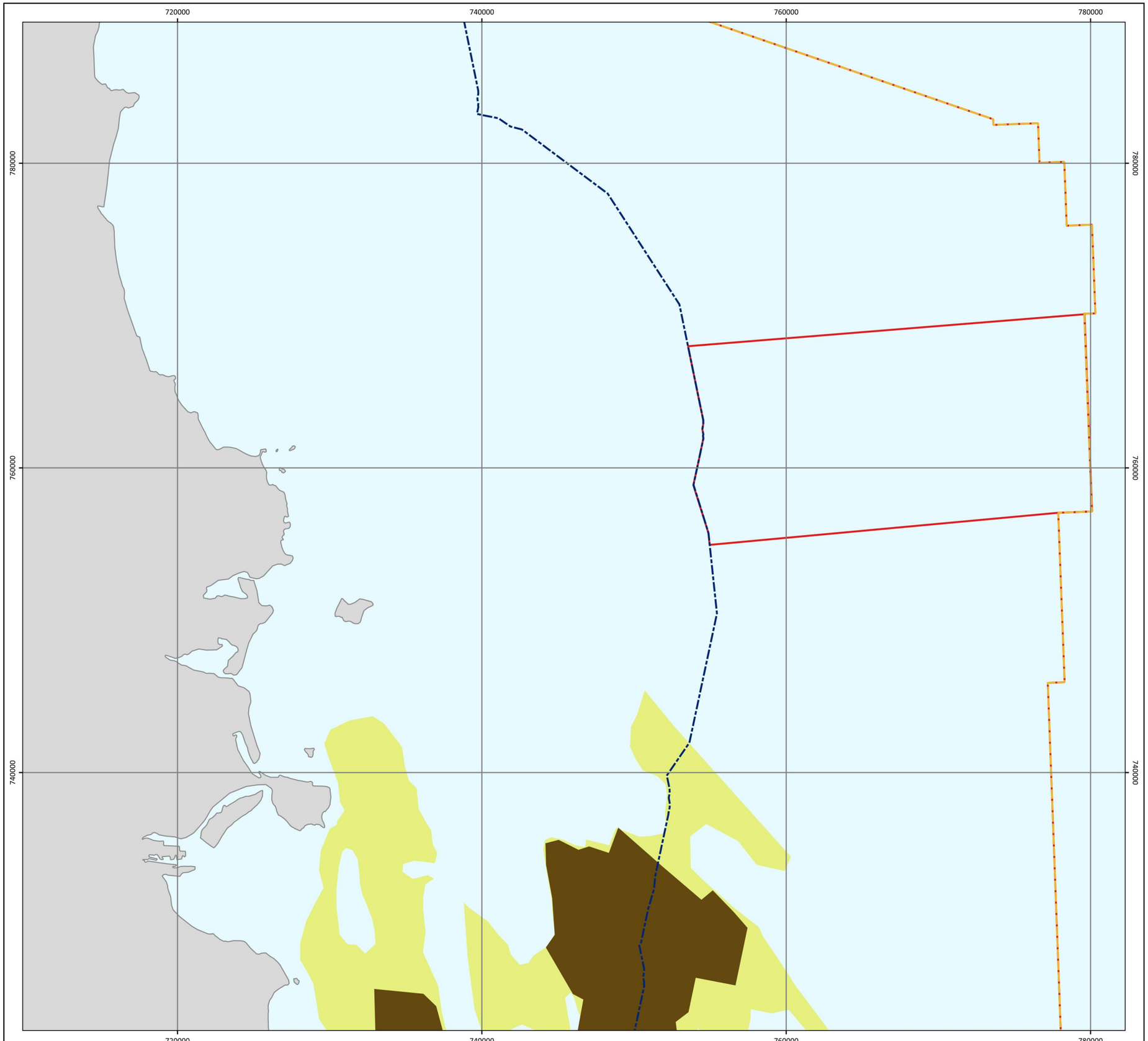
MARESCONNECT INTERCONNECTOR
MARITIME USAGE LICENCE

INFRASTRUCTURE

Marine Aggregates

Drawing No: P2578M-INFR-003	A



Legend

- Maritime Usage Area

Adminstrative Boundaries

- 12nm Territorial Sea Limit
- EEZ

Marine Aggregates

- Marine Aggregate Resource Study Area
- Marine Aggregate Resource Area

N

NOT TO BE USED FOR NAVIGATION

Date	2024-04-26 15:09:00
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File Reference	J:\P2578\Mxd_QGZ\00_OffshoreIreland\06_INFR \P2578M-INFR.qgz
Created By	[redacted]
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Approved By	

0 3 6 9 12 km

2.16.2.2 Disposal site

There were no disposal sites (dumpsites) observed within the MULA (EPA, 2024)

2.16.3 Oil and Gas Infrastructure

The Department of Environment, Climate and Communications issues licences from their internal Petroleum Affairs Division.

A policy statement in relation to petroleum exploration and extraction was published in August 2022, following the then-Taoiseach's announcement in September 2019, the 2022 policy statement was published in order to reflect the current policy and legislative position of the Government on Petroleum Exploration and Production, and to provide clarity to stakeholders in relation to future authorisations which may be granted under legislation. New exploration for oil would end as it is incompatible with a low-carbon future. Subsequently, the current Programme for Government in Ireland, adopted in June 2020, sets a clear pathway towards less reliance on fossil fuels across every sector of society and specifically contains a commitment to end the issuing of new licences for the exploration and extraction of gas on the same basis as the decision taken in 2019 by the previous Government in relation to oil exploration and extraction. Holders of existing authorisations are not affected by these changes and may apply to progress their authorisations through the licensing stages towards a natural conclusion.

The MULA is not within any oil and gas licensing blocks. The nearest authorised block from the MULA is 136 km away, this authorisation is held by Providence Resources for an exploration licence. There are no gas fields within or adjacent to the MULA, the closest 'dry hole' (A wellbore that has not encountered hydrocarbons in economically producible quantities) wells are located to the south of the MULA, with 4 'dry hole' wells being located on the Kish Basin. The 'Interconnector 1' gas pipeline runs through the centre of the MULA, this gas pipe runs from southwest Scotland into Gormanstown, Co. Dublin.

2.16.4 Offshore Renewable Energy Installations

There are no existing offshore renewable energy installations within or adjacent to the MULA. However, there are at least seven Offshore Wind Farms planned for surrounding the MULA boundary, these are discussed further in the section below.

2.16.5 Chartered Anchorages

Shipping represents a potential collision hazard to offshore structures or an anchoring hazard to cables on or buried within the seabed. Vessels that drop their anchors have the potential to interact with the cables if the anchor is dragged along the cable route or dropped directly on the cable. Ships in transit do not typically anchor under normal conditions and planned anchoring normally takes place within a designated area. Contact with an anchor is often catastrophic for the cable as the forces applied by a moving anchor can be extremely large. The anchoring hazard may result from:

- Emergency anchoring: Where an anchor is deployed to prevent collision or grounding;
- Accidental anchoring: Where an anchor falls unexpectedly from a vessel due to equipment impact or operator error. Accidental anchoring is accentuated by proximity to a port or anchorage where, for navigational reasons such as the traffic density, proximity of obstructions, shallow waters and other vessels, anchors are more likely to be readied for deployment; and
- A vessel being anchored inadequately: Where an anchor is deployed but drags along the seabed prior to embedment.

Marine Themes Vector Data for the area the MULA identifies no anchorage points near or within the MULA.

2.17 Interactions and In-combinations effects

As discussed above in Section 1 our approach to assessing the project will be multi-phased to ensure comprehensive evaluation. Below, we evaluate the survey project MULA with works undertaken elsewhere in Irish Waters, which may interact in-combination with this project. Then, we will consider both the MULA and FLA with the works that will be undertaken in UK waters, in combination with other plans or projects. This structured methodology ensures that all aspects and potential impacts are thoroughly assessed.

2.17.1 Site Investiation Surveys and Other Activities in-combination with MULA and FLA

A search of Foreshore licence Applications and MUL's (carried out on 10th of June 2024) for surveys or other activities which could interact with the proposed site investigation works was conducted using the following databases:

- Department of Housing, Local Government and Heritage (DHLGH) 'Applications and Determinations' website
- MARA's MUL application page
- An Bord Pleanála case search engine
- Bluewise Marine's Desktop study on *Impact of geophysical and geotechnical site investigation surveys on fish and shellfish (2023).*

It is acknowledged that these website's do not reflect all applications submitted to the DHLGH and MARA as prospective applicants may choose to maintain the confidentiality of their applications pending validation and commencement of the statutory procedures.

Commercial fisheries, shipping interests and recreational uses have been scoped out of the list of projects as they are considered to represent baseline conditions.

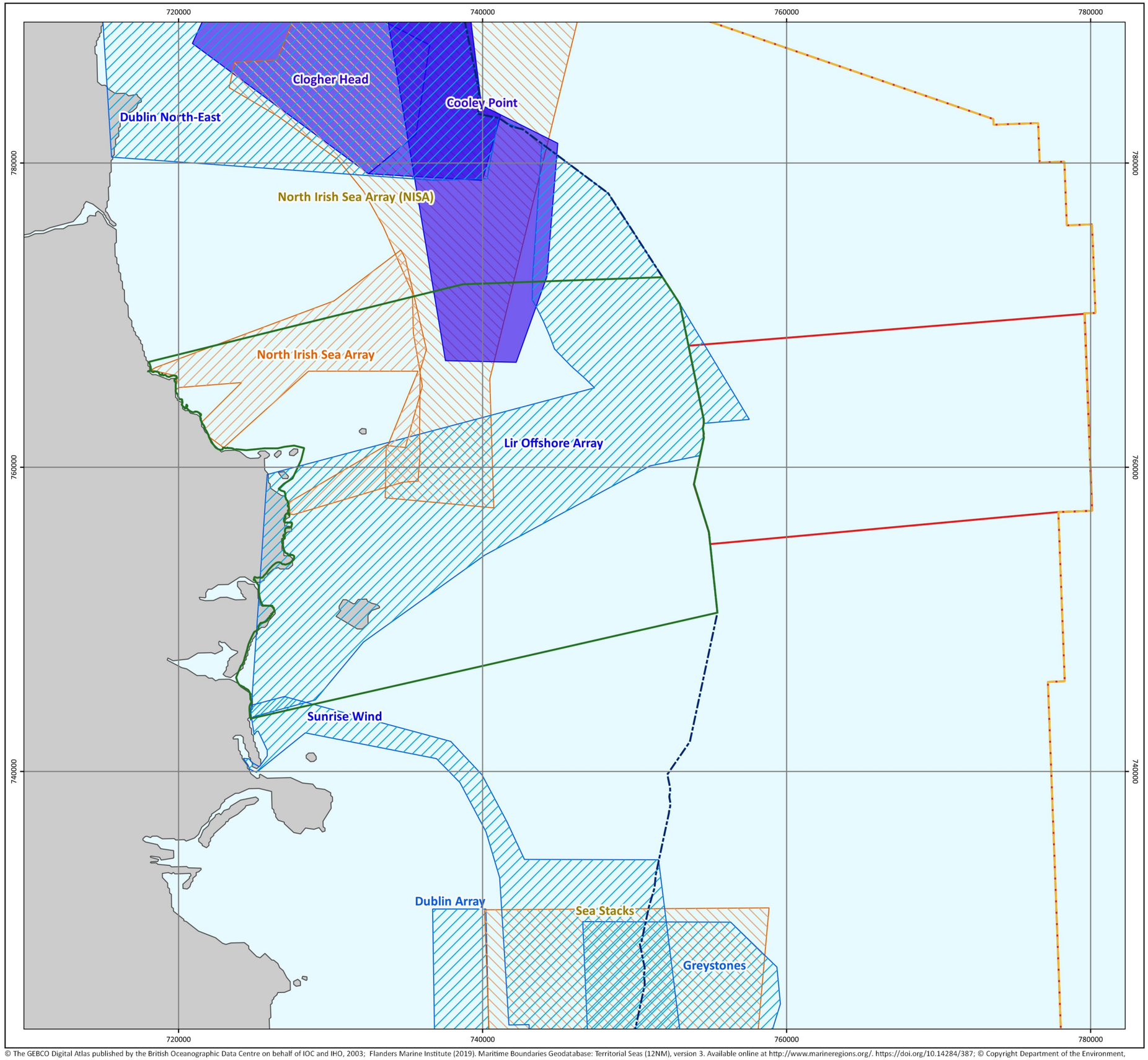
MULA and FLA overlaps with potential export cable routes and offshore array areas of certain proposed offshore renewable energy (ORE) projects. Figure 2-26 (Drawing Reference: P2578M-INFR-001) displays the location of proposed (ORE projects) identified through the databases outlined above. Table 2-6 lists the foreshore licence, MUL and Planning applications identified near the MULA and FLA.

