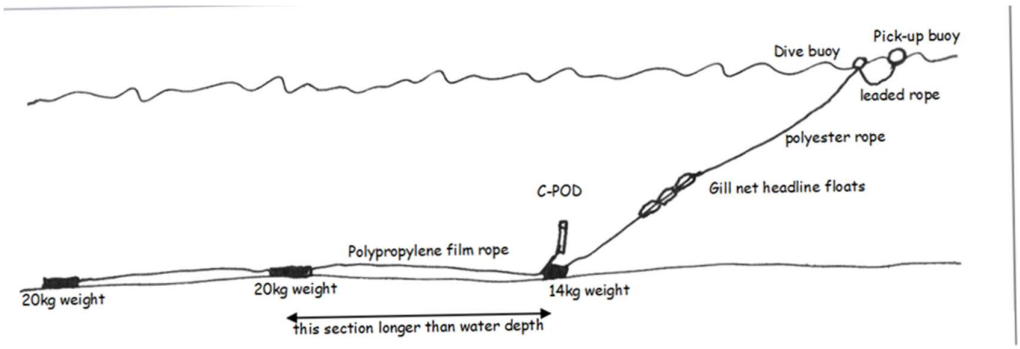

Figure 8 Typical C-POD Mooring (Chelonia Ltd).

Fish and Shellfish Monitoring

2.4.8 Up to three annual potting surveys may be undertaken using fishing gear comparable to that used by the local fishing fleet and suitable for whelk and crab and lobster. Ten strings, each comprising 20 pots will be deployed. Deployment locations will provide coverage of the proposed array and cable corridors as well as locations within a tidal excursion (14 km to north and south) of the array boundary as shown in Figure 6.

2.4.9 Target species, gear and deployment locations will be agreed in consultation with the local fishing industry and the Sea Fisheries Protection Authority (SFPA).

2.4.10 All strings will be marked at either end so they can be clearly seen. A weight will be attached at each end to hold the strings in the desired position. Pots would be left to soak for approximately 24 hours before being collected.

2.4.11 Seasonal trawl surveys may also be undertaken during Winter, Spring, Summer and Autumn periods for two – three years. The surveys will include up to 15 pelagic and up to 15 otter trawls. Deployment locations will provide coverage of the proposed array and cable corridors as well as locations within a tidal excursion of the development boundary. The location of the trawls will be agreed in consultation with the local fishing industry and the Sea Fisheries Protection Authority (SFPA).

2.4.12 A demersal otter trawl is a cone shaped net that is towed on the seabed to target demersal fish species and nephrops. The mouth of the trawl is held open by a pair of trawl doors (otter boards). Pelagic trawling is a method of towing a trawl in mid-water i.e. at any point in the water column between the surface and seabed. It is, generally, used to target shoaling species such as sprat and herring.

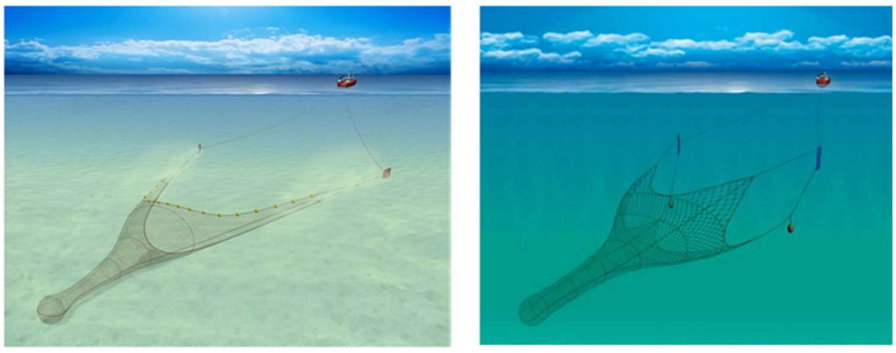

Figure 9 Typical configuration of demersal trawling gear (left) and pelagic trawling gear (right) (Source: Seafish, 2015)

Subtidal Benthic Ecology Survey

2.4.13 Subtidal benthic monitoring is also proposed which will include video and camera stills imagery and grab sampling at up to 90 locations using a Van Veen or Day Grab type sampler (0.1 – 0.2 m^2). Sample depth may be up to 20 cm depending on seabed type. The grab will be deployed and retrieved by winch. Video/stills camera will be deployed at each sampling location prior to grabs being taken. Monitoring will be undertaken annually for two – three years prior to commencement of construction of the wind farm.

2.4.14 The final sampling locations will be identified following review of the geophysical data of the area which will be analysed to identify ground types and seabed features and to refine the selection of grab locations to ground truth the data and to provide material for biological sampling. Sample locations will be across the lease area and cable corridors as well as locations within a tidal excursion of the development boundary.

2.4.15 Epibenthic sampling may also be undertaken annually for two to three years pre-construction, to collect information on epibenthic invertebrate species, as well as small demersal and juvenile fish. Up to 90 trawls will be completed using a standard 2m CEFAS beam trawl fitted with a 5mm cod end. Trawls will be standardised by length (500m) or duration (10 minutes).

Intertidal Benthic Ecology Survey

2.4.16 Monitoring of the intertidal area may also be undertaken on an annual basis for two – three years pre-construction. Monitoring will comprise a walkover survey and a series of shallow hand cores, at up to eight stations at the proposed landfall location. Sampling locations will be chosen to be representative of the upper, middle and lower shore, and will be taken along three transects. Each sample will be approximately 90mm in diameter and up to 500mm in depth and will be analysed for infauna, sediment granulometry and organic carbon content. Up to three replicates will be taken at each station.

3 SURVEY VESSELS

3.1.1 The proposed licenced works will be carried out by dedicated marine vessels and equipment, suitable for the scope of work required, the water depth and the anticipated conditions of the survey area. The exact vessels and equipment to be used will be confirmed following a tender process to procure the survey contractor(s). A summary of the type and number of vessels is provided below and summarised in Table 3.

3.1.2 All vessels will possess all relevant classification certificates and will conform to the following minimum requirements as appropriate:

- Compliance with Safety of Life at Sea (SOLAS), International Maritime Organization (IMO) and national requirements for operating within Irish territorial waters;
- Station-keeping and sea keeping capabilities required to carry out the proposed operations safely;
- Sufficient qualified staff to allow the operations to be carried out efficiently, (typically 24 hour continuous for offshore survey); and
- Appropriate accommodation and crew welfare facilities.

3.1.3 The appointed contractor(s) will be responsible for all shipboard systems and equipment calibration and re-calibration, including spares. In addition to AIS[4] the vessels shall have the following communications equipment as a minimum:

- Multi-channel Very High Frequency (VHF) and High Frequency (HF) radio capable of working at all marine frequencies and with a dual watch facility;
- Mobile phone;
- Hand-held radios;
- Frame and winch for the deployment of equipment and sensors, appropriate for the required equipment and pulling force;
- Gyrocompass;
- SATCOM facilities (phone/fax and e-mail);
- 2 independent Differential Global Positioning systems (DGPS), a primary and secondary system.

Geophysical Survey Vessels

3.1.4 The main geophysical survey vessel operating in the offshore area will be approximately 70 – 100 m in length with a draft of approximately 4 – 6 m and operational speed of approximately 5 knots. The offshore vessels will be capable of remaining safely at sea for a minimum period of 28 days and shall at all times remain in full, proper and safe working order.

[4] Automatic Identification System

3.1.5 The geophysical survey vessel will be dynamically positioned with full redundancy (specifically DP2) for all of the work elements. A deck mounted crane or A- frame will be required. Vessel deck areas will have good lighting and deck areas used for equipment deployment/recovery will be either visible from the bridge or good quality closed-circuit TV pictures of such areas shall be provided on the bridge at all times of such operations and recorded. All survey vessels and marine support vessels will conform to the relevant ISO and API technical specifications for the required operations.

3.1.6 A smaller vessel will be required to undertake the geophysical survey in the shallow waters (less than 7m LAT) across the Kish and Bray Banks and nearshore. The vessel will have a shallow draft and be approximately 16 – 20 m in length.