MARESCONNECT INTERCONNECTOR MARITIME USAGE LICENCE

INFRASTRUCTURE

Existing Foreshore Licence Applications for Site Investigations

Drawing No: P2578M-INFR-001 | A



Legend

- Maritime Usage Area
- MCL FLA

Adminstrative Boundaries

- 12nm Territorial Sea Limit
- EEZ

FLA Application Stage

- Concept / Early Planning
- Foreshore survey license granted
- Site survey license application submitted

N

NOT TO BE USED FOR NAVIGATION

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Coordinate System	IRENET95 / Irish Transverse Mercator
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Data Sources	GEBCO; DECC; UCC; MarineRegions
File Reference	J:\P2578\Mxd_QGZ\00_OffshoreIreland\06_INFR \P2578M-INFR.qgz
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Table 2-6 Foreshore Licence Applications, MUL and Planning applications near MULA and FLA

Name of development & developer	Licence ref	Type of activity	Commencement date	Licence Status	Approx. distance from MULA (km)	Approx. Distance from FLA area (km)
Oriel Offshore Wind Farm	OA15.319799	Marine development Application to ABP for the construction of the Oriel Offshore Wind Farm and Associated infrastructure.	Unknown	Application lodged on the 24/05/2024	36.79	23.26
Arklow Bank Wind Park SSE Renewables	OC27.315796	Marine development Application to ABP for the construction of the Arklow Bank 2 Offshore Wind Farm and Associated infrastructure.	Unknown	Consultation closed 25/01/2024	69.36	57.99
Microsoft Ireland Operations Ltd.	LIC230018	Geophysical survey and site investigations for a proposed subsea fibre optic cable having a landfall in Portmarnock, County Dublin to evaluate options for the route traversing the Irish Sea to Abergele, Wales.	Q2 2024 – Mid 2024	Applied	Overlaps	Overlaps
North Irish Sea Array (NISA) Statkraft	LIC230001	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	Q2 2024 – Mid 2024	Consultation	Overlaps	Overlaps
Lir Offshore Array Lir Offshore Array Ltd.	FS007392	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	Summer 2022	Applied	Overlaps	Overlaps
Dublin Array RWE Renewables	FS007188	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Unknown	Determined	9.74	Overlaps
Braymore Head (Setanta) SSE Renewables	FS006973	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	Summer 2019 for five years	Determination	10.0	Overlaps
North Irish Sea Array (NISA) Statkraft	FS007031	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Summer 2020	Determination	10.33	Overlaps
North Irish Sea Array (NISA) Statkraft	LIC230001	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Q1 2024	Determination	10.33	Overlaps

Name of development & developer	Licence ref	Type of activity	Commencement date	Licence Status	Approx. distance from MULA (km)	Approx. Distance from FLA area (km)
Greystones Cobra / Flotation Energy	FS007367	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	2023	Applied	16.95	Overlaps
North Irish Sea Array (NISA) Export cable Statkraft	FS007358	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Summer 2024	Determination	17.24	Overlaps
Cooley Point Hibernian Atlantic /ESB	FS006852	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Summer 2019 to Summer 2022	Determination	17.33	6.9
Sunrise Offshore Wind Farm Sunrise Wind Limited	FS007151	Site investigation works likely consisting of Geophysical, Geotechnical, Environment , Oceanographic and Meteorological investigations	2022 (2023) up to 5 years	Consultation	21.02	Overlaps
The Leinster Project Leinster Offshore Wind	FS007162	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	Q2 2023 up to 2 years	Applied	22.43	14.52
Clogher Head Hibernian Atlantic / Parkwind / ESB	FS006787	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Unknown	Determination	22.84	8.86
Réalt na Mara Offshore Wind Farm Limited Ocean Winds	FS007330	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	Spring 2023	Applied	24.17	9.82
Sea Stacks Offshore Windfarm ESB/Equinor	FS007134	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	2022-2023	Consultation	24.46	7.80
Banba Offshore Wind Farm Banba Wind Limited	FS007283	Site investigation works likely consisting of geophysical, geotechnical, environmental, metocean campaigns.	2022 (2023) up to 5 years	Consultation	25.87	9.99
Codling Wind Farm	FS007546	Site investigation works likely consisting of Geophysical Geotechnical Fish & Shellfish surveys Benthic & Intertidal	Q2 2023	Determination	32.02	8.11

Name of development & developer	Licence ref	Type of activity	Commencement date	Licence Status	Approx. distance from MULA (km)	Approx. Distance from FLA area (km)
ESB/Fred Olsen Renewables		Surveys Archaeological surveys Metocean and Floating LiDAR Marine Mammal Acoustic POD survey				
Codling Wind Farm ESB/Fred Olsen Renewables	FS007045	Site investigation works likely consisting of Geophysical Geotechnical Fish & Shellfish surveys Benthic & Intertidal Surveys Archaeological surveys Metocean and Floating LiDAR Marine Mammal Acoustic POD survey	Q4 2020 / Q1 2021 for metocean and LIDAR campaign and Q1/2 2021 for other survey works which are expected to commence with geophysical surveys.	Determination	34.95	9.51
Benthic Ecology Survey in export Cable Corridor Mac Lir Offshore Wind,	FS007546	Benthic Ecology Survey		Applied	35.29	9.57
Laytown Beach Meath County Council	FS006602	Removal of the existing damaged gabion sea defence system and its replacement with a new sea defence system using a rock armour revetment.	unknown	Determination	36.5	
Oriel Wind Farm Parkwind / ESB	FS007383	Foreshore Licence application for geophysical, geotechnical, ecological and metocean site investigation works.	2018/2019	Determination	36.79	23.26
Maintenance Dredging Drogheda Port Company	FS007359	Maintenance dredging of the commercial estuary and seaward approaches to the River Boyne	2021	Determination	41.2	
Export Cable Route Wicklow Offshore Wind	FS007588	Foreshore Licence application for geophysical, geotechnical, ecological and metocean site investigation works.	Unknown	Applied	52.27	38.7
Latitude 52 Offshore Wnd Farm Site Investigations DP Energy	FS007232	Foreshore Licence application for geophysical, geotechnical, ecological and metocean site investigation works.	Unknown	Applied	55.47	49.75
Wicklow Sea Wind Site Investigations Wicklow Sea Wind Ltd	FS007163	Foreshore Licence application for geophysical, geotechnical, ecological and metocean site investigation works.	Unknown	Consultation	60.40	51.41
Arklow Bank Wind Park Phase 2	FS007339	Site investigations likely consisting of Geotechnical surveys.	Unknown	Determination	69.36	57.99

2.17.2 Transboundary In-Combination Effects with Site Investiation Surveys and Other Activities

Commercial fisheries, shipping interests and recreational use have been screened out of the list of projects as they are considered to represent baseline conditions, and are not considered as projects, plans or licenced activities. Existing pipelines and cables within the MULA were also not considered as they will not interact with the proposed site investigations.

On June 10th, 2024, a search was undertaken of the following databases for plans and projects in UK waters.

- JNCC Noise Registry
- National Resource Wales - Marine licensing: applications received and determined search engine
- Kingfisher Bulletin Notice Map

Table 2-7 Transboundary Plans and Projects

Name of development & developer	Licence ref	Type of activity	Commencement date	Licence Status	Approx. distance from MULA (km)
MaresConnect Limited	CML2331	Geophysical, Geotechnical and Environmental Surveys	Q1 2025	Determined	0
McMahon Design & Management Limited	RML2412	Marine Survey & Site Investigation Works SOBR2	2024-05-03 - 2024-12-16	Applied	0
McMahon Design & Management Limited	RML2413	Marine Survey & Site Investigation Works SOBR1	2024-05-03 - 2024-12-16	Applied	28
Stena Line Ports Ltd	DML1935	Holyhead Harbour Maintenance Dredging	2023-05-17 - 2028-12-31	Determined	40
Morlais renewable energy	ORML1938	Morlais Tidal Stream Demonstration Project	2021-12-14 - 2060-12-13	Determined	42.7
Mona Offshore Wind Limited	CML2315	Suction Bucked Foundation Trials	2023-07-12 - 2024-07-11	Determined	70.66
Ocean Ecology Limited	RML2319	Grab samples	2023-04-01	Determined	83

3. POTENTIAL ENVIRONMENTAL EFFECTS

3.1 Assessment Methodology

To assess the significance of effects on the environment from the proposed site investigation it is first necessary to identify the pressures and potential effects the proposed site investigations may have.

Pressures are the mechanism through which an activity influences any part of the ecosystem. The nature of the pressure is determined by the activity type, intensity, and distribution. A list of marine physical / chemical and biological pressures and their definitions has been formally agreed by the OSPAR Intercessional Correspondence Group on Cumulative Effects (ICG-C) (OSPAR 2011) and the list of pressures is published within OSPAR Agreement 2014-02 and has been used in the assessment. The ICG pressure list does not include human pressures and, therefore, categories have been developed based on industry experience.

An impact is the consequence of the pressure i.e., a predicted change in the baseline environment. The effect is the consequence of the impact and is usually measurable. Effects only occur when an impact is present within an environment that is sensitive to it. In assessing the significance of the effect, the magnitude (the spatial extent of the impact, the duration and frequency) and sensitivity, recoverability and importance of the receptor are considered. The EPA (2022) definitions of significance have been used in the assessment as follows:

- Imperceptible – An effect capable of measurement but without significant consequences.
- Not Significant – An effect which causes noticeable changes in the character of the environment but without significant consequences.
- Slight – An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
- Moderate – An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
- Significant – An effect which, by its character, magnitude, duration, or intensity alters a sensitive aspect of the environment.
- Very Significant – An effect which, by its character, magnitude, duration, or intensity alters most of a sensitive aspect of the environment.
- Profound – An effect which obliterates sensitive characteristics.

This section describes the potential pressures that the proposed site investigation works could have on the environment and the significance of the resulting effects. The section is ordered by receptor. Where considered appropriate, mitigation has been proposed to avoid or reduce the significance of effects.

3.1.1 Identification of pressures

Potential pressures associated with the proposed site investigation works were identified as:

- Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion;
- Visual (and above water noise) disturbance;
- Underwater sound changes;
- Risk of injury by collision;
- Loss or damage to fisheries habitats/fish stocks;
- Direct or indirect damage to an archaeological asset;
- Damage to or interference of an external cable/pipeline asset;
- Temporary displacement of vessels or fishing activity;
- Restricted access to commercial or recreational users; and
- Cumulative and in-combination effects.

3.2 Land and Soils

As discussed, in Section 2.2, all proposed site investigations occur exclusively within the offshore marine environment, posing no potential impact on land or soils.

3.3 Water

Project vessels will comply with the IMO International Convention for the Prevention of Pollution from Ships (MARPOL) standards. It is an offence under the Sea Pollution Acts and Regulations to discharge anywhere within the 12nm limit from a ship registered in the State, or to discharge in the State from any ship of any oil, oily mixture, noxious liquid substance, harmful substance, garbage, substances subject to control by Annex VI to the MARPOL Convention, anti-fouling systems. Accordingly, as the site investigation works are entirely in the offshore area and no discharges of waste or sewage or other pollutants are permitted within 12nm of the coast, therefore no impacts to bathing waters are anticipated. Impacts of any discharges beyond 12nm offshore by ships not registered in the State will be temporary and localised and are unlikely to have a potential effect on water quality.

3.4 Biodiversity – marine benthos, Natura 2000 Sites, marine mammals, birds, and fish ecology

3.4.1 Potential Effects on Benthic Ecology

3.4.1.1 Penetration and/or disturbance of the substrate

Small areas of seabed will be removed by the geotechnical and environmental sampling. Based upon the indicative sampling locations presented in the Project Overview provided in Section 1.5, the geotechnical (VC) will remove approximately 150.06 m^3 and environmental grab sampling will remove approximately 0.855 m^3 of sediment from the MULA. The precise sampling locations will be determined only after the geophysical survey data is completed and analysed, and this will avoid or reduce any likely effects on the seabed or any archaeological features.

The main habitat within the offshore MULA (333,124 km^2) is A5.37 “Deep circalittoral mud” with an estimated 260,682.5km^2 area coverage within the MULA (78.2% of the total MULA), The A5.37 habitat is likely to be characterised by molluscs, polychaetes and solitary ascidians, this habitat type takes up the majority of the MULA. A5.27 “Deep circalittoral sand” is the second largest predicted habitat type in the MULA with 72,389km^2 area coverage (21.7% of the total MULA). A5.15 “Deep circalittoral coarse sediment” makes up 53.069km^2 Faunal communities in this habitat are closely related to offshore mixed sediments.

The muddy and sandy sediment habitat is likely to be dominated by polychaetes, bivalves and echinoderms which will recover quickly from any disturbance caused by site investigation works. The VC’s will be taken at various locations to inform the geotechnical properties of the local geology.

The geotechnical sampling programme will create small depressions and mounds within these sediments. However, metocean conditions within the study area are highly dynamic with the presence of shifting sand waves which indicates a very mobile seabed and abundance of sediment therefore, any mounds created during sampling will be quickly dispersed and depressions infilled following equipment removal.

Benthic communities within the footprint of sampling equipment will be affected through minor disturbance around the sample station and from smothering from cuttings produced by borehole drilling. Any smothering will be a thin layer due to the small volumes of sediment displaced during the sampling and this deposited sediment will be quickly dispersed given the strong currents in the area. The area of disturbance will naturally back fill leaving no permanent significant loss or damage to habitat. Areas of sandy and coarser sediments are highly recoverable given that the sample

depressions will be quickly infilled following cessation of disturbance and therefore typical species are able to quickly recolonise the area (Dernie et al, 2003).

The sedimentary benthic habitats identified within the survey area are widespread and common for the region. Therefore, any disturbance is not expected to influence the wider population of benthic fauna and the significance of any effect will be **Imperceptible** for sedimentary habitats.

Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion. This includes the disturbance of sediments where there is limited or no loss of substrate from the system as well as abrasion relating to the damage of the seabed surface layers (typically up to 50cm depth). Disturbance of sediments and benthic habitats can occur from anchoring, geotechnical and environmental sampling activities. The total seabed area affected by samples collected by the survey will be negligible in comparison to the size of the site; therefore, the impacts of penetration and/or abrasion are expected to be very localised and temporary and limited to the boundary of the MULA. There will be no spatial overlap with SACs with receptors/habitats that may be sensitive to this pressure and the pressure will not impact the conservation objectives or status of the features. Anchor abrasion is expected to be negligible.

3.4.2 Potential Effects on Natura 2000 Sites

The SISAA included in this application thoroughly assess the potential effects of the proposed site investigation activities on Natura 2000 sites and describes the environmental baseline of the MULA and proposes suitable mitigation measures in line with relevant guidance and the conditions of Foreshore Licence Application FS007635. The SISAA concludes that the proposed site investigation activities, either independently or in combination with other activities and developments, will not adversely impact the integrity of any Natura 2000 sites.

3.4.3 Potential Effects on Marine Mammals

3.4.3.1 Underwater sound changes

One of the most important environmental considerations related to the proposed site investigations is the potential effects of underwater sound on marine mammals. For the purposes of this assessment, a qualitative approach has been taken using existing literature as this was considered proportionate to the proposed site investigations and their potential to generate underwater sound changes which could affect environmental receptors (i.e., marine mammals). The proposed site investigations will generate two distinct types of sound: continuous and impulsive.

- **Impulsive:** Geophysical survey will produce either a discrete pulse or a series of pulses. Impulsive sounds are generally transient and brief, but in the case of geophysical surveys could also be near continuous where the repetition of pulses is considered a series of multiple discrete acoustic events within a 24-hour period.
- **Continuous:** Non-pulsed and can be broadband, narrowband, or tonal. The survey vessel movements including the use of thrusters for dynamic positioning will produce continuous sound over a 24-hour period throughout the survey campaign. The vibrocore and borehole drilling operations as part of the geotechnical survey will also produce continuous sound

Background levels of sound will influence how marine species react to the temporary introduction of sound from the survey campaign. 2021 EMODNet Vessel density data (all ship types) ranges from <0.05 to 10 vessel hours per month (per km^2) within the MULA. AIS data is mandatory for vessels larger than 12 m in length, therefore certain smaller vessels (e.g., fishermen and pleasure craft) are not likely to be recorded. Marine Institute Data highlights fishing vessels are active across the MULA. Therefore, the environment surrounding the MULA will already experience levels of anthropogenic sound in addition to natural ambient sound levels. Therefore, it's unlikely that vessel noise from the survey will be noticeable against background levels in the area.

Most research has described changes in behaviour or damage (or not) to hearing in marine mammals due to underwater sound. In some rarer cases, physical injury has also been reported due to underwater sound, but such effects are more pronounced for seismic surveys, plie driving and UXO detonation.

Description of Continuous Sound

Shipping is a large contributor of low frequency background noise in oceans. There are concerns regarding noise generated by propellers, thrusters (like those used in dynamic positioning systems) and noise from the ship 's hull, from the ship's engine and other systems.

Continuous sound will be produced by the survey vessels over a 24-hour period for the duration of the survey works. Table 3-1 below outlines indicative parameters for continuous sound sources associated with the proposed site investigations.

Table 3-1 Continuous sound sources

Activity	DP vessel (Genesis 2011)
Source Level: SPL RMS (Total dB re 1 µPa^2 @ 1m)	184
Frequency: Hz	3 – 131kHz (16 Octave)

Description of Impulsive Sound

Specific equipment details are not currently known as the contracts for the proposed site investigations and surveys have not been awarded. To address this minimum and maximum frequency ranges have been provided and worst-case scenario for frequency ranges has been assessed to address potential difference in equipment. Table 3-2 outlines typical parameters for an offshore geophysical survey campaign.

Table 3-2 Impulsive sound sources

Equipment type	Purpose	Frequency (kHz) (min-max)	Source level SPL (peak) in dB re 1 µPa@1m	Source
Multibeam Echosounder (MBES)	A remote sensing acoustic device typically attached to a vessel's hull. The purpose is to map the water depth to seabed (bathymetry).	Systems range from 200 – 700 Typically, 400 for this water depth	210 – 245	Danson (2005), Hopkins (2007), Genesis (2011), Lurton and DeReutier (2011), BEIS (2020), (Jiménez-Arranz et al., 2020)
Side Scan Sonar (SSS)	Typically towed at an altitude or 10-15m, sends and receives dual frequency acoustic pulses to detect objects (pipelines, shipwrecks etc) and enable classification of surficial marine geology (sediment type, outcrops, bedforms)	100 – 900 with high resolution models 600/1600	200 – 240	DAHG (2014), BOEM (2019), BEIS (2020), (Jiménez-Arranz et al., 2020) Edgetech (2022)
Sub-Bottom Profiler (SBP)	Typically hull mounted or towed at the surface, sends short pulses to the seafloor, and are used to image geological layers and	Overall: 0.5 – 40 Pingers: 2.5 – 7	196 – 247	Danson (2005), King (2013), BOEM (2016), BEIS (2020), (Jiménez-Arranz

Equipment type	Purpose	Frequency (kHz) (min-max)	Source level SPL (peak) in dB re 1 µPa@1m	Source
	sediment thicknesses beneath the seabed. Types of SBP systems include Pingers, Boomers, Sparkers and Chirp, which have different frequencies.	Boomers: 0.3 – 6 Sparker: 0.3 – 5kHz Chirp: 3-40		et al., 2020), Innomar, (2022)
Magnetometer/ Gradiometer	Passive equipment which detects ferromagnetic anomalies in the seafloor such as pipelines, cables, debris, and unexploded ordnance	No sound emitted	No sound emitted	N/A
Ultra-short baseline (USBL)	A USBL system has a hull mounted transducer with a transceiver attached to survey equipment. It uses low frequency acoustic sound to verify subsea positioning.	19-34	184-202	Jiménez-Arranz et al., 2020

Marine Mammal Auditory Groups and Injury threshold

Both cetaceans and pinnipeds have evolved to use sound as an important aid in navigation, communication, and hunting (Richardson et al. 1995). It is generally accepted that exposure to anthropogenic sound can induce a range of behavioural effects and, in extreme circumstances, lead to permanent injury in marine mammals. Loud and prolonged sound above background levels may be considered noise and may have a negative effect on marine life. In marine mammals, this may mask communicative or hunting vocalisations, inhibiting social interactions and effective hunting.

High intensity noises can cause temporary or permanent changes to animals' hearing if the animal is exposed to the sound in proximity and, in some extreme circumstances, can lead to the death of the animal (Richardson et al. 1995). Where the threshold of hearing is temporarily damaged, it is considered a temporary threshold shift (TTS), and the animal is expected to recover. If there is permanent damage (permanent threshold shift (PTS)) where the animal does not recover, social isolation and a restricted ability to locate food may occur, potentially leading to the death of the animal (Southall et al. 2007). Despite this, there is no direct evidence to link physical injury and geophysical survey to marine mammals, however there is evidence that marine mammals exhibit short-term behavioural responses to geophysical survey (Gordon et al. 2004; Stone and Tasker 2006; Southall et al. 2007; Thompson et al. 2013; Sarnocińska et al. 2020).

Behavioural disturbance from underwater sound sources is more difficult to assess than injury and is dependent upon many factors related to the circumstances of the exposure (Southall et al. 2007, NFMS 2018). An animal's ability to detect sounds produced by anthropogenic activities depends on its hearing sensitivity and the magnitude of the noise compared to the amount of natural ambient and background anthropogenic sound. In simple terms, for a sound to be detected it must be louder than background levels and above the animal's hearing sensitivity at the relevant sound frequency. The direction of the sound is also important.

Southall et al. (2019) separated marine mammals into auditory groups based on their functional hearing sensitivity. The generalised hearing ranges of these groups are provided by NMFS (2018) as summarised in Table 3-3.

Table 3-3 Marine mammal groups based on auditory bandwidth

Group (based on auditory bandwidth)	Species observed within and in proximity to the MULA	Auditory range
Low-frequency cetaceans (LF)	Minke whale, humpback whale, fin whale	7Hz – 35kHz
High frequency cetaceans (HF)	Short-beaked common dolphin, common bottlenose dolphin, white-beaked dolphin, long-finned pilot whale, Northern bottlenose whale	150Hz – 160kHz
Very high frequency cetaceans (VHF)	Harbour porpoise	275Hz – 160kHz
Phocid carnivores in water (PCW)	Grey seal, harbour seal	50Hz – 86kHz
Other marine carnivores in water (OCW)	European otter	60Hz – 39kHz

The thresholds for the onset of PTS and TTS, as published in Southall et al. (2019), are provided in Table 3-4. These reflect the latest peer-reviewed published state of scientific knowledge.

Table 3-4 Injury thresholds for marine mammals from impulsive (SPL, unweighted) and continuous (SEL, weighted) sound

Auditory Group	Impulsive noise		Continuous noise	
	SPL (unweighted) – dB re 1 µPa (peak)		SEL (24 hr, weighted) – dB re 1 μPa^2s	
	PTS onset	TTS onset	PTS onset	TTS onset
LF	219	213	199	179
HF	230	224	198	178
VHF	202	196	173	153
PCW	218	212	201	181
OCW	232	226	219	199

Source: Southall *et al.* (2019) Table 6: non-impulsive sound and Table 7: impulsive sound.

Continuous sound

The estimated unweighted source level for sound from the survey vessels is approximately 184dB re 1 µPa @ 1m. The survey vessels will use thrusters sporadically throughout the proposed site investigations; therefore, the source level will fluctuate throughout the duration of the proposed site investigations and will only peak at approximately 184 dB re 1 µPa @ 1m for short periods.

The estimated sound levels exceed the thresholds for the onset of a temporary threshold shift, indicating that there is the potential for temporary auditory injury in cetaceans. However, the likelihood of potential injury has been assessed as low and limited to discrete windows during the proposed site investigations and only in close vicinity (<10m) to the survey works. It is assumed that all marine mammals will move away at a speed of 1.5m/s (Otani *et al*. 2000, Lepper *et al*. 2012) from a sound source level. This is considered conservative as there is data (McGarry *et al*. 2017, Kastelein *et al*. 2019, van Beest et al. 2018) to suggest that animals will, at least initially, move away at much higher speeds (e.g., harbour porpoise at 1.9m/s (Kastelein *et al*. 2019)). During the proposed site investigations, the survey vessel will be operating at lower speeds, therefore it is expected that any individuals in proximity to the survey vessel will be able to move away from the area affected to avoid injurious noise levels. However, the action of moving away from a sound level is a behavioural response. Whether this can be considered disturbance relates to whether the animal(s) is significantly affected by the response e.g. whether the sound will lead to a change in the animals' condition.

Immediately following either the vessel's transit through the area or the proposed site investigations overall, individuals will be able to return to the area.

There are no published guidelines available on disturbance thresholds due to the complexity and variability of the responses of marine mammals to anthropogenic disturbance. For the purposes of this assessment, the threshold used for behavioural disturbance is 120dB re 1 $\mu Pa^{-2}s$ (RMS) (Gomez *et al*. 2016, BOEM 2017, NMFS 2018) and has been used for continuous sound for all cetacean species. The likelihood of disturbance from continuous noise will depend on the types of vessels and the cumulative effect of several vessels operating in the area.

The proposed site investigations should be considered in the context of the existing baseline sound environment. Shipping density within the MULA is low, however there it is consistent across the year with low to moderate levels of fishing vessels transiting north and south throughout the year. Additionally, there is a consistent level of cargo vessels transiting north and south, suggesting that marine mammals in the area will be habituated to higher levels of underwater sound. The change in underwater sound caused by the addition of the survey vessels for the proposed site investigations and survey works will not be noticeable above natural and anthropogenic noise in the region. Overall, effects of continuous underwater sound changes as part of the proposed site investigations have been assessed as **Temporary** and **Not Significant**.