3.1.7 A small rib (rigid inflatable boat) is likely to be used for the refraction survey in the nearshore and intertidal.

3.1.8 Operations are likely to be on a 24-hour basis with crew changes every 12 hours. The requirements of Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters, DAHG (2014) regarding commencement of operations in daylight and good visibility will be observed.

Geotechnical Survey Vessels

3.1.9 The geotechnical survey may be undertaken from a vessel similar to that described above for the main geophysical survey vessel or from a jack-up barge which will utilise a fixed anchoring system to maintain position. In the case of the latter the works will be carried out from a self-elevating platform which is raised above the water's surface. A large jack-up barge legs will have a seabed foot print of approximately 15 – 20m^2.

Figure 10 Example Jack-Up Vessel (Source, Geosea)

3.1.10 Operations are likely to be on a 24-hour basis with crew changes every 12 hours. A crew change vessel will be required to facilitate crew transfers to and from the jack-up barge.

Monitoring Equipment Deployment and Ecological Survey Vessels

3.1.11 SAM and buoys for wind, wave and current measurement will be deployed from a buoy laying tender or multi-CAT which will require a minimum usable deck space of 18 m with a low freeboard and a deck-mounted towing winch. A similar vessel will be required to undertake the ecological surveys. A fishing vessel may be utilised for the seasonal trawl surveys.

Table 3 Summary of vessel requirements

Survey Activity	Vessel Type	Number	Location
Geotechnical Survey	Main DP[5] Vessel	1	In waters deeper than approximately 7m.
	Multicat[6] or similar	1	Performing VC and CPT along export route.
	Jack-up barge	1	Shallower water, less than 7m, nearshore and on the Kish and Bray Banks for drilling of boreholes.
	Crew Change Vessel	1	Crew transfer to and from the jack-up barge.
Geophysical Survey	Main DP Vessel	1	In waters deeper than approximately 7m.
	Shallow draft vessel	2	Shallower water, less than 7m, nearshore and on the Kish and Bray Banks
	Rigid inflatable boat	1	Refraction survey of intertidal
SAM, wind wave and current measurement buoy deployment	Multicat or similar	1	All areas
Ecological Monitoring	Multicat or similar	1 per survey	All areas

[5] Dynamically Positioned
[6] Multi-category work boat.

4 DESCRIPTION OF THE ENVIRONMENT[7]

4.1 Benthic Sub-tidal and Inter-tidal Habitats

4.1.1 The benthic survey conducted in 2021 (Fugro, 2021) observed that the main sediment type across the array and export cable corridor areas was sand with varying proportions of shell fragments, gravel and mud. Six stations located on the Kish and Bray banks were characterised by clean, sometimes gravelly sand, potentially Annex I habitat 'Sandbanks which are slightly covered by sea water all the time'. The only faunal species observed during these surveys were sandeels.

4.1.2 To the east of the Kish and Bray sandbanks, the general area is characterised by a large expanse of sand and areas of sand and shell. Areas of 'circalittoral mixed sediment' were observed also to be present with a high proportion of dense shell material on slightly gravelly, slightly muddy sand. Closer to Poolbeg the stations were characterised by sand with a muddier component and shell fragments.

4.1.3 Areas of geogenic reef[8] (Annex I habitat)[9] may be present in the nearshore areas where one of the proposed export cable route corridors reaches landfall at Shanganagh, where dense aggregations of large boulders and cobbles with patches of slightly gravelly, slightly muddy sand were observed (Fugro, 2021). Boulders and cobbles were covered by faunal turf (Hydrozoa/Bryozoa including *Nemertesia antennina* and *Haleciidae*), barnacles (*Sessilia*) and red algae (*Rhodophyta*).

4.1.4 The surrounding area within the Ecological Monitoring boundary is classified predominantly as 'circalittoral sand and circalittoral mud', with areas of 'circalittoral coarse sediment to the south', EUSeaMap (2019) Broad-Scale Predictive Habitat Map, (Irelands Marine Atlas, Marine Institute).

4.1.5 The intertidal area at the Shanganagh landfall zones has been characterised (Aquafact, 2017 and 2021) and shows the upper shore consisting of a band of cobbles and pebbles with occasional boulders grading into a finer gravel and coarse sand down the shore. This upper to midshore is classified as 'barren littoral shingle'[10] merging into 'barren littoral coarse sand'[11]. In the middle to lower shore a small patch of the biotope 'Lanice conchilega in littoral sand'[12] was noted between scattered boulders, cobbles and pebbles to the north of the proposed landfall location.

[7] This section of the report should be read in conjunction with the Environmental Impact Assessment Screening and Environmental Report (Annex C) and Marine Archaeological Assessment (Annex D) and Appropriate Assessment Screening and Natura Impact Statement (Annex E).
[8] Formed by non-biogenic substrate and is topographically distinct from the surrounding seafloor.
[9] Annex 1 to the Habitats Directive lists habitats which are considered threatened in the EU territory.
[10] The Marine Life Information Network (MarLIN) UK and Ireland classification - LS.LCS.Sh.BarSh
[11] MarLIN classification - LS.LSa.MoSa.BarSa
[12] MarLIN Classification - LS.LSa.MuSa.Lan

Figure 11 Detail of intertidal biotopes in northern extent of Shanganagh Beach. (Aquafact, 2021).

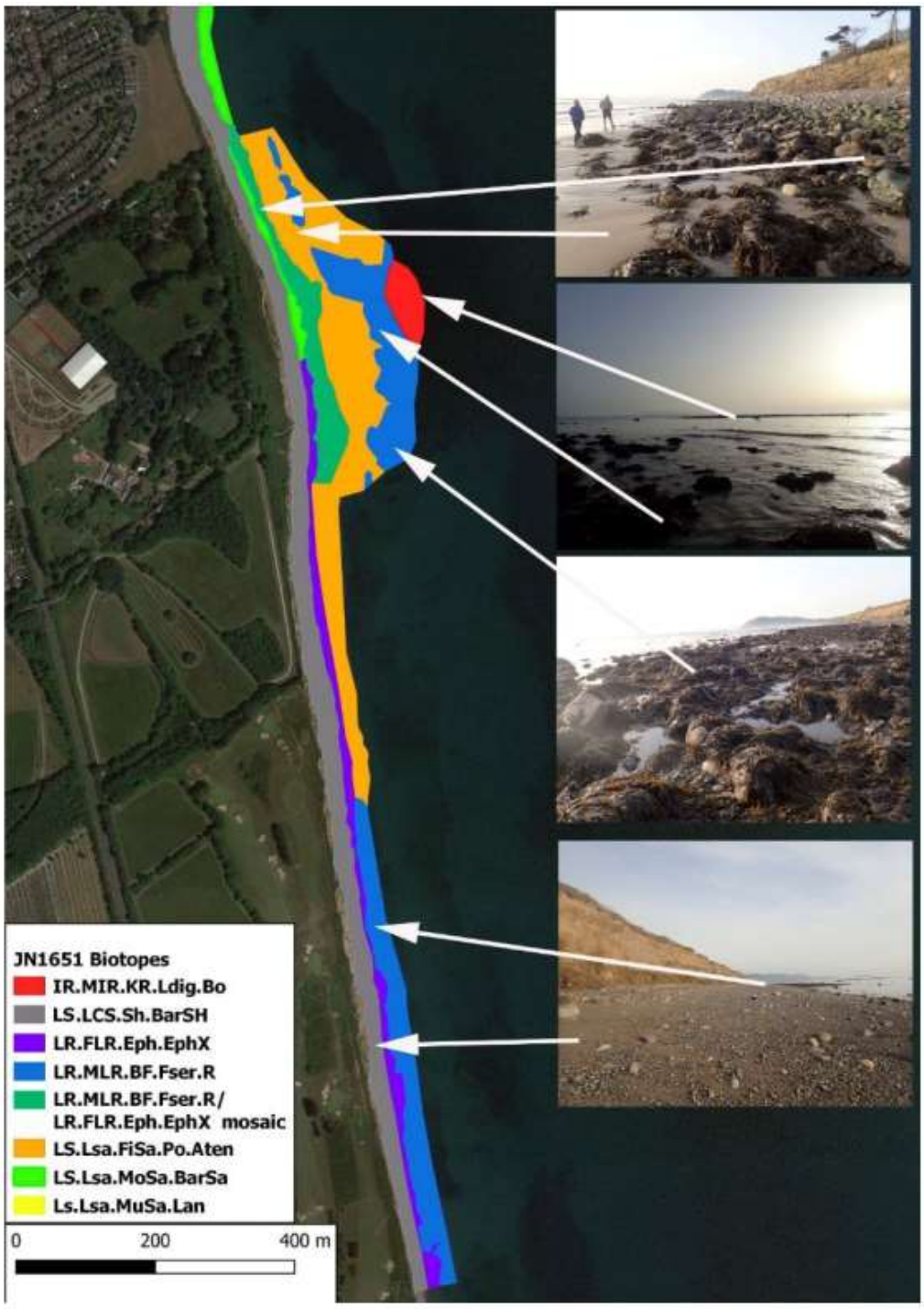

Figure 12 Detail of intertidal biotopes in southern extent of Shanganagh (Aquafact, 2021).

4.1.6 The infaunal analysis revealed low numbers of oligochaetes and talitrid amphipods similar to the talitrids on the upper shore and strand-line biotope[13]. The mid shore at the landfall site consisted of boulders and cobbles covered with ephemeral green algae (*Ulva intestinalis and and Ulva lactuca*) with some *Porphyra purporea*, consistent with the 'ephemeral green and red seaweeds on variable salinity and/or disturbed eulittoral mixed substrata biotope'[14]. The lower shore along the transect length was consistent with the 'polychaetes and Angulus tenuis in littoral fine sand biotope'[15]. 'Fucus serratus and red seaweed on moderately exposed lower eulittoral rock'[16] is also common along the lower shore associated with boulders and cobbles as well as clay boulders that have been eroded from the cliff face and been colonised by macroalgae in the lower shore.

4.1.7 The sediments in the intertidal area at Poolbeg are predominantly sands but grade to sandy muds in some places. NPWS (Scally *et al* in prep) describes a single littoral sediment community from the intertidal zone at Poolbeg / Shellybanks as 'fine sands with *Angulus tenuis* community complex'. Aquafact, 2021 also reported 'fine sands with *Angulus tenuis* community complex' from the upper to lower shore with incipient Marram grass dunes forming in three locations in the upper shore, above the high water mark.

4.1.8 In the lower shore, in the main tidal drainage channel approximately 600m south of Poolbeg Beach a large patch of Ulva spp. was recorded. An area of cobbles of approximately 2,000 m^2 was recorded in the upper shore to the south of Poolbeg power station, 40m south of the access road. This cobble substrate consisted of tightly packed cobbles and coarse pebbles with fine sand and shell debris.

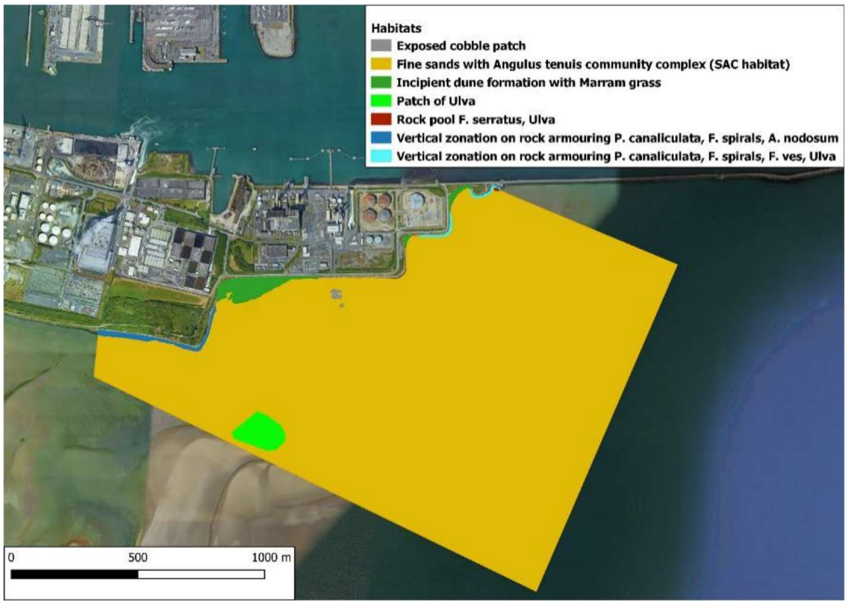

Figure 13 Poolbeg biotope map

13 MarLIN classification - LS.LSa.St.Tal
14 MarLIN classification - LR.FLR.Eph.Eph.X
15 MarLIN classification - LS.LSa.FiSa.Po.Aten
16 MarlIN classification – LR.MLR.BF.Fer.R

4.1.9 At Poolbeg, access to the beach by track machine has the potential to impact areas of *Zostera noltii*, marram grass (*Ammophila arenaria*) and annual vegetation of drift lines. Machinery is planned to be lowered to the beach by crane from Shellybanks Road, or brought to shore by barge, and therefore there would be a small corridor (approximately 3m) of disturbance by the machinery tracks between the point of access and sampling station.

4.1.10 Reinstatement of the intertidal habitat at all landfall locations will be carried out to pre-survey conditions. Spoil from boreholes will be contained and removed off site to a licenced disposal or waste recovery site. The intertidal borehole locations close to the anticipated route of the horizontal directional drill will be filled with grout to prevent weakness during drilling operations.

4.2 Fish and Shellfish Ecology

4.2.1 Several species of fish are known to spawn in the vicinity of the proposed area which is the subject matter of this Foreshore Licence application, namely lemon sole (*Microstomus kitt*), sprat (*Sprattus sprattus*), plaice (*Pleuronectes platessa*), sole (Solea solea), whiting (*Merlangius merlangus*), cod (*Gadus morhua*), mackerel (*Scomber scombrus*) and the Norwegian lobster (*Nephrops norvegicus*) (Coull et al., 1998 and Ellis et al, 2012). All spawning is recorded as being of low intensity with the exception of plaice, where the area of high intensity overlaps the northern extent of the survey area. The nursery areas which occur in the vicinity include those for cod, haddock (*Melanogrammus aeglefinus*), herring, lemon sole, Nephrops, plaice, whiting, mackerel and horse mackerel (*Trachurus trachurus*) and sandeel (Ellis et al., 2012 and Marine Institute). With the exception of cod and whiting, all nursery grounds are recorded as being of low intensity.

4.2.2 The nearest designated salmonid rivers to the proposed site are approximately 36 km to the north, and 95 km to the south of the proposed Foreshore Licence area [Boyne River Special Area of Conservation (SAC) and Slaney River SAC respectively]. The Boyne River SAC lies approximately 50 km to the north of the proposed survey area.

4.2.3 However, migratory fish are known to have a temporal or spatial overlap with the proposed Foreshore Licence area. River systems flowing into Dublin Bay (the River Liffey, River Tolka and River Dodder) are reported to support sea trout (*Salmo trutta*). Atlantic Salmon (*Salmo salar*) are known to occur within the River Liffey, whilst the Dodder and Tolka also support smaller populations (Holmes et al, 2018). Sea trout (CSTP, 2016) and salmon (Holmes et al., 2018) have also been reported in the River Dargle which flows through Bray (approximately 10 km southwest of the proposed Dublin Array site). European eel (*Anguilla anguilla*) has been documented in the Tolka and Liffey rivers (Holmes et al., 2018) and the Lower Liffey is a migratory corridor for river and brook lamprey known to occur in the wider Liffey catchment.

4.2.4 Common whelk, European lobster, brown crab, velvet crab, scallops and nephrops are all considered to be commercially important shellfish in the wider area on account of their landings weight and value. The commercial value of the whelk fishery in particular has been identified through consultation with the local fishing fleets, who identified that the Dublin Bay area is almost exclusively targeted for whelk.

4.2.5 Beam trawls undertaken in the Dublin Bay shipping channel (in the vicinity of the northern export cable route corridor (Alexandra Basin Redevelopment Project Strategic Infrastructure Development application, Dublin Port Company, 2014) recorded relatively high densities of brown shrimp (*Crangon crangon*) and green crab (*Carcinus maenas*).