Impulsive Sound

MBES

MBES are widely used in the marine environment to measure water depth by emitting rapid pulses of sound towards the seabed and measuring the sound reflected (BEIS 2020). Sound frequencies emitted, in water depths of less than 200m, are typically between 300 and 400kHz (Danson 2005, Hopkins 2007, Lurton and DeReutier 2011). Sound source levels have been reported ranging from 210 – 245dB re 1µPa-m (Genesis 2011, Lurton and DeReutier 2011). Evidence has shown that MBES operating at greater than 200kHz do not cause behavioural responses in harbour porpoise (Dyndo *et al*. 2015). This is because the frequency range falls outside the hearing thresholds of cetaceans and the sound attenuates more swiftly than lower frequencies and operate at a lower power (JNCC 2017). The MBES survey is not expected to cause injurious effects to marine mammals.

The assessment has concluded that MBES will have **No Effect** on marine mammals.

SSS

SSS systems operate at relatively high frequencies (between 100to 600kHz) with the higher frequencies (above 160kHz) being outside the hearing thresholds of cetaceans and other marine mammals (Genesis 2011, JNCC 2010). Maximum source levels for SSS can be up to 228 dB re 1 µPa-m (peak SPL) (SCAR 2002). Little evidence of potential effects to marine mammals from SSS exists. The relatively high frequencies at which SSS operate will attenuate more swiftly than lower frequencies with sound levels reducing rapidly from the source. The proposed site investigations will be of short duration, a total of approximately three months, therefore any injurious effects and disturbance resulting from SSS to marine mammals will be **Temporary** and **Not Significant**.

SBP

SBP systems are used to produce subsurface images of the seabed. The resolution and type of images required determines which system is required. Pingers operate on a range of single frequencies between 3.5 kHz and 7 kHz. Boomers have a broader frequency between 500 Hz to 5 kHz and Sparkers which generate lower frequencies for maximum penetration in the seabed. CHIRP systems are modern systems designed to replace pingers and boomers. CHIRP systems operate around a central frequency but alternate through a range of frequencies between 3 kHz to 40 kHz. SBP produce sound source levels between 196 and 225 dB re 1 µPa – 1m (rms SPL) which are therefore audible to some marine mammals, particularly harbour porpoise (Danson 2005; King 2013; BOEM 2016).

Most sound energy generated by SBP will be directed towards the seabed and the pulse duration is very short with the survey constantly moving. Lower frequencies generated by SBP are within the hearing range of marine mammals, therefore this type of equipment could have localised, temporary effects on marine mammal behaviour. The UK Department for Business, Energy & Industrial Strategy (BEIS) undertook noise modelling as part of a review of consented offshore wind farms in the Southern North Sea SAC (designated to conserve harbour porpoise) which was based on the maximum source levels and bandwidths obtained from a range of SBP's. The results of the noise modelling demonstrated that for harbour porpoise in particular the onset of Permanent Threshold Shift (PTS) could arise from between 17m and 23m from source and potential behavioural effects within 2.4km and 2.5km (BEIS 2020). This was a worst-case scenario and the use of a Chirper with a peak SPL of 267 dB re 1 µPa-m.

The zone of ensonification based on the above geophysical survey methods are within proximity to the source, therefore marine mammals would need to be present near the survey vessel and remain within the localised zone of ensonification for an extended period of time to experience injurious effects. Research has shown that marine mammals can swim away from a sound source level at a speed of 1.5m/s (Otani *et al*. 2000, Lepper *et al*. 2012). This is considered conservative as there is research to suggest that animals will move away at much higher speeds (e.g., harbour porpoise at 1.9m/s (McGarry *et al*. 2017, van Beest *et al*. 2018; Kastelein *et al*. 2019)), at least initially. During the proposed site investigations, the survey vessel will be operating at lower speeds, therefore it is expected that any individuals in proximity of the survey vessel will be able to move outside of the zone of ensonification to avoid injurious noise levels.

There are no published guidelines on disturbance thresholds due to the complexity and variability of the responses of marine mammals to anthropogenic disturbance. In relation to geophysical surveys, the UK JNCC have established an effective deterrent range (EDR) of 5km for geophysical surveys (JNCC 2020). The EDR represents the limit range at which disturbance effects have been detected (for example avoidance behaviour) specifically for harbour porpoise (Crocker & Fratantonio 2016, Crocker *et al*. 2018). On this basis there is the potential for the proposed site investigations to induce a disturbance response in marine mammals, in particular very high and high frequency cetacean species.

Evidence suggests that avoidance behaviour will be temporary, with individuals returning to the area affected once the sound has ceased (Bowles et al. 1994; Morton and Symonds 2002; Stone and Tasker 2006; Gailey et al. 2007; Stone et al. 2017). It is important to note that, the proposed site investigations are temporary, being undertaken intermittently over the course of two – four months, therefore any individuals that are disturbed will be able to return to the MULA as soon as the survey activity has ceased.

The screening of protected sites in the additional document's Supporting Information for Screening for AA identified that Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC, located 76.6km from the MULA, lists cetaceans as a qualifying interest, Lambay Island SAC, Slaney River Valley SAC, and Murlough SAC, list grey seals as a qualifying interest, and Lambay Island, Slaney River Valley SAC, Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC and Murlough SAC, list harbour seal as a qualifying interest, each of which could potentially be affected by the proposed site investigation and survey works. The LSE assessment, conducted prior to the consideration of mitigation measures, did not find any potential significant effect of the proposed site investigations and survey works on their own or in-combination for Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC, Slaney River Valley SAC, Murlough SAC. Which concludes that the presence of survey vessels will not affect the breeding, moulting and resting behaviour of seals from any of these three sites. The population composition of these sites will not be affected. While any individuals present within the waters of the MULA may be disturbed by the survey activities, this disturbance effect will be temporary. As the area is also busy for vessel and fishing traffic within the SAC, there is a degree of background noise which seals will already be accustomed to. Therefore, site investigation works will not cause disturbance at a level

which will adversely affect the harbour seal population at the site and will not prevent harbour seal from accessing suitable habitat.

The frequencies at which the peak sound pressure levels of the proposed vibrocore surveys are within the audible bandwidth for low-frequency cetaceans. As the frequency is outside of the auditory bandwidth for mid-frequency cetaceans, high frequency cetaceans and pinnipeds, there is unlikely to be a significant impact from continuous noise to these species.

Southall et al., 2019 determined that the Sound Exposure Levels (SEL) (24 hr weighted) for continuous noise to cause a TTS in low-frequency cetaceans is 178dB re 1 µPa-2s or 199dB re 1 µPa-2s for a Permanent Threshold Shift (PTS). VC are only used for short durations, typically around 10 minutes until the VC is submerged and a sample can be taken. Therefore, for 93 VC samples there will be approximately up to 26 hours of underwater noise generated across the 2–4-month survey period. For marine mammals to experience a TTS from the vibrocoring, they would have to be continuously exposed to the noise at approximately 15m for 12 hours (NMFS, 2018). For marine mammals to experience PTS from VC sampling, an individual would have to be continuously within approximately 1km of the sound source for 48 hours (NMFS, 2018). As the noise generated is short in duration and intermittent, underwater noise generated by vibrocores during the proposed surveys will not exceed the threshold for injury to marine mammals. Additionally, marine mammals will likely move away from a sound source at a speed of 1.5m/s (Otani *et al.,* 2000, Lepper *et al*., 2012) from a sound source level. This is considered conservative as there is data (McGarry *et al.* 2017, Kastelein et al., 2019, van Beest *et al.,* 2018) to suggest that animals will, at least initially, move away at much higher speeds (e.g., harbour porpoise at 1.9m/s, Kastelein *et al.,* 2019). Marine mammals would, therefore, move outside of the radius for TTS and PTS radius within a minute and would not be at risk of TSS or PTS from the vibrocoring noise.

Based on the above discussion, any disturbance effects from noise associated with operations will be **localised, temporary and transient**. There will be no long-term effect or risk of injury to marine mammals from vibrocore sampling as part of the proposed site investigations.

3.4.3.2 Risk of Injury from vessel collision

There is the risk that animals could collide with survey vessels. Shipping collision is a recognised cause of marine mammal mortality worldwide, the key factor influencing the injury or mortality caused by collisions is the ship size and its travelling speed. Ships travelling at 14 knots or faster are most likely to cause lethal or serious injuries (Laist et al., 2001).

Vessels involved in the survey are likely to be either stationary or travelling considerably slower than 14 knots, typically 3-4 knots, therefore the collision risk is lower than that posed by commercial shipping activity. Therefore, risk of injury from collision to marine mammals is very low, and the significance of any effects will be Imperceptible.

3.4.3.3 Visual (and above water noise) disturbance

Seals, particularly breeding and moulting individuals, hauled out on land are known to exhibit reactions to the presence of vessels. Research indicates that ships located more than 1,500 meters away from hauled out grey or common seals are unlikely to evoke any reactions. However, when vessels are positioned between 900 meters and 1,500 meters from the seals, it is expected that the seals may detect their presence, potentially leading to behavioural responses. At distances closer than 900 meters, seals may exhibit flight reactions in response to nearby vessels (Brasseur & Reijnders, 1994). It is important to note that while this pressure may be significant for breeding and moulting seals hauled out on the coast and on intertidal banks, the proposed survey activities outlined in this application pertain to the offshore area between the 12nm limit and the EEZ. Therefore, survey vessels will not interact with breeding and moulting seals in these coastal areas, mitigating potential disturbances to seal populations during critical life stages**.**

3.4.4 Proposed mitigation for marine mammals

- Survey vessels will stay at least 900m away from known seal haul-out locations during the period May to December to minimise disturbance to breeding seals.
- A qualified Marine Mammal Observer (MMO) will be appointed to monitor for marine mammals and to log all relevant events using the relevant date forms in the DAHG guidance.
- The MMO will be located at a suitable vantage point, providing good all-round visibility.
- Delays to the commencement of the site investigations will be recommended should any species be detected within the relevant monitored zone.
- An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break. It shall only proceed on positive confirmation with the MMO.
- The MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by MMO.
- In the case of geophysical surveys the prescribed Pre-Start Monitoring shall subsequently be followed by Ramp-Up Procedure, where applicable, which should include continued monitoring by the MMO. The process laid out in Sections 4.3.4 and 4.3.4 of the DAHG 2014 guidance shall be strictly adhered to.
- An MMO report to be submitted to the Licensor's Marine Advisor (Environment) within 30 days of completion of any geophysical and drilling survey activity.

3.4.5 Potential Effects on Ornithology

3.4.5.1 Visual (and above water noise) disturbance

The potential for the proposed site investigations within the MULA to disturb birds which use the area for feeding, and loafing has been assessed below.

Disturbance can lead to several physiological and behavioural responses which can affect demographic characteristics of the population. Responses to disturbance can result in loss of energy; impaired breeding; unrest through increased vigilance; and disruption to incubation leading to increased nest failures due to predation and nest abandonment (Valente et al. 2011).

The extent to which a seabird responds to disturbance is dependent upon a number of factors including period of breeding cycle during which disturbance occurs; duration, type and intensity of the disturbance; presence of opportunistic predators; and the degree of habituation with the disturbance (Showler et al. 2010). Some seabirds are more resilient to disturbance than others.

Whilst birds present on the surface waters in the vicinity of the survey vessel could be temporarily displaced from their chosen feeding/resting location, they are likely to readily move to another nearby location. Given the short duration of the operations with the vessel moving steadily forward along the survey route, any disturbance at a given location is likely to be minimal and given the level of shipping activity in the region, disturbance is unlikely to be felt against background levels. Therefore, the significance of effects on birds in the offshore environment from the proposed site investigations will be **Temporary and Imperceptible**.

3.4.6 Proposed Mitigation for Ornithology

- To avoid disturbance to the breeding birds the working vessel will stay 2km away from breeding bird locations during the period February to October to minimise disturbance.

- MaresConnect will co-ordinate with any operators within the region carrying out operations which are likely to result in underwater noise to ensure that surveys do not occur simultaneously or concurrently.
- Drift lines contain the highest proportion of potential food source for bird species. If present, these will be avoided by machinery and personnel.

3.4.7 Invasive Species

3.4.7.1 Proposed Mitigation on Invasive Species

Through the transport and discharge of vessel ballast waters (and associated sediment), and to a lesser extent fouling organisms on vessel/rig hulls, invasive non-native species (INNS) may be introduced to the marine environment. Should these introduced species survive and form established breeding populations, they can result in negative effects on the environment.

The proposed survey vessels are unlikely to change the risk of the introduction of INNS as the vessels typically operate in a geographically localised area, and the risk from hull fouling is low, given the geographical working region.

Furthermore, management of ballast waters is addressed by the IMO through the International Convention for the Control and Management of Ships Ballast Water & Sediments, 2004 (the Ballast Water Management Convention). As Ireland is a member of the IMO it must meet with the legislation enacted.

The Ballast Water Management Convention is a treaty adopted by the IMO in order to help prevent the spread of potentially harmful aquatic organisms and pathogens in ships' ballast water. From 8th September 2017, ships have been required to manage their ballast water so that aquatic organisms and pathogens are removed or rendered harmless before the ballast water is released into a new location. This will help prevent the spread of invasive species as well as potentially harmful pathogens.