4.2.6 Video surveys conducted in Outer Dublin Bay (in close proximity to the Poolbeg Lighthouse) consisted of muddy and fine sands, with fauna reflecting the substrate. Hermit crabs (*Pagurus bernhardus*) and masked crabs (*Corystes sp*.) were common across the area, with whelk (*Buccinum undatum*) and shrimp also present (Alexandra Basin Redevelopment Project, 2014).

4.3 Marine Mammals

4.3.1 The key species likely to be present within the survey area and surrounds are harbour porpoise (*Phocoena phocoena*), harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*). Other species have been recorded in the area, including minke whales (*Balaenoptera acutorostrata*), bottlenose dolphins (*Tursiops truncatus*), Risso's dolphins (*Grampus griseus*) and common dolphins (*Delphinus delphis*), however they are not commonly encountered.

4.3.2 There have been several studies of marine mammals in the Irish Sea and in the vicinity of Licence application area. These include site specific visual boat transect surveys conducted by the project between June 2019-January 2020 and May 2020 to April 2021 and visual boat transect surveys, boat fixed point surveys and aerial surveys conducted in 2001 – 2002. A number of broad scale surveys also provide coverage of the area including SCANS-II and SCANS-III (aerial and vessel visual surveys conducted in summer 2015 and 2016 respectively) and the ObSERVE-aerial programme conducted in summer 2015 and 2016 and winter 2015 and 2016.

4.3.3 Harbour porpoise was the most commonly sighted marine mammal during the site-specific surveys between June 2019 and April 2021. Porpoise were sighted throughout the survey area and spatial modelling showed that density estimates were generally higher on the western most coastal side of the Survey Area, especially in the north-west corner which is the point nearest to the Rockabill to Dalkey Island SAC. While sightings rates and resulting density estimates were high in November 2019 and September 2020, overall there wasn't any evidence of a seasonal pattern in the sightings. In 2016, harbour porpoise were found to be distributed throughout the SAC survey area, but significant changes occurred in their spatial distribution between individual surveys with abundance higher in the northern section of the SAC during August and September when compared to June and July data. Harbour porpoise sightings in the outer Dublin Bay area also varied between surveys but were generally low compared to adjacent waters surveyed within the SAC; most sightings were distributed to the north and south of Dublin Bay (O'Brien and Berrow, 2016).

4.3.4 Lambay Island which is designated for grey and harbour seals, lies to the north, 4km from the proposed Foreshore Licence area and approximately 18 km from the geotechnical and geophysical survey boundaries. The survey area is within the likely foraging range for both species. Grey seals and harbour seals occur year-round and the island's intertidal shorelines, coves and caves are used by resting and moulting seals. Dalkey Island (within Rockabill and Dalkey Island SAC) is also a known haul-out and breeding site for grey seals (NPWS, 2013). Harbour seal forms part of the mixed colony (with greys) around Dalkey Island and Dublin Bay.

4.3.5 Screening for Appropriate Assessment and a Natura Impact Statement are presented in Annex E to this application.

4.4 Birds

4.4.1 Ireland is internationally important for breeding bird populations. For two species, European storm-petrel (*Hydrobates pelagicus*) and roseate tern (*Sterna dougallii*), more than 10% of the species are found breeding in Ireland, while significant numbers of great cormorant (*Phalacrocorax carbo*) and Manx shearwater (*Puffinus puffinus*) also breed in the country.

4.4.2 There are several seabird species that have been identified in previous Dublin Array site survey reports. The key species are listed in Table 4 together with details on the key season for each species.

Table 4 Summary of key bird species in the Foreshore Licence area.

Key species	Key season
Manx shearwater (*Puffinus puffinus*)	Breeding season – birds leave the Irish Sea and migrate south for non-breeding season.
Gannet (*Morus bassanus*)	Breeding season – most Gannets move south in non-breeding season.
Shag (*Phalacrocorax aristotelis*)	Predominantly breeding season.
Herring gull (*Larus argentatus*)	All year.
Great black-backed gull (*Larus marinus*)	Predominantly breeding season, although some birds present all year.
Kittiwake (*Rissa tridactyla*)	All year.
Little gull (*Hydrocoloeus minutus*)	Non-breeding season.
Common tern (*Sterna hirundo*)	Post-breeding season – birds leave the Irish Sea and migrate south for non-breeding season.
Arctic tern (*Sterna paradisaea*)	Post-breeding season – birds leave the Irish Sea and migrate south for non-breeding season.
Roseate tern (*Sterna dougallii*)	Breeding and post-breeding season – birds leave the Irish Sea and migrate south for non-breeding season.
Guillemot (*Uria aalge*)	Predominantly breeding season.
Razorbill (*Alca torda*)	Predominantly breeding and post-breeding season.

4.4.3 Part of the inshore extents of the proposed survey area falls within the South Dublin Bay and River Tolka Estuary SPA, which supports an internationally important population of light-bellied Brent goose and nationally important populations of a further nine wintering species. Furthermore, the site supports a nationally important colony of breeding Common Tern and is an important staging/passage site for a number of tern species (Roseate tern, common tern and Arctic tern) in the autumn (mostly late July to September).

4.4.4 The inter-tidal survey locations are popular coastal areas of high amenity which have increased amenity activity during summer months. As a result, the presence of additional anthropogenic

activity on/near the shore during summer would not cause a significant additional disturbance as the species on site would be accustomed to high disturbance levels. However, localised, disturbance of birds in close proximity to geotechnical investigation locations may occur whilst drilling is on-going. The inter-tidal survey at Poolbeg will be carried out outside the over-wintering season (1st September to 31st March) to avoid disturbance to over-wintering bird species.

4.4.5 Screening for Appropriate Assessment and a Natura Impact Statement are presented in Annex E to this application.

4.5 Fishing and Aquaculture

4.5.1 The location of the proposed survey area is within the Irish Sea within International Council for the Exploration of the Seas (ICES) rectangle 35E4 and 35E3.

4.5.2 An initial review of ICES rectangle data indicates that Republic of Ireland vessels land the majority of catch, by weight, from both 35E3 and 35E4, although landings are also noted by Scottish, Belgian and Northern Irish vessels.

4.5.3 Vessels which are under 10m form the majority of the inshore fleet and are not required to complete logbooks and therefore their landing figures are not included in the EU DCF and Central Office data/ICES rectangle.

4.5.4 As confirmed from on-going consultation the species catch landed in the highest quantity is whelk, targeted by the inshore potting fleet. Whelk is consistently targeted in 35E4.

4.5.5 Consultations undertaken to date with the Marine Institute, Sea Fisheries Protection Authority (SFPA), Bord Iascaigh Mhara (BIM)and local fisherman indicate that the regional fishing fleet is characterised by approximately 30 vessels operating off the East coast (including amongst other areas, the area which is the subject matter of this application). This includes vessels based at the following ports (from north to south): Howth, Dún Laoghaire, Greystones, Wicklow, and Arklow.