3.5 Fisheries and Aquaculture

3.5.1 Potential Effects on Fisheries and Shellfish

3.5.1.1 Physical disturbance/temporary loss of habitat for juvenile and adult sandeel

Investigation activities which have the potential to cause disturbance the seabed is namely the geotechnical survey sampling. Typically, the extent of this disturbance will be limited to the footprint of the geotechnical and environmental sampling. Given the large extent of potential spawning grounds in the area the impact of the survey is expected to be **negligible**.

3.5.1.2 Underwater sound changes

The ability of fish to hear noise is dependent on their hearing structures, which indicate their sensitivity to sound. Sound pressure is only detected by those species possessing a swim bladder; the otolith organ acts as a particle motion detector and were linked to the swim bladder, converts sound pressure into particle motion, which is detected by the inner ear. Generally, species with specialisations for sound pressure detection (e.g. a swim bladder) can hear higher frequencies (between 200Hz to 3kHz) than fishes lacking morphological adaptations, which can detect sound at lower frequencies between 100Hz to 1kHz (Carroll et al. 2017). High sensitivity hearing species such as clupeids (e.g. herring, sprat, twaite shad and allis shad) have specialisations of the auditory apparatus where the swim bladder and inner ear are intimately connected and are able to detect frequencies up to 3kHz; with optimum sensitivity between 300Hz to 1kHz (Nedwell *et al.,* 2007).

Disturbance and injurious effects may occur due to the sudden change in pressure generated by the activities. The greater the sound pulse the greater the likely effects to hearing specialist fish. There is

also potential for some fish and shellfish species to be vulnerable to impulsive activities during sensitive life stages, for example during the egg and larvae development stages.

All SACs within 100km of the MULA have been screened within the SISAA submitted with this application (See additional document Supporting Information for Screening for AA" (P2578-R6410) for the presence of Annex II migratory fish species as Qualifying Interests, in recognition that mobile species including fish could potentially enter the MULA. The following Annex II listed species are likely to be within or moving through the MULA at certain times of the year:

- Twaite shad – year-round and migrate into rivers from April-July.

Twaite shad are known to be sensitive to underwater noise. Other species present in the MULA known to be sensitive to underwater noise include herring. Twaite shad and herring are both members of the Clupidae family.

It is recognised that fish are mobile species and therefore Annex II listed migratory species have the potential to cross the MULA during the survey operations. Twaite shad are sensitive to noise changes and therefore potentially vulnerable to the proposed site investigations.

Twaite shad occur in coastal waters and in estuaries along the southeast coast of Ireland. Twaite shad are anadromous, migrating to freshwater to spawn in early summer (May to July). At maturity (3 years old for males and 5 years old for females), they stop feeding and congregate in the estuaries of suitable rivers in April and May. Upstream migration from the estuaries appears to be triggered by temperature, with peak migratory activity occurring at water temperatures of 10°C–14°C. Given that twaite shad reach maturity at age 3-5, twaite shad are likely to be found in coastal areas of the MULA all year round, with the greatest density likely to be observed during the May-July migration.

The ability of fish to hear noise is dependent on their hearing structures, which indicate their sensitivity to sound. Sound pressure is only detected by those species possessing a swim bladder; the otolith organ, located directly behind the brain, acts as a particle motion detector, and were linked to the swim bladder, converts sound pressure into particle motion, which is detected by the inner ear. High sensitivity hearing species such as clupeids (twaite shad) have specialisations of the auditory apparatus where the swim bladder and inner ear are intimately connected and are able to detect frequencies to over 3kHz; with optimum sensitivity between 300Hz-1kHz (Nedwell *et al.*, 2004).

To calculate the ZOI for recoverable and temporary injury to fish an assessment was conducted which used the results from a literature review, the assessment used thresholds for injury derived from Popper et al., (2014). These reflect the current state of scientific knowledge.

Different fish species react differently to sound. The typical behavioural response to sounds by fish might range from no change in behaviour, to a mild awareness (startle response) to larger movements of temporary displacement for the duration of the sound (Popper and Hastings, 2009). Popper et al., (2014) identified that there is no direct evidence of permanent injury to fish species from shipping and other continuous noise (such as the near-continuous noise produced by geophysical equipment).

Geophysical Survey

Most noise from a geophysical survey is generated at frequencies greater than 1kHz (Table 3-2), above the auditory capacity of fish (generally between 0.2Hz to 1kHz). In addition, sound from survey equipment is targeted towards the seabed, meaning that effects to fish are only expected if they are within the immediate zone of ensonification below the survey vessel.

Shad and herring are members of the Clupeiformes family. Herring has a hearing range between 30Hz and 4kHz, with a peak frequency of between 30Hz and 1kHz (Nedwell et al., 2004). Teague & Clough (2011) observed that young-of-year twaite shad showed significant reactions at frequencies between 30 and 60kHz, peaking at 45kHz.

Acoustic Thresholds for onset of permanent and temporary threshold shift (NMFS 2016) spreading model was used for this assessment to calculate the distance at which sound generated by the survey activities will attenuate to below the injury and disturbance thresholds. It assumes that sound is spread geometrically away from the source but does not account for attenuation or directional sources; it therefore provides conservative estimates. It also does not take into consideration the conditions within the application area, such as bathymetry, water depth or sediment type and thickness.

Based on these sensitivities, shad are not sensitive to the very high frequencies associated with MBES (albeit with some overlap at low frequency operation) and SSS surveys. It is likely however, they will hear the low frequency noise and sense particle vibration from SBP, USBL's, drilling and vibrocoring. All proposed surveys will operate at frequencies outside of the range of juvenile shad and, therefore, they will not be impacted by them. It has been suggested that the ability of the Alosids, including shad, to detect ultrasound evolved to assist in avoiding predation by echo-locating predators, e.g., toothed whales (Popper et al., 2004; Teague & Clough, 2011). As such, underwater sound may act as an acoustic deterrent for shad and suggests that shad exhibit avoidance behaviour in response to underwater noise. It is, therefore, expected that twaite shad may avoid the sound source.

Based on the hearing capabilities of shad and the survey sound sources, the shad hearing range has the potential to overlap with the MBES, SBP and USBL, however the mortality/injury threshold will only be exceeded within proximity of the sound source. Popper et. al. (2014) states the maximum distance for a lethal effect or physical injury on a fish with a swim bladder (such as twaite shad) at a SPL level of 207 dB re 1 µPa is 12 metres. For the MBES, SBP and USBL survey work, the vessel will be transiting slowly along survey lines and fish will also be in motion, therefore, the zone of injury will be transient, and it is unlikely that any fish will stay close to the sound source. Typical behavioural responses suggest that twaite shad will move away from the sound source (Popper et al., 2004; Teague & Clough, 2011) and the slow vessel speed will facilitate this behavioural response. Additionally, underwater sound from the geophysical survey equipment is targeted in relatively narrow beams towards the seabed, therefore, fish are only at risk of injury if immediately within the zone of ensonification (area filled with sound) below the sound source.

Vessel density in the MULA is relatively low to moderate, however there is consistent fishing and cargo traffic movements in the MULA all year round. Therefore, it is likely that existing background noise levels from shipping will mask the disturbance effect to twaite shad from the survey vessel.

In relation to the impulsive, high frequency sounds that will be produced as part of the geophysical survey, it has been found that pacific herring (another member of the Clupidae family) display no behavioural response to high frequency sounds from sonar or echo sounders (Peng, Zhao and Liu, 2015). As such, it is likely that twaite shad will show no visible behavioural response to these survey methods.

For the deeper penetration, a boomer sub bottom profiler, or similar could be used to achieve high quality data at the required depth. Sub-bottom Profiler systems are used to produce images of the geological sub-structures of the seabed. Boomers may typically penetrate to depths of up to 50 m into the seabed depending on the geological conditions on site. The most appropriate sub-bottom system will be chosen to reflect the geological conditions on site. Boomers generate impulsive sound in the frequency range 300 Hz to 10 kHz, with source levels of 215 dB re 1µPa (0-peak) equivalent to 214dB re 1µPa^2.s (peak) or 208dB re 1µPa^2.s (rms) (data for AA301 Boomer Applied Acoustics, 2020).

An assessment of the potential impacts on fish species from this technique has been provided below. Sub-bottom Profiler systems are used to produce images of the geological sub-structures of the seabed. Boomers may typically penetrate to depths of up to 50m into the seabed depending on the geological conditions on site. The most appropriate sub-bottom system will be chosen to reflect the geological conditions on site. Boomers generate impulsive sound in the frequency range 300 Hz to 10

kHz, with source levels of 215 dB re 1µPa (0-peak) equivalent to 214dB re 1µPa^2.s (peak) or 208dB re 1µPa^2.s (rms) (data for AA301 Boomer Applied Acoustics, 2020).

Generally, fish species with specialisations for sound pressure detection (e.g., a swim bladder) can hear higher frequencies (between 200Hz – 3kHz) than fishes lacking morphological adaptations, which can detect sound at lower frequencies between 100Hz to 1kHz (Carroll et al. 2017).

The values for fish with swim bladders which are involved in hearing have been given in Table 3-2, as these are the most sensitive category of fish.

Table 3-5 Injury and disturbance thresholds for impulsive sound

Type of Animal	Mortality and potential mortal injury	Impairment	
		Recoverable injury	Temporary Threshold Shift (TSS)
Fish: swim bladder involved in hearing (primarily pressure detection)	>207 dB re 1 µPa (peak)	>207 dB re 1 µPa (peak)	186dB re 1 µPa^2.s

Popper *et al*. (2014) Table 7.4.

The frequency range of boomers overlaps with the hearing ranges of fish, and, therefore, may be audible to some fish species and cause disturbance. The peak SPL for boomers may also exceed the Popper et al. (2014) threshold for injury and mortality to fish given in Table 3-2. However, as per the modelling method described in Appendix B for a TTS to occur, the fish would have to be within 83m of the sound source. For injury to occur, the fish would have to be within 3.3m of the sound source.

Fish are likely to leave the survey area during the survey activities horizontally or move to deeper water, away from the noise source (Løkkeborg and Soldal, 1993; Engas et al., 1993, 1996). Therefore, it is unlikely that fish will experience significant impact other than temporary displacement from the immediate area surrounding the geophysical survey activity. The impact to fish will be temporary and transient. Therefore, there is unlikely to be a significant impact to fish from boomers in the proposed surveys.

During the geophysical survey, the continued noise within 24-hour operations means it is likely that the most hearing sensitive fish species e.g., twaite shad will demonstrate temporary avoidance behaviour from early on and remain outside the ZOI for the duration of the operation. The potential ZOI is transient as it moves slowly in a constant direction along the principal survey line orientation.

Popper and Hastings. (2009) review paper suggests that some fish will move away from a loud sound source by swimming away. Slotte et al. (2004), undertook surveys of Atlantic herring and blue whiting during seismic surveys. It was observed that abundances of fish were higher outside than inside the seismic shooting area, suggesting that fish are exhibiting short-term avoidance behaviour from the survey noise.

Nedwell et al. (2012) reviewed herring sensitivity to sources of noise from non-pulse cable laying operations (i.e., cable lay and trenching) and proposed effect ranges. Clupeids are expected to show strong avoidance behaviour (i.e. reaction by virtually all individuals) within 8 m of the works, whilst significant avoidance (85% of individuals will react to noise) is expected within 66 m.

A number of studies which have estimated fish distribution in open sea fisheries have also suggested that fish leave survey areas during seismic survey activities horizontally or move to deeper water, away from the noise source (Løkkeborg and Soldal, 1993; Engas et al., 1993, 1996).

Based on the above, it is predicted that fish will avoid the area once operations have started and are extremely unlikely to move towards the sound source. The works will not lead to any long-term

displacements as they are transient and brief. Individuals are expected to return once the operation has passed through.

Geotechnical survey

Vibrocores are used to retrieve continuous sediment samples by penetrating the seabed with a core barrel fitted with a liner using vibrational energy. A pneumatic or electric vibrahead vibrates the tube, causing the sediment to liquify which facilitates penetration into the sediment. These vibrations emit low levels of noise, with a frequency of between 30Hz and 50Hz, and a Sound Pressure Level (SPL) of 188 dB (rms) re 1 µPa @ 1m (Chorney et al., 2011). There is limited publicly available data on noise generated by geotechnical borehole. Underwater noise measurements were recorded from a jack-up barge (JUB) undertaking geotechnical boreholes in Swansea Bay, Wales (Willis et al., 2010). This activity involved a percussion corer used to take soft sediment samples and rotary coring used for hard rock samples. Sediment varied through the site from soft muds to coarse sand. Sediments were typically 20m thick overlying sedimentary mud rock or shale. These conditions are similar to those identified in the EMODnet 2021 data within the area subject to the application for Foreshore Licence (FS007635) and therefore, the noise measurements provided below have been used as an analogy.

Noise measurements during geotechnical site investigations involving shallow core drilling to 16-17m in sand and mudstone, recorded source levels of 142–145 dB re 1 µPa rms @ 1 m (30–2000 Hz) (Erbe and McPherson 2017).