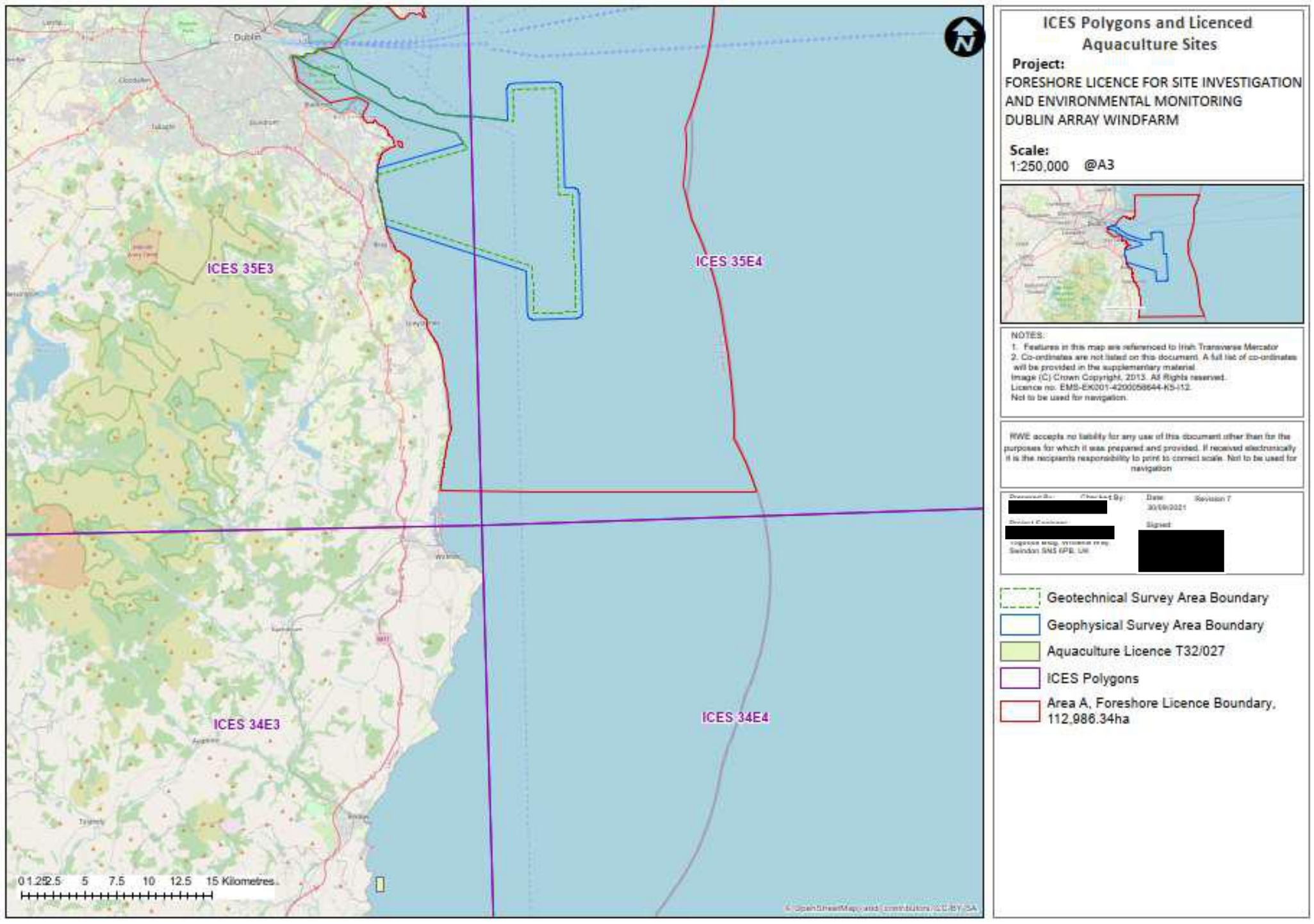

Figure 14 ICES Rectangles and Licenced Aquaculture Sites

4.5.6 A dredge fishery targeting queen scallop is noted in the region adjacent to and slightly overlapping the south west portion of the Foreshore Licence application area, towards Shanganagh Cliffs. Scallop dredging also takes place to the east of the Kish and Bray Banks. This queen scallop fishery is targeted by Irish, Northern Irish and Scottish vessels.

4.5.7 No beam trawl activity has been found to occur across the proposed Foreshore Licence area boundaries; the closest beam trawl grounds are approximately 19 km east of the array boundary. VMS data indicates very little otter trawl activity across the survey area.

4.5.8 A Foreshore and Aquaculture Licence has been awarded for the establishment of a mussel seed farm between Clogga Bay and Kilmichael Point, off the coast of Co. Wicklow approximately 35km south of the Foreshore Licence boundary. There are also designated aquaculture zones are at Carlingford Lough, approximately 68km north of the Foreshore Licence boundary and Wexford Harbour approximately 85 km to the south.

4.6 Navigation

4.6.1 Vessel routeing in the area is largely dictated by the local shallow banks, including the Kish and Bray Bank. Given the shallow water depths associated with these banks, larger commercial vessels currently avoid the project area, with only smaller fishing or recreational vessels transiting through the proposed site.

4.6.2 The area surrounding the banks is very busy with a number of high density vessel routes passing to the west and north of the Kish and Bray Banks, the majority of which are associated with Dublin Port. This includes regular passenger and freight ferry routes.

4.6.3 There are a number of ports on the east coast of Ireland. The busiest of these is Dublin Port located to the north west of the survey area. Dublin Port caters for freight, passenger and cruise liners. In 2019 Dublin Port processed 38,100,000 tonnes of freight together with 1.949 million passengers and 158 cruise ships. The total number of ship arrivals was 7,898.

4.6.4 Scheduled shipping and ferry routes in and out of Dublin Port are largely to the east coast of the UK and south through the Irish Sea to continental Europe with the main routes being;

- ICG: Dublin – Holyhead, Dublin – Cherbourg
- Seatruck: Dublin – Liverpool, Dublin – Heysham
- P+O: Dublin – Liverpool
- Cobel Fret: Dublin – Rotterdam, Dublin – Zeebrugge
- Stena: Dublin – Holyhead
- Isle of Man Steampacket: Dublin – Douglas

4.6.5 The main scheduled shipping routes are illustrated in Figure 15 and Figure 16. Most shipping and ferry routes from Dublin Port pass to the north of the Kish Bank and are clear of the survey areas.

4.6.6 There are also Lo-Lo container services out of Dublin Port and these include;

- Samskip - Rotterdam, Zeebrugge
- BG – Antwerp, Belfast, Liverpool, Rotterdam
- Euron – Rouen, Southampton, Antwerp, Rotterdam
- CMA – Le Havre