The frequencies at which the peak sound pressure levels of the proposed vibrocore surveys are within the audible range for herring, and therefore are assumed to overlap the audible range for twaite shad. However, it is below the optimal hearing range, so is unlikely to cause significant disturbance to twaite shad. Additionally, given that spawning occurs upstream in the relevant rivers, outside the ZOI of the survey (2.2 km, Appendix B), the survey will not affect twaite shad spawning habitat, their distribution and population structure, nor will it cause a deterioration in water quality.

Popper et al. (2014) determined that continuous sound can cause a Temporary Threshold Shift (TTS) in hearing specialist fish, such as twaite shad, when exposed for more than 158 dB re 1 µPa rms for 12 hours or more. Recoverable injury may occur with exposure to 170 dB re 1 µPa rms for more than 48 hours. VCs are only used for short durations, typically around 10 minutes until the VC is submerged and a sample can be taken. Therefore, for 93 shallow water VC there will be approximately up to 16 hours of underwater noise generated across the up to 4-month survey period. For a hearing specialised fish such as twaite shad to experience TTS from VC sampling, an individual would have to continuously be within approximately 15m for 12 hours (NMFS, 2018). To cause injury to twaite shad, an individual would have to be continuously within approximately 2m of the sound source for 48 hours (NMFS, 2018). As the noise generated is short in duration and intermittent, underwater noise generated by vibrocores during the proposed surveys will not exceed the threshold for TTS or injury to twaite shad.

The source level frequency for borehole drilling may be within the optimal hearing range of twaite shad, and so may cause disturbance to twaite shad. However, borehole drilling is below the SEL for a TTS or injury to hearing fish (Popper et al., 2014). Therefore, borehole drilling will not cause a TTS or injury to twaite shad during the proposed surveys.

Any disturbance effects from noise associated with operations will be localised, brief and transient. There will be no long-term effect on the distribution of the species and migration to and from rivers will not be impeded.

Given that spawning occurs upstream in the relevant rivers, outside the ZOI of the survey, the survey will not affect twaite shad spawning habitat, their distribution and population structure, nor will it cause a deterioration in water quality.

Based on the above assessment it is unlikely that these sources will cause injury or noticeable disturbance to fish and have been assessed as **Temporary** and **Not Significant.**

3.5.2 Proposed Mitigation for Fisheries

- The effects of Physical disturbance/temporary loss of habitat for juvenile and adult sandeels has been assessed as negligible and therefore no project specific mitigation has been proposed.
- The effects from underwater noise on fish have been assessed as Not Significant and therefore no project specific mitigation has been proposed.

3.6 Marine Processes

3.6.1 Bathymetry, Tidal Flow, Waves Assessment

Due to the localised and short-term nature of the proposed survey works no potential effects are expected to occur on bathymetry, tidal flow, and waves.

3.6.2 Sediment and seabed Assessment

The proposed site surveys: grab-sampling, geotechnical surveys, and anchoring of survey vessels will potentially cause a localised and short-term increase in suspended sediment in the water column (increased turbidity) with subsequent re-deposition of sediment on surrounding habitats. The coarser fraction of the sediment disturbed is likely to be initially re-deposited on the seabed close to the work but will remain mobile. Any fine material released in a high energy area will disperse widely with eventual deposition over a large area i.e., in a sediment plume. Where seabed operations impact low energy areas, fine sediments may be disturbed, and large quantities of fine material could be released. Given the temporary and localised nature of the proposed work the relative area of the seabed that will be disturbed is small and the suspended sediment concentration will be negligible, therefore no significant effects are expected to occur.

3.7 Air Quality

The proposed MULA crosses the Irish Sea which is characterised by low levels of human activity (and therefore away from sources of emissions that may influence air quality). Air quality and particulate matter (as indicated by concentrations of gases which are potentially harmful to human health) is not generally considered to be an issue for offshore developments (Fuzzi et al. 2015). The EPA Air Quality report 2022 reported that Ireland is below EU legal limits for Dioxins and has met its EU Cleaner Air for Europe Directive (CAFÉ) legal requirements the CAFÉ directive sets out legal limits for pollutants such as PM_{10}, $PM_{2.5}$, and Nitrogen Dioxide. Home heating is also thought to be the reason why Polycyclic Aromatic Hydrocarbons (PAH) are above European Environment Agency levels at four of the five stations. Potential air quality pressures from the project will primarily occur from engine exhaust emissions from marine vessels used during cable installation and maintenance. Given that these emissions will be emitted in the coastal or offshore environment away from any major emission sources, emission from the project are not expected to cause a deterioration in local air quality. It is therefore concluded that emissions from the project will not be a significant contributor to global emissions the project.

3.8 Noise & Vibration

Noise will be generated from project vessels operating in the survey area and from equipment used during geophysical sampling. As discussed in Section 2.2.3 there is a moderate level of marine traffic already in the area transiting to and from Dublin Port and vessels for fisheries operations. The change in underwater sound caused by the addition of the survey vessels for the proposed site investigations will not be noticeable above natural and anthropogenic noise in the region.

3.9 Seascape and Landscape

3.9.1 Potential Impacts on Seascape and Landscape

3.9.1.1 Visual Intrusion from survey vessels and equipment

The presence of survey vessels and deployment of equipment may cause temporary visual disturbances in the seascape. However, these are expected to be minimal due to the transient nature of the activities.

Night-time operations may involve lighting, which could impact the visual quality of the seascape, particularly when seen from coastal areas.

3.9.1.2 Impact on coastal views

The surveys are unlikely to significantly alter the coastal views as observed from the shoreline due to the distance from land (12nm to the EEZ limit).

3.9.2 Proposed Mitigation Measures for Seascape and Landscape

To mitigate against risks to seascape and landscape, the following measures are proposed:

- Survey's will be scheduled to avoid peak recreational periods and sensitive times of the year.
- Minimise night-time lighting and use shielding to reduce light pollution.
- Engage with local communities, recreational users, and other stakeholders to inform them about the survey activities and address any concerns.

3.10 Traffic and Transport (including navigation)

3.10.1 Potential Effects on Traffic and Transport including navigation

3.10.1.1 Displacement of vessels and fishing activity

The proposed site investigation works are minor, temporary activities, involving geophysical, geotechnical, and environmental surveys with the longest individual survey campaigns expected to take place over a three-month period.

Notices to Mariners will be issued by the contractor for the proposed site investigations requesting that vessels keep a safe distance from the works. The Fisheries Liaison Officer (FLO) will ensure that all local fishing organisations are in receipt of the Notice to Mariners and are aware of the proposed site investigations ahead of mobilisation. In addition, as required under expected Licence conditions a notification to the fishing industry will be submitted 30 days prior to any work commencing, Other marine users will be requested to keep a safe distance from the survey vessels; this is generally 500m radial distance, although it might be extended further to the rear of the survey vessel if towed gear is in use. An FLO will be engaged early in the project as part of the project requirements, who will liaise with the fishing industry through consultation to develop a fisheries management plan.

As the exclusion zone moves with the survey spread, potential effects will be temporary and restricted to this relatively small zone. The geotechnical vessels will also have a temporary exclusion zone due to their restricted manoeuvrability.

The execution of the proposed site investigation works will increase the volume of shipping traffic by an imperceptible amount, within the boundary of seasonal fluctuations. Therefore, there will be no additional navigational safety implications. However, established marine navigation practices will be adhered to and maintained by the survey vessels involved.

As the works are temporary there will be no effect on marine navigation and fishing activity once the proposed site investigations have been completed. Whilst it is acknowledged there will be temporary

disruption to individual vessels using the MULA during the proposed site investigations, the effects will be localised. In the context of the whole commercial fishery, and the wider pattern of shipping use, the significance of effects will be **Temporary** and have been assessed as **Imperceptible**.

3.10.2 Proposed Mitigation Measures for Traffic and Transport

To mitigate against risks to shipping and navigation, standard industry measures should be adequate, including:

- An FLO will be appointed before the survey works commence. The FLO will device a consultation plan to liaise with local fishers, local ports, and harbours. The consultation plan will include at minimum methods, notifications, meetings and contact information.
- Notices to Mariners and any other notices required as a condition of the Licence will be issued.
- Consultation with Commissioners of Irish Lights regarding marking, lighting, and any necessary guard buoys.
- Consultation with Irish Coast Guard.
- Vessel assurance and management including procedures such as compliance with The International Regulations for Preventing Collisions at Sea 1972 (COLREGS), use of appropriate marking and lighting, AIS broadcasts with up-to-date navigational status, adverse weather policy, emergency response plans, etc.

3.11 Archaeology and Cultural Heritage

3.11.1 Potential Effects on Archaeology and Cultural Heritage

3.11.1.1 Direct or indirect damage to an archaeological asset

The geophysical survey is non-intrusive and therefore it is not anticipated it will have any impact on archaeological features.

In addition, to obtaining the environmental conditions of the seabed, the geophysical survey is intended to determine the location of any unknown archaeology. The magnetometer data acquired during the geophysical survey is a key component of this. A detection device consent (under the National Monuments Acts) will be applied for ahead of the survey, and consultation undertaken with the Department of Culture, Heritage, and the Gaeltacht – Underwater Archaeology Unit to ensure that all requirements are met during the application process.

The results of the geophysical survey will be interpreted by a licensed marine archaeologist to inform: the positioning of the intrusive features of the geotechnical and environmental surveys e.g., VCs, CPTs, geotechnical boreholes and environmental grab sample stations; and future environmental assessment. In addition to this, an archaeologist will carry out a walkover inspection of the intertidal area prior to commencement of any intrusive survey works. All sample locations will be positioned to avoid archaeological sensitive areas. An archaeological excavation licence will be applied for once the geophysical data has been reviewed.

This mitigation within the survey design and compliance with the conditions of the archaeological excavation licence will ensure that the effect of the proposed survey on archaeology will be Imperceptible.

3.11.2 Proposed Mitigation Measures for Archaeology and Cultural Heritage

- An archaeology desk-based assessment will be undertaken by a qualified and experienced marine archaeologist prior to intrusive survey works occurring.

- An archaeologist will carry out a walkover inspection of the land/intertidal area prior to commencement of any boreholes or sampling within the land/intertidal area.
- Geophysical data will be reviewed by an archaeologist and geotechnical sampling locations moved as appropriate to avoid features of interest.
- A Written Scheme of Investigation and Protocol for Archaeological Discoveries will be prepared and implemented during the site investigation works. An archaeologist will be on-hand during the survey should any archaeological finds be made.

3.12 Population and Human Health

This is a broad factor and involves assessing the existence, activities and health of people, usually considering people as groups or 'populations.

3.12.1 Potential Effects on Commercial Fisheries

3.12.1.1 Loss or damage to commercial shellfish/fisheries habitats or stocks

There will be no sampling taking place within designated shellfish water as there is no designated shellfish areas within the MULA, however sampling which may cause impact that is occurring close by would be geotechnical sampling with the potential to cause disturbance due to siltation rate changes in the water column. The effect from displaced sediment will be very localised, only affecting species in the immediate vicinity of geotechnical sampling. Suspended sediment settlement levels will be minimal with any material deposited quickly re-suspended and distributed by natural hydrodynamic processes. Therefore, **No Effect** will occur.

Commercially exploited shellfish species in the area are lobster, *Nephrops*, crabs, scallops, razor clams and whelks (STECF 2018 and MMO 2018). The likelihood of the proposed site investigations affecting these species will be minimal as these species commonly occur in naturally turbid environments and have the ability to recover from environmental disturbance (Marlin 2020). Additionally, given the shifting sandwaves and high current speeds in the area the species will be adapted to higher sediment loads. According to the MarLIN sensitivity review *Nephrops* have a high recoverability rate (full recoverability within two years) (MarLIN, 2021). Therefore, there will be **No Effect** on these commercially exploited species.

Potential effects on fish will be limited to disturbance from underwater sound generated by the vessel and survey equipment. Most sound generated by the geophysical survey is likely to be at frequencies above the auditory capacity of fish. Fish may avoid the survey area once operations have started but will not experience a significant effect other than temporary displacement from the immediate area surrounding the survey activity. Any loss of individuals (adults or juveniles) within the immediate area of the survey is unlikely and given the wider geographic extent of the spawning and nursery areas, if there is a disturbance effect it will be slight. Therefore, the effects of the marine survey on commercial fish will be **Temporary and Not Significant**.

3.12.1.2 Proposed Mitigation Measures for Commercial Fisheries

The effects from underwater noise on fish have been assessed as Not Significant and therefore no project specific mitigation has been proposed. The project will appoint a Fisheries Liaison Officer (FLO) ahead of the surveys, whose liaison scope will cover the commercial fishing industry, but also include a wider selection of stakeholders, including the recreational fishing industry and other recreational users of the marine area.

3.13 Major Accidents and Disasters

As outlined in Section 2.13, the proposed site investigation activities are not expected to cause natural disasters such as earthquakes, subsidence, landslides, erosion, or flooding.

3.14 Climate

The site investigations and survey works will be conducted within a concise timeframe, during which there will be no detectable contribution to climate change. The site investigation activities will involve the deployment of a limited number of additional vessels to the MULA. These vessels will be strategically distributed across the survey area and will only remain present for relatively short periods corresponding to the duration of the site investigation activities (e.g., several weeks for non-intrusive surveys, and weeks to months for geotechnical operations). All vessels selected for the proposed surveys will adhere to modern standards of certification and undergo inspection using the Common Marine Inspection Document (CMID). This standardised format ensures the safety and efficiency of vessel operations (IMS, 2018). Consequently, the overall impact on climate is expected to be **negligible**.