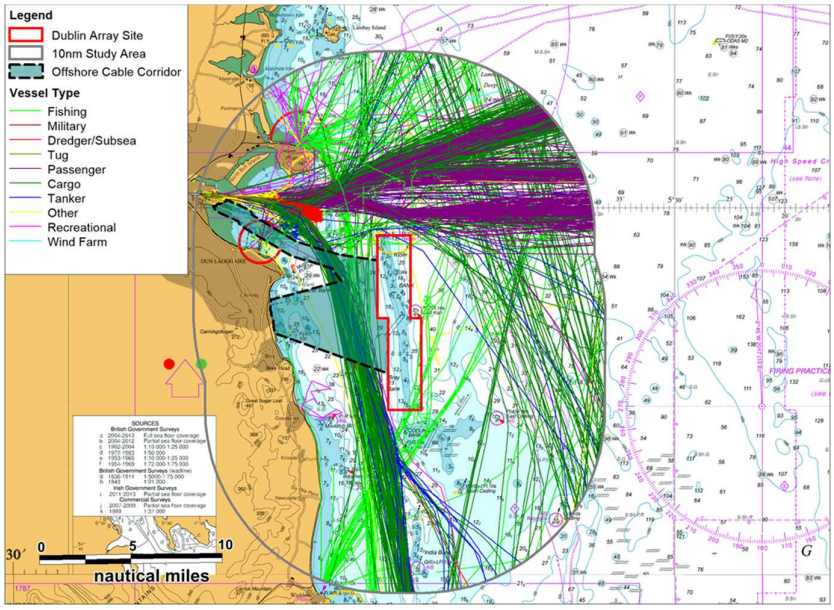

Figure 15 14 Days AIS Winter 2018

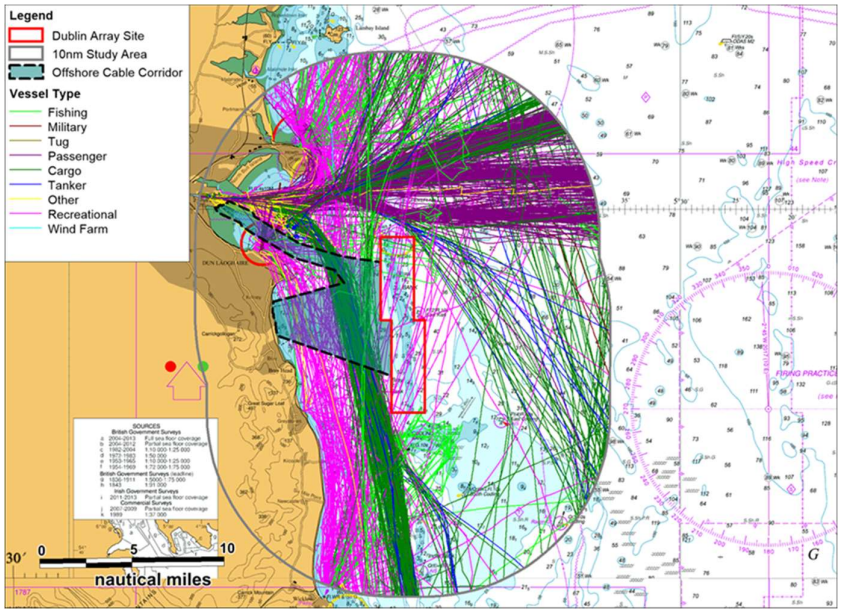

Figure 16 14 Days AIS Summer 2018

Ship Separation Zone

4.6.7 There are designated Traffic Separation Schemes (TSS) along the south west and north sides of the Burford Bank. Vessels transiting between the Kish / Bray banks and the coastline utilise the South Burford TSS and those travelling east-west from Dublin Port utilise the North Burford TSS. There is also a designated ship anchorage zone north east of Dun Laoghaire and west of the Burford Bank. Effective communication procedures will be agreed with Dublin Port to enable geotechnical sampling at locations in proximity to these navigational features to be undertaken safely.

Marinas, Sailing and Recreation

4.6.8 There are a number of marinas in the area, including Dun Laoghaire (820 berths), in the River Liffey at Poolbeg (100 berths), Howth (250 berths), Greystones Harbour (250 berths) and at Bray Harbour (approximately 100 moorings).

4.6.9 There are four waterfront yacht clubs located in Dun Laoghaire (the Royal St. George; the National; the Royal Irish and the Dún Laoghaire Motor Yacht Club) and two umbrella clubs Royal Alfred Yacht Club, and the Dublin Bay Sailing Club. The Irish National Sailing School and Irish Youth Sailing School are also based in Dun Laoghaire. Poolbeg Yacht and Boat Club operates from Poolbeg Marina.

4.6.10 The yacht clubs at Dun Laoghaire and Poolbeg have a comprehensive sailing programme throughout the period from the end of April to early October with evening sailing on weekdays and with large fleets racing at weekends. The sailing clubs at Bray and Greystones also organise a schedule of races across the sailing season.

4.6.11 Other marine leisure clubs and groups active in the area include rowing clubs (Greystones Rowing Club, St Michaels Rowing Club, Stella Maris Rowing Club, Dalkey Rowing Club, Bray Rowing Club), various sea scouts groups, sea angling, swimming, kayaking, diving and sub aqua clubs. An outline of the pattern of pleasure craft movements from AIS records is shown in Figure 15 and Figure 16.

Tourism

4.6.12 Between March and September, Dublin Bay Cruises currently offer several sightseeing tours of Dublin Bay daily, with the MV St Bridget operating between Dun Laoghaire, Dalkey Island, Howth and Dublin City. Other tourism related activities offered in Dublin Bay include sea kayaking tours, stand up paddle boarding and kitesurfing.

RNLI

4.6.13 The nearest RNLI Station is in Dun Laoghaire harbour with both a D Class lifeboat (for inshore operations) and a Trent Class lifeboat (for all weather, offshore operations) based there.

4.6.14 RNLI Stations are also located at Howth and Arklow and both stations operate a D Class lifeboat and a Trent Class lifeboat. The RNLI station at Wicklow operates an inshore D Class lifeboat.

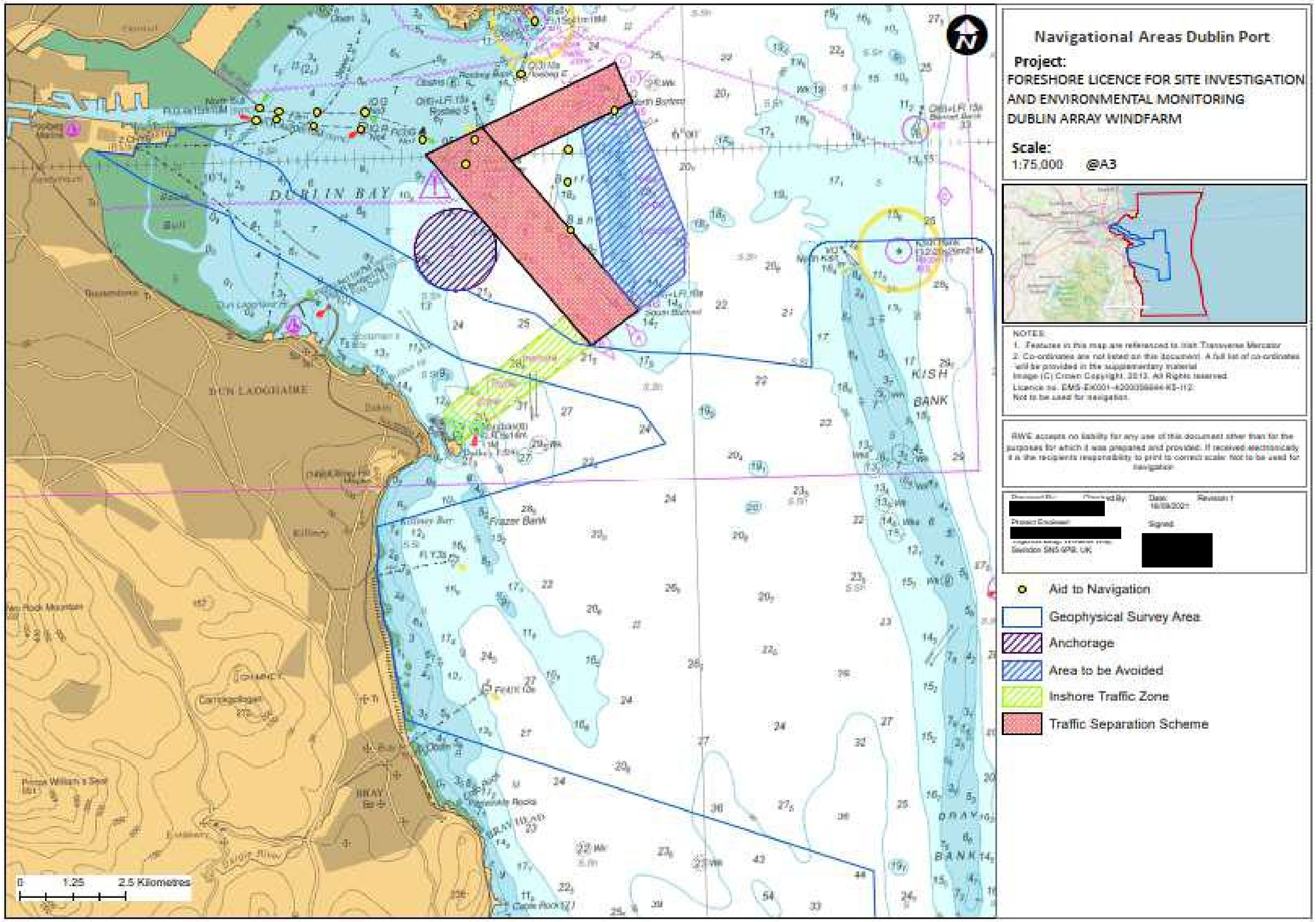

Figure 17 Navigational Features, Dublin Bay

4.7 Marine Archaeology

4.7.1 An assessment of the proposed site investigation activities on marine archaeological features has been undertaken by Maritime Archaeology Ltd and is presented in Annex D of this Foreshore Licence application. The Marine Archaeological Assessment Report includes consideration of the environmental context of the area and of marine activity from the Palaeolithic to post-medieval period in the proposed survey area.

4.8 Marine Infrastructure

4.8.1 The location of existing pipelines and cables within the proposed Foreshore Licence application area are within the export cable search area as shown in Figure 18. The existing subsea infrastructure includes:-

- A sub-sea sewer pipeline from Dun Laoghaire to the Ringsend sewage treatment works at Poolbeg;
- A sub-sea sewer pipeline from Poolbeg to Sutton;
- A sub-sea gas pipeline from Booterstown to Poolbeg;
- The ESAT 2 fibre optic cable from Sandymount to Southport (UK);
- Shanganagh Waste Water Treatment Plant, primary long sea outfall;
- Shanganagh Waste Water Treatment Plant, secondary stormwater overflow; and,
- The offshore section of the long sea outfall at Bray.

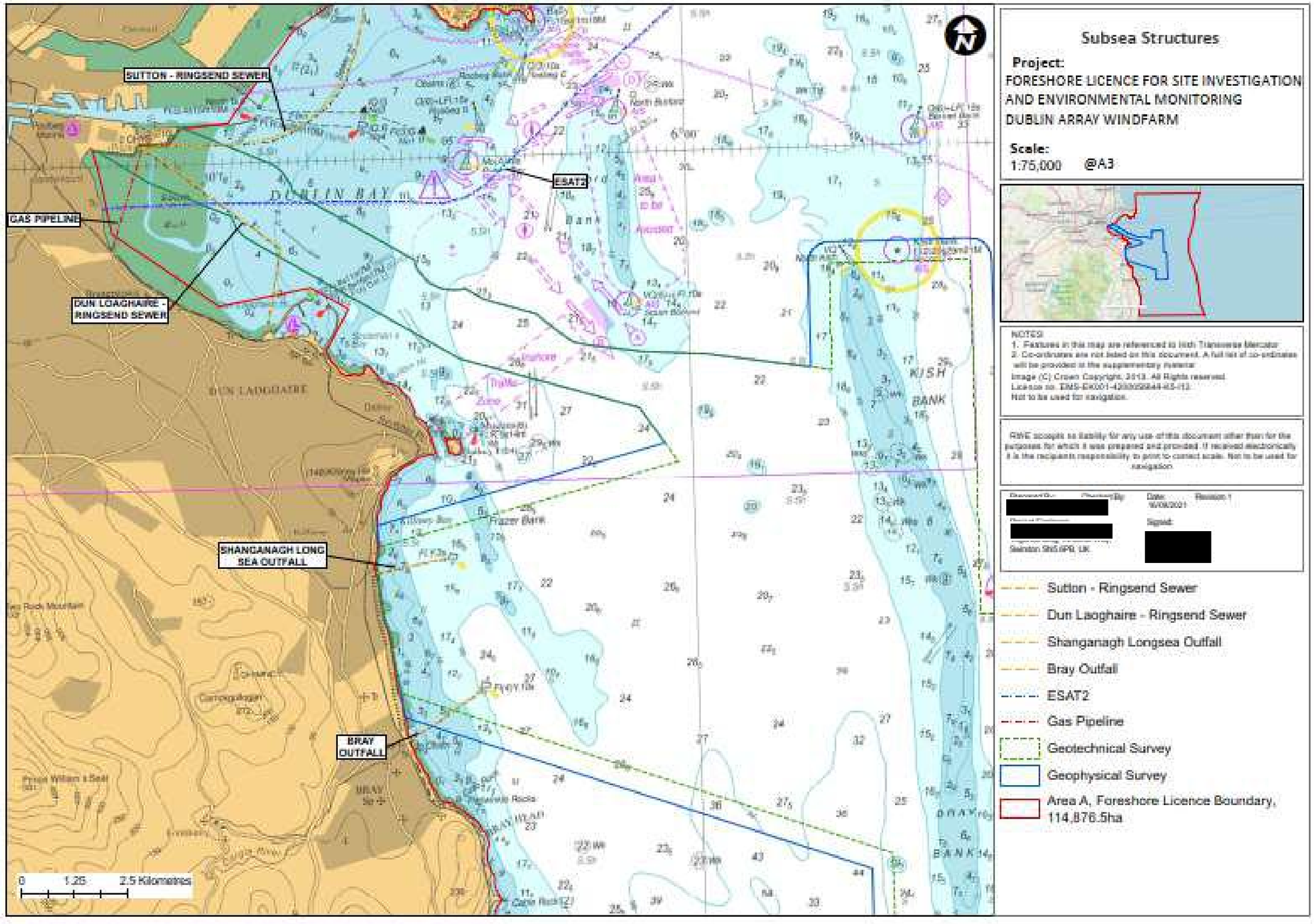

Figure 18 Existing Subsea Infrastructure on Approach to Poolbeg

5 CONSULTATION AND LIAISON

5.1 Pre-application Consultations

5.1.1 The following consultation has been undertaken during the preparation of this Foreshore Licence Application.

Table 5 Pre-application consultation

Organisation	Date	Method	Matters Discussed
Department of Housing, Local Government and Heritage.	19 November 2021	Online meeting	Preliminary consultation meeting – advice given by DHLGH to indicate area within Foreshore Licence boundary where static acoustic monitoring equipment would not be deployed. Advice regarding new guidance for presentation of Foreshore Licence figures.
Department of Housing, Local Government and Heritage.	13 August 2021	Online meeting	Pre-application consultation meeting following change of scope. Advice received regarding required supporting documents.
Department of Housing, Local Government and Heritage.	23 August 2021	Online meeting	Pre-application call with Ecological Advisor to discuss information required to support Minister's Appropriate Assessment Screening process.
National Parks and Wildlife Service	06 and 09 July 2021	Email correspondence	Email exchange regarding scope of works and proposed ecological mitigation measures. Confirmation from NPWS that the mitigation measures proposed appeared to be in order.
Dublin Port	09 July 2021 and 29 Sept 2021	Email correspondence	Email exchange regarding scope of works and proposed navigation mitigation measures. RWE confirmed that Communication Protocol will be implemented, number of survey vessels operating in Port approaches will be limited in agreement with the Port and final location of SAM will also be agreed with the Port prior to deployment.
Fishers	15 and 16 September 2021	Written briefing and meeting at harbours in Dun Laoghaire and Wicklow.	Briefing meeting on proposed survey scope and foreshore licence application

6 HEALTH, SAFETY, QUALITY AND ENVIRONMENTAL MANAGEMENT

6.1 Health, Safety and Quality

6.1.1 The works will be undertaken in accordance with the following standards as applicable:

- Safety, Health and Welfare at Work Act, 2005;
- Safety, Health and Welfare at Work (Construction) Regulations, 2013;
- Merchant Shipping (Passenger Boat) Regulations, 2002
- ISO19901-8 section 5.4 Health, Safety and Environmental (HSE) requirements for marine operations;
- CIRIA – Assessment and management of unexploded ordnance risk in the marine environment, C754, 2015;
- IHO standards for hydrographic surveys 5th Addition Feb 2008 special publication No.44;
- IHO standards for hydrographic surveys Post construction surveys MGN 371;
- IMCA / IOGP Report No. 373-19, June 2011 Global Navigation Satellite Systems;
- IMCA, April 2011, Guidance on Vessel USBL Systems for Use in Offshore Survey and Positioning Operations, Report No. IMCA S-017, International Marine Contractors Association;
- OGP P1/11 Geophysical position data exchange format Report 483-1 version 1.1 April 2015;
- OGP P2/11 Positioning data exchange format Report No. 483-2 Version 1.1 April 2015;
- OGP Report No. 373-18-1 Guidelines for the conduct of offshore drilling hazard site surveys;
- SUT Offshore Site Investigation and Geotechnics Committee (2014), Guidance Notes for the Planning and Execution of Geophysical and Geophysical Ground Investigations for Offshore Renewable Energy Developments;
- Frameworks and Principles for the Protection of the Archaeological Heritage (Department of Culture, Heritage and the Gaeltacht [DCHG], 1999);
- Model Clauses for Archaeological Written Schemes of Investigation (The Crown Estate 2010);
- Offshore Geotechnical Investigations and Historical Environment Analysis: Guidance for the Renewable Energy Sector (COWRIE, 2011).