3.15 Waste

As outlined in Section 2.15, the site investigation works do not entail any demolition or removal of structures, thus eliminating the production of demolition waste. Waste generated during the Site investigation works will be managed on the survey vessels themselves, encompassing materials specifically originating from onboard activities. The quantity of waste will vary depending on the vessel used, with typical materials including bilge water, oily residues (sludge), sewage (black water), greywater, plastics, food wastes, domestic wastes, cooking oil, operational wastes, cargo residues, and other non-common waste streams (e.g., ballast water) (EMSA/OP/02/2016).

3.16 Material Assets

A comprehensive analysis was conducted utilising the Irish Marine Atlas, the Foreshore Licence and MUL database to determine existing infrastructure within the Licence Area. This assessment revealed various cables cross through the MULA, these are discussed in Section 2.16. The proposed site investigation works and surveys will be short-term and localised and marine charts will be used to avoid anchorage or survey equipment over existing assets during the survey. Therefore, there will be no adverse effects posed to existing offshore cables or the Interconnector 1 gas pipeline. Consultation will take place before survey works begin with relevant operators to ensure any required written agreement is acquired before survey works take place.

3.17 Interactions and In-Combination Effects

3.17.1 In-Combination Effects in Irish Waters

As discussed in section 2.17.1 and outlined in table 3-6 below a review was undertaken to identify other activities and potential plans, projects, and activities in Irish Waters which could have an in-combination effect with the FLA and MULA. This was carried out on 10th of June 2024, and the review concluded that there were surveys and/or other activities which could interact with the proposed site investigation works .

Table 3-6 Foreshore Licence Applications, MUL and Planning applications near MULA and FLA

Name of development & developer	Licence ref	Type of activity	Commencement date	Licence Status	Approx. distance from MULA (km)	Approx. Distance from FLA area (km)
Oriel Offshore Wind Farm	OA15.319799	Marine development Application to ABP for the construction of the Oriel Offshore Wind Farm and Associated infrastructure.	Unknown	Application lodged on the 24/05/2024	36.79	23.26

Name of development & developer	Licence ref	Type of activity	Commencement date	Licence Status	Approx. distance from MULA (km)	Approx. Distance from FLA area (km)
Arklow Bank Wind Park SSE Renewables	OC27.315796	Marine development Application to ABP for the construction of the Arklow Bank 2 Offshore Wind Farm and Associated infrastructure.	Unknown	Consultation closed 25/01/2024	69.36	57.99
Microsoft Ireland Operations Ltd.	LIC230018	Geophysical survey and site investigations for a proposed subsea fibre optic cable having a landfall in Portmarnock, County Dublin to evaluate options for the route traversing the Irish Sea to Abergele, Wales.	Q2 2024 – Mid 2024	Applied	Overlaps	Overlaps
North Irish Sea Array (NISA) Statkraft	LIC230001	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	Q2 2024 – Mid 2024	Consultation	Overlaps	Overlaps
Lir Offshore Array Lir Offshore Array Ltd.	FS007392	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	Summer 2022	Applied	Overlaps	Overlaps
Dublin Array RWE Renewables	FS007188	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Unknown	Determined	9.74	Overlaps
Braymore Head (Setanta) SSE Renewables	FS006973	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	Summer 2019 for five years	Determination	10.0	Overlaps
North Irish Sea Array (NISA) Statkraft	FS007031	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Summer 2020	Determination	10.33	Overlaps
North Irish Sea Array (NISA) Statkraft	LIC230001	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Q1 2024	Determination	10.33	Overlaps
Greystones Cobra / Flotation Energy	FS007367	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	2023	Applied	16.95	Overlaps

Name of development & developer	Licence ref	Type of activity	Commencement date	Licence Status	Approx. distance from MULA (km)	Approx. Distance from FLA area (km)
North Irish Sea Array (NISA) Export cable Statkraft	FS007358	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Summer 2024	Determination	17.24	Overlaps
Cooley Point Hibernian Atlantic /ESB	FS006852	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Summer 2019 to Summer 2022	Determination	17.33	6.9
Sunrise Offshore Wind Farm Sunrise Wind Limited	FS007151	Site investigation works likely consisting of Geophysical, Geotechnical, Environment , Oceanographic and Meteorological investigations	2022 (2023) up to 5 years	Consultation	21.02	Overlaps
The Leinster Project Leinster Offshore Wind	FS007162	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	Q2 2023 up to 2 years	Applied	22.43	14.52
Clogher Head Hibernian Atlantic / Parkwind / ESB	FS006787	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic and Meteorological investigations	Unknown	Determination	22.84	8.86
Réalt na Mara Offshore Wind Farm Limited Ocean Winds	FS007330	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	Spring 2023	Applied	24.17	9.82
Sea Stacks Offshore Windfarm ESB/Equinor	FS007134	Site investigation works likely consisting of Geophysical, Geotechnical, Archaeological, Ecological, Oceanographic, topographic, and Meteorological investigations	2022-2023	Consultation	24.46	7.80
Banba Offshore Wind Farm Banba Wind Limited	FS007283	Site investigation works likely consisting of geophysical, geotechnical, environmental, metocean campaigns.	2022 (2023) up to 5 years	Consultation	25.87	9.99
Codling Wind Farm ESB/Fred Olsen Renewables	FS007546	Site investigation works likely consisting of Geophysical Geotechnical Fish & Shellfish surveys Benthic & Intertidal Surveys Archaeological surveys Metocean and Floating LiDAR Marine Mammal Acoustic POD survey	Q2 2023	Determination	32.02	8.11

Name of development & developer	Licence ref	Type of activity	Commencement date	Licence Status	Approx. distance from MULA (km)	Approx. Distance from FLA area (km)
Codling Wind Farm ESB/Fred Olsen Renewables	FS007045	Site investigation works likely consisting of Geophysical Geotechnical Fish & Shellfish surveys Benthic & Intertidal Surveys Archaeological surveys Metocean and Floating LiDAR Marine Mammal Acoustic POD survey	Q4 2020 / Q1 2021 for metocean and LIDAR campaign and Q1/2 2021 for other survey works which are expected to commence with geophysical surveys.	Determination	34.95	9.51
Benthic Ecology Survey in export Cable Corridor Mac Lir Offshore Wind,	FS007546	Benthic Ecology Survey		Applied	35.29	9.57
Laytown Beach Meath County Council	FS006602	Removal of the existing damaged gabion sea defence system and its replacement with a new sea defence system using a rock armour revetment.	unknown	Determination	36.5	
Oriel Wind Farm Parkwind / ESB	FS007383	Foreshore Licence application for geophysical, geotechnical, ecological and metocean site investigation works.	2018/2019	Determination	36.79	23.26
Maintenance Dredging Drogheda Port Company	FS007359	Maintenance dredging of the commercial estuary and seaward approaches to the River Boyne	2021	Determination	41.2	
Export Cable Route Wicklow Offshore Wind	FS007588	Foreshore Licence application for geophysical, geotechnical, ecological and metocean site investigation works.	Unknown	Applied	52.27	38.7
Latitude 52 Offshore Wnd Farm Site Investigations DP Energy	FS007232	Foreshore Licence application for geophysical, geotechnical, ecological and metocean site investigation works.	Unknown	Applied	55.47	49.75
Wicklow Sea Wind Site Investigations Wicklow Sea Wind Ltd	FS007163	Foreshore Licence application for geophysical, geotechnical, ecological and metocean site investigation works.	Unknown	Consultation	60.40	51.41
Arklow Bank Wind Park Phase 2	FS007339	Site investigations likely consisting of Geotechnical surveys.	Unknown	Determination	69.36	57.99

The following offshore wind development planning applications, which will be submitted to An Board Pleanála in the near future at the time of writing been identified as being within the Cumulative Effects Spatial Scope and Cumulative Effects Temporal Scope of the Licence Area:

- Oriel Offshore Wind Farm – Marine Development Application - Bord Pleanála Case reference: OA15.319799
- Arklow Bank 2 Offshore Wind Farm – Marine Development Application - Bord Pleanála Case reference:
- North Irish Sea Array Offshore Wind Farm – Marine Development Application - Bord Pleanála Case reference: VC06F.310329

The following offshore wind development related Foreshore Licence Applications and MUL applications have been identified as being within the Cumulative Effects Spatial Scope and Cumulative Effects Temporal Scope of the Licence Area:

- Lir Offshore Array Ltd (Offshore Wind Farm (OWF))
- Statkraft North Irish Sea Array (NISA) Site Investigations Array Area (OWF)
- Statkraft North Irish Sea Array (NISA) Cable Route (OWF)
- SSE Renewables Braymore Point (now Setanta) (OWF)
- Cooley Point (OWF)
- Clogher Head (OWF)
- Leinster (OWF)
- Sunrise (OWF)
- Banba (OWF)

Other developments identified within the Cumulative Effects Spatial Scope and Cumulative Effects Temporal Scope of the Licence Area are:

- Microsoft Ireland Operations Ltd.

Whilst the exact schedule for activities is unknown, it is assumed there will be some spatial and temporal overlap; however, whilst activities may take place concurrently, it will not be continual throughout the site, limiting the potential for cumulative effect.

Given that there are no other projects and plans within the MULA, The limited scope and short-term, transient nature of the proposed survey works and existing background levels of disturbance, no significant in-combination or cumulative effects on European Sites are expected.

3.17.2 In-Combination Effects in UK Waters

As discussed in section 2.17.2 and outlined in table 3-7 below, a review was undertaken to identify other activities and potential plans, projects, and activities in the surrounding area of the MULA in UK Waters which could have an in-combination effect with site investigation activities taking place within the MULA. This was carried out on 10th of June 2024, and the review concluded that there were surveys and/or other activities which could interact with the proposed site investigation works, based on their timings or distance to the MULA or FLA.

Table 3-7 Transboundary Plans and Projects

Name of development & developer	Licence ref	Type of activity	Commencement date	Licence Status	Approx. distance from MULA (km)
McMahon Design & Management Limited	RML2412	Marine Survey & Site Investigation Works SOBR2	2024-05-03 - 2024-12-16	Applied	0
McMahon Design & Management Limited	RML2413	Marine Survey & Site Investigation Works SOBR1	2024-05-03 - 2024-12-16	Applied	28
Stena Line Ports Ltd	DML1935	Holyhead Harbour Maintenance Dredging	2023-05-17 - 2028-12-31	Determined	40
Morlais renewable energy	ORML1938	Morlais Tidal Stream Demonstration Project	2021-12-14 - 2060-12-13	Determined	42.7
Mona Offshore Wind Limited	CML2315	Suction Bucked Foundation Trials	2023-07-12 - 2024-07-11	Determined	70.66
Ocean Ecology Limited	RML2319	Grab samples	2023-04-01	Determined	83

There is one marine licence in place that could potentially have in-combination effects with the site investigation works taking place at EEZ section of the MULA, this is, McMahon Design & Management Limited (RML2412). However, given that the site investigations for MaresConnect is due to take place in Q1 2025, and the marine licence RML2412 expires in December 2024, it is concluded that no significant in-combination or cumulative effects on European Sites are expected.

3.17.3 Potential Cumulative Effects of Interactions

3.17.3.1 Underwater sound changes

Marine mammals

The assessment above concluded that the significance of the effect of the proposed site investigations on marine mammals is Not Significant. However, there remains the possibility that if considered alongside other activities occurring within the same region the site investigation works could contribute to significant cumulative effects. This potential is discussed below.

Cumulative effects are likely to result where localised disturbance from more than one activity either occurs simultaneously resulting in a wider zone of disturbance restricting foraging, migratory or breeding behaviour: or consecutively within a restricted area resulting in an extended period of disturbance or the production of a barrier restricting movements.

It is planned that the proposed site investigations for the MaresConnect survey area, in Irish waters, (MULA and FLA), will be conducted as soon as possible after the grant of a five-year Licence, which will facilitate the investigation and survey work being undertaken according to contractor availability and within suitable weather windows. At this time, it is not known precisely when or if each proposed site investigation and survey licence application pending will be granted, or where already granted, when the investigation or survey work will be undertaken by those licensees. Two scenarios were considered by the cumulative impact assessment. Firstly, that all the site investigations are conducted at the same time, and secondly that they occur consecutively. The first scenario is highly unlikely as data acquisition can be impaired if two or more geophysical surveys occur at the same time in proximity due to equipment interference. There is also a significant constraint in terms of contractor and vessel availability. It is therefore more likely that site investigations would occur consecutively

(although not necessarily continuously). This second scenario would result in an extension of the potential period over which marine mammals could be disturbed.