6.1.2 A project specific HSEQ plan will be prepared prior to starting the survey works. RWE Renewables will appoint a competent Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) for the project under the requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013 as they relate to the undertaking of the surveys set out in this licence application.

6.2 Environmental Management

6.2.1 The survey vessels will operate under international standards according to the MARPOL (maritime pollution) Convention with respect to wastewater and food waste discharges. Survey vessels will also comply with the relevant Irish legislative requirements including, for example, the Sea Pollution Act, 1991 as amended, Dumping at Sea Acts 1996 to 2009, Sea Pollution (Prevention of Pollution by Garbage from Ships) Regulations 2012 and Sea Pollution (Prevention of Pollution by Sewage from Ships) (Amendment) Regulations 2012, as amended.

6.2.2 All refuse and waste materials will be kept onboard the vessel and safely disposed of onshore in a suitable licensed waste facility.

6.2.3 Particular care will be taken when handling or storing hazardous materials. These will be stored, handled, used and documented in accordance with accepted guidelines, assessments in relevant legislation, guidelines and codes of practice including, for example the Safety, Health and Welfare at Work Act, 1995, the Safety, Health and Welfare at Work (Chemical Agents) Regulations (2001-2021) and its associated Code of Practice as published by the Health and Safety Authority. Spill kits shall be available on board all vessels.

7 SUMMARY OF MITIGATION COMMITMENTS[17]

7.1 Benthic Sub-tidal and Inter-tidal Habitats

7.1.1 The inter-tidal and sub-tidal geotechnical sampling locations will be selected after review of the most up to date available geophysical and environmental data. The data will be reviewed for the presence of potential ecological features such as subtidal geogenic reef.

7.1.2 Sampling will be preceded by drop down video and images will be reviewed to confirm that sampling will not impact upon reef features. Sampling locations will then be micro-sited where necessary to avoid any impact on these features.

7.1.3 To prevent damage to saltmarsh and sand dune habitat, all access to the Poolbeg inter-tidal area by track machine will be supervised by an ecologist to ensure these sensitive areas are avoided. Machinery will be either lowered to the beach by crane from Shellybanks Road, or brought to shore by barge.

7.1.4 The intertidal boreholes may be grouted to within 2m of surface of the base of mobile sediment typically using a 2:1 bentonite cement mix. The surface will be reinstated to previous condition as the investigations at each location are completed. Any residual material will be contained and removed off site for disposal.

7.2 Marine Mammals

7.2.1 Geophysical and geotechnical surveys will be undertaken in accordance with Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters, DAHG Guidance (2014) or other updated guidance as agreed with the National Parks and Wildlife Service (NPWS). Qualified and experienced marine mammal observers (MMO) will be appointed to monitor for marine mammals before the commencement of sound producing activities, during ramp-up procedures and following breaks in sound output, as defined in DAHG (2014). Sound producing activities will not commence until the monitored zone, as defined in DAHG (2014) has been clear for the period required under the guidelines.

7.2.2 In addition to the requirements outlined above, additional mitigation is proposed to allow for the presence of Harbour porpoise calves during the months of May to September inclusive. During this period sound-producing geophysical surveys shall not commence until at least 45 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO. This requirements was raised during consultation with NPWS in relation to survey works proposed under Foreshore Licence FS007029 and will also be implemented for geophysical surveys proposed in this application.

7.3 Birds

7.3.1 The inter-tidal geotechnical investigation works at the Poolbeg landfall are proposed to be carried out outside the over-wintering period (1st September – 31st March) to avoid

[17] This section provides a summary of the mitigations contained within Annexes C, D and E of the Foreshore Licence Application.

disturbance to over-wintering bird species. An ecologist will be present during the inter-tidal surveys to ensure disturbance is minimised.

7.3.2 When undertaking all proposed works in the intertidal area, drift lines which contain the highest proportion of potential food source for bird species, will be avoided as far as possible by machinery and personnel.

7.4 Commercial Fisheries

7.4.1 RWE will consult with the local static fishing gear community as part of the planning and delivery of any survey authorised.

7.4.2 A Fisheries Liaison Officer has been in place for the project since May 2019 and will continue to be available to the fishing community to ensure effective communications during the planning and execution of the proposed surveys.

7.4.3 Where temporary removal of static fishing gear is necessary, agreements will be sought with relevant local fishers to minimise disruption.

7.4.4 Details of the survey programme, vessels and contact details will be made available through Marine Notices published by Department of Transport.

7.5 Shipping and Navigation

7.5.1 The location of SAM deployment will be determined following review of available AIS data and in consultation with Dublin Port and commercial operators so that the main shipping routes into and out of Dublin Port and pilot boarding areas will be avoided.

7.5.2 The final geotechnical and benthic sampling locations within Dublin Port's jurisdiction will also be agreed with the Harbour Authority. Prior to the survey commencing discussions will be held with the Harbour Master at Dublin Port to agree the timing of works in the vicinity of the Traffic Separation Scheme and to agree a communication protocol and any restrictions on number of survey vessels operating at any one time within the Port's jurisdiction.

7.5.3 Arrangements will be made by the applicant for the publication of formal Marine Notices through the Department of Transport. The Marine Notices will provide vessel and contact details together with a general description of operations and approximate dates of marine survey commencement and completion, deployment timing and location of fixed monitoring equipment.

7.5.4 Information will also be provided to Dublin Port for inclusion in a Notice to Mariners to be issued for works within the Port's jurisdiction.

7.5.5 Appropriate radio / nav-text broadcast warnings to advise shipping approaching the survey area will be made through communication with the Irish Coast Guard .

7.5.6 During the relevant survey operations other vessels will be requested to maintain a safe distance due to the restricted manoeuvrability of the survey vessels. Lights, shapes and other internationally recognised identification or warning signals will be displayed as appropriate.

7.5.7 The survey vessels will comply fully with all requirements of the International Regulations for Preventing Collisions at Sea.

7.5.8 Liaison will be established with the operators of marinas and with the yacht clubs at Poolbeg and Dun Laoghaire prior to the start of marine survey operations.

7.5.9 The lighting requirements of the fixed metocean monitoring equipment will be discussed and agreed with the Marine Survey Office. Charting requirements will also be agreed and relevant information provided to the UKHO in appropriate timescales for inclusion on navigational charts.

7.6 Marine Archaeology

7.6.1 Measures to avoid impact on archaeological receptors as described in Annex D to this Foreshore Licence application, will be implemented.

7.6.2 Ahead of the geophysical and geotechnical surveys the licences required under the National Monuments Act 1930-2014 will be obtained.

7.6.3 **The most recent available geophysical data will be assessed ahead of any seabed impact at geotechnical, ecological sample and buoy deployment.** Where assessment of geophysical data is not possible, or data is not available and impact on the sea floor is expected, or material is being recovered from the seabed an archaeologist might be required onboard vessels undertaking geotechnical or ecological sampling.

7.6.4 Archaeological Exclusion Zones (AEZs) will be established around known wrecks and potential receptors, as identified in the archaeological baseline assessment. AEZs will have a radius of 100 m or 300 m radius from a centre point of the receptor, or the extent of the site where needed to protect associated material and scour. Within the Foreshore License area there are 149 locations that require an Archaeological Exclusion Zone.

7.6.5 Site-specific training covered in the Protocol for Archaeological Discoveries (PAD) facilitating dialogue between the on-site offshore development contractors, Dublin Array, the archaeological curator and the retained archaeologist mitigating the impact on unexpected archaeological discoveries. The PAD should be utilised when/if an archaeologist is not onboard, for example on vessels deploying buoys, anchors or undertaking non-intrusive surveys.

7.6.6 Geoarchaeological assessments of deposits of archaeological potential recovered during geotechnical investigations within the study area will be undertaken. The geoarchaeological assessments will follow a Method Statement developed in consultation with the UAU.

7.7 Marine Infrastructure

7.7.1 Geotechnical and benthic sampling stations and SAM and buoy deployment locations will be positioned a minimum of 100m from the as-found position of existing cables and buried pipelines or 250m from the as-laid position if the position is not confirmed during the non-intrusive surveys.

7.7.2 Pipeline and cable operators will be notified of the planned works prior to commencement to agree communication protocols if required.

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