The potential cumulative effect has been assessed as **Temporary** and **Not Significant.** This is based on the results of a study in the UK SNS SAC on the potential cumulative effects from a number of nearby windfarms on harbour porpoise (BEIS 2020). The study found that harbour porpoise displacement was temporary and harbour porpoise relocated elsewhere. It was concluded that seismic surveys would not have an adverse effect upon the integrity of the SNS SAC. The same behavioural response is likely in open coastal waters where marine mammals can avoid the temporary site investigation works.

Subject to contractor availability and weather conditions, all reasonable endeavours will be made to co-ordinate with other licensees, leases or persons otherwise authorised to undertake activities within the region of the MULA to avoid overlapping or concurrent activities likely to cause noise or disturbance to species.

Fish

The assessment above concluded that the significance of the effect of the proposed site investigations on fish is **Not Significant**. Like marine mammals, there is potential that if a survey occurred simultaneously resulting in a wider zone of disturbance this could restrict the migration of fish in and out of the River Barrow and River Nore SAC and Slaney River Valley SAC or if it occurred consecutively this could result in an extended period of disturbance or the production of a barrier restricting movement. Concurrent surveys were discounted as a scenario because of data quality.

The potential cumulative effect has been assessed as **Temporary** and **Not Significant**. This is based on proposed geophysical surveys being primarily offshore and not within the estuaries of any of the important twaite shad rivers. Given that spawning occurs upstream in the relevant rivers, outside the ZOI of the survey, the survey will not affect twaite shad spawning habitat or cause a deterioration in water quality.

The potential zones of influences are transient and move slowly in a constant direction along the principal survey line orientation. It is predicted that fish will avoid the area once operations have started and are extremely unlikely to move towards the sound sources. The survey alone or in-combination will not lead to any long-term displacements as they are transient and brief. Individuals are expected to return once the operation has passed through.

As noted, subject to contractor availability and weather conditions, all reasonable endeavours will be made to co-ordinate with other licensees, lessees or persons otherwise authorised to undertake activities within the region of the MULA to avoid overlapping or concurrent activities likely to cause noise or disturbance to species.

3.17.3.2 Temporary displacement of vessels

Several ORE site investigation projects, overlap with the MULA and FLA (see Section 2.17.1). There is, therefore, the potential for cumulative effects on commercial fisheries and other marine users from displacement. The worst-case is that fishermen using static gear (pot fishing) are requested to move fishing gear or other marine users are requested to keep at a safe distance for more than one project, extending the period in which they cannot access their traditional grounds.

However, the cumulative effect will be temporary as fishermen and other marine users will be able to return to the area once the proposed site investigations have passed. An FLO will be engaged early in the project as part of the project requirements, who will liaise with the fishing industry through consultation to develop a fisheries management plan. In addition, outcomes and recommendations which apply to this project which are proposed from the Seafood-Offshore Renewable Energy Working Group will also be applied as best practice. and therefore, it is concluded that the significance of cumulative effects will be **Slight.**

4. CONCLUSIONS

4.1 Conclusion

This document is an Assessment of Impact on the Maritime Usage report, which assesses the significance of likely environmental effects having regard to EPA Guidelines (2022) . The proposed site investigations may cause temporary and localised disturbance to other marine users within the MULA e.g., fishing, shipping, and recreational users.

To determine whether the proposed site investigations are likely to have a significant effect on the surrounding environment and European Sites, either individually or in-combination with other plans or projects, a number of assessments were carried out, including a significance assessment and Screening for AA. This is provided in a separate document; Supporting Information for Screening for AA" (P2578_R6410_Rev0)

The significance assessment concluded that for all pressures identified effects on environmental receptors will range from No Effect to Slight. While the activities will cause underwater sound changes, with the potential to cause disturbance effects to fish and Annex II listed pinnipeds and European Protected Species (cetaceans) outside of a European site, the disturbance will be Not Significant.

Adherence to the measures proposed in this document, as summarised in section 4.2 below, to avoid or reduce such effects will ensure that there are no adverse effects on the integrity of any European site, that there is no deliberate disturbance of any protected animals, fish, or birds, and that the potential impacts on other marine users are avoided and minimised.

4.2 Summary of Mitigation

The following measures are proposed and may be conditioned in the grant of any Licence for the site investigation and survey works.

Table 4-1 Summary of Mitigation Measures

Section	Mitigation
Land and Soils	▪ Not applicable, as all operations take place within the marine environment.
Water	▪ Chemical substances utilised will originate from the List of Approved Chemicals and will be discharged into the marine environment in accordance with the Offshore Chemical Notification Scheme. ▪ Stringent maritime regulations, standard vessel operating procedures, and adherence to both International Maritime Law and National Maritime Legislation will mitigate the likelihood of a chemical release, thereby minimizing any anticipated significant impacts. ▪ Furthermore, all vessels employed will be fully compliant with MARPOL regulations and hold certification from the Maritime Safety Office, as mandated by law.
Biodiversity	
Benthic Ecology	▪ The effects of penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion has been assessed as Imperceptible and therefore no project specific mitigation has been proposed.
Natura 2000 Sites	▪ As no likely significant effects are expected for any protected SAC or SPA due to the proposed site investigation activities, no mitigation measures are proposed.
Marine Mammals	▪ Survey vessels will stay at least 900m away from known seal haul-out locations during the period May to December to minimise disturbance to breeding seals. ▪ A qualified Marine Mammal Observer (MMO) will be appointed to monitor for marine mammals and to log all relevant events using the relevant date forms in the DAHG guidance. ▪ The MMO will be located at a suitable vantage point, providing good all-round visibility. ▪ Geophysical and drilling operations will only commence in daylight hours. ▪ Delays to the commencement of the site investigations will be recommended should any species be detected within the relevant monitored zone. ▪ An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break. It shall only proceed on positive confirmation with the MMO. ▪ The MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by MMO. ▪ Procedures for drilling operations including prescribed Pre-Start Monitoring and breaks in sound output as outlined in section 4.3.2 of the DAHG 2014 guidance shall be strictly adhered to. ▪ In the case of geophysical surveys the prescribed Pre-Start Monitoring shall subsequently be followed by Ramp-Up Procedure which should include continued monitoring by the MMO. The process laid out in Sections 4.3.4 and 4.3.4 of the DAHG 2014 guidance shall be strictly adhered to.

Section	Mitigation
	▪ An MMO report to be submitted to the Licensor's Marine Advisor (Environment) within 30 days of completion of any geophysical and drilling survey activity.
Marine Reptiles	▪ The effects on marine reptiles have been assessed and therefore no project specific mitigation has been proposed.
Ornithology	▪ To avoid disturbance to the breeding birds the working vessel will stay 2km away from breeding bird locations during the period February to October to minimise disturbance. ▪ MaresConnect will co-ordinate with any operators within the region carrying out operations which are likely to result in underwater noise to ensure that surveys do not occur simultaneously or concurrently. ▪ Drift lines contain the highest proportion of potential food source for bird species. If present, these will be avoided by machinery and personnel.
Invasive Species	▪ All survey vessels will adhere to the Ballast Water Management Convention.
Fisheries and Aquaculture	▪ The soft-start/ramp-up procedure described in the 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' protocol (DAHG, 2014) will be followed to ensure that any adverse effect to fish species due to disturbance caused by underwater noise will be mitigated for. ▪ If a temporal overlap is likely between the proposed site investigation activities and projects identified as having the potential to cause in-combination effects to noise pressure sensitive fish species, MCL will engage with those projects to ensure that activities are sufficiently distanced to ensure that adverse effects on such species are mitigated for. ▪ No likely significant effects are expected for aquaculture operations or shellfish in result of the proposed site investigation survey works, no mitigation measures are proposed.
Marine Processes	▪ Due to the localised and short-term nature of the proposed survey works no mitigation measures are proposed as no potential effects are expected to occur on bathymetry, tidal flow, and waves.
Air Quality	▪ Not applicable, as no significant effects are predicted from the site investigations and survey works on Air Quality.
Noise and Vibration	▪ Not applicable, as there will be no noise noticeable above natural and anthropogenic noise in the region as a result of the site investigations and survey works.
Landscape and Seascape	▪ Survey's will be scheduled to avoid peak recreational periods and sensitive times of the year. ▪ Minimise night-time lighting and use shielding to reduce light pollution. ▪ Engage with local communities, recreational users, and other stakeholders to inform them about the survey activities and address any concerns.
Traffic and Transport including navigation	▪ An FLO will be appointed before the survey works commence. The FLO will device a consultation plan to liaise with local fishers, local ports, and harbours. The consultation plan will include at minimum methods, notifications, meetings and contact information. ▪ Notices to Mariners and any other notices required as a condition of the Licence will be issued.

Section	Mitigation
	▪ Consultation with Commissioners of Irish Lights regarding marking, lighting, and any necessary guard buoys. ▪ Consultation with Irish Coast Guard. ▪ Vessel assurance and management including procedures such as compliance with The International Regulations for Preventing Collisions at Sea 1972 (COLREGS), use of appropriate marking and lighting, AIS broadcasts with up-to-date navigational status, adverse weather policy, emergency response plans, etc.
Archaeology and Cultural Heritage	▪ An archaeology desk-based assessment will be undertaken by a qualified and experienced marine archaeologist prior to intrusive survey works occurring. ▪ An archaeologist will carry out a walkover inspection of the land/intertidal area prior to commencement of any boreholes or sampling within the land/intertidal area. ▪ Geophysical data will be reviewed by an archaeologist and geotechnical sampling locations moved as appropriate to avoid features of interest. ▪ A Written Scheme of Investigation and Protocol for Archaeological Discoveries will be prepared and implemented during the site investigation works. An archaeologist will be on-hand during the survey should any archaeological finds be made.
Population and Human Health	
Major Accidents and Disasters	▪ Vessel assurance and management including procedures such as compliance with The International Regulations for Preventing Collisions at Sea 1972 (COLREGS), use of appropriate marking and lighting, AIS broadcasts with up-to-date navigational status, adverse weather policy, emergency response plans, etc.
Commercial Fisheries	▪ During site investigation activities, other vessels will be asked to keep a safe distance from survey vessels due to their limited manoeuvrability. ▪ Fishermen will be requested to avoid stationary survey equipment once deployed, which occupies a small area. ▪ Fishermen with stationary gear within the survey area will be engaged by a fishery liaison officer, discussing potential relocation of gear. ▪ Site investigation activities are temporary and short in duration.
Climate	▪ Not applicable, as no significant effects are predicted from the site investigations and survey works on Climate.
Waste	▪ Adherence to stringent maritime regulations, standard vessel operating procedures, and precautionary measures in compliance with both International Maritime Law and National Maritime Legislation will effectively mitigate the risk of chemical releases, thus minimizing any potential significant impacts. ▪ All vessels utilized must adhere to MARPOL regulations and hold full certification from the Maritime Safety Office, as mandated by law.
Material Assets	▪ Geophysical data will be reviewed by an archaeologist and geotechnical sampling locations moved as appropriate to avoid features of interest. ▪ An archaeology desk-based assessment will be undertaken by a qualified and experienced marine archaeologist prior to intrusive survey works occurring.

Section	Mitigation
	▪ Third party asset owners will be consulted prior to site investigation activities commencing.
Interactions	▪ Subject to contractor availability and weather conditions, all reasonable endeavours will be made to co-ordinate with other licensees, leases or persons otherwise authorised to undertake activities within the region of the MULA to avoid overlapping or concurrent activities likely to cause noise or disturbance to species. ▪ Third party asset owners will be consulted prior to site investigation activities commencing.

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APPENDIX A

Programme of Survey Works

A.1 PROGRAMME OF SURVEY WORKS

A.1.1 Introduction

This Appendix provides an overview of the programme of survey works that will be undertaken as part of the site investigations and surveys for the MaresConnect Interconnector. The intention is to commence the proposed site investigation activities as soon as feasible following award of the MUL, taking into consideration any proposed mitigation requirements. The survey works will preferably be undertaken in the months feasible from the summer and/or autumn months in 2025 onwards following award of the MUL and subject to weather conditions and vessel availability. However, there is potential for programme slippage and MCL are applying for a MUL to be valid for a five-year period to provide contingency for any delays. Figure A-1 (Drawing reference: P2578M-LOC-002) below outlines the indicative sampling locations within the MULA.

A.1.2 Licensable Activities

The following Licensable Activities are proposed (note that all sample numbers are indicative and include an extra 20% for a conservative estimate):

- **Geophysical survey:** The geophysical survey will comprise multibeam echosounder (MBES), sidescan sonar (SSS), sub-bottom profiler (SBP) and magnetometer survey sensors to determine seabed conditions within the MUL area. Surveys will be undertaken at any time of the year (subject to weather conditions) and will be carried out over a period of 3-months (including downtime). It is currently planned that the geophysical survey would be undertaken in conjunction with the benthic sampling programme, but this is not certain (see below).
- **Geotechnical**: Up to 93 shallow-water CPTs and shallow-water vibrocores (VCs) (both with a penetration depth up to 6m) will be acquired to evaluate the nature and mechanical properties of the seabed sediments. Up to 19 boxcores or Van Veen grabs may be used to characterise shallow soils if the sediment is found to be very soft. The geotechnical survey is likely to be carried out over multiple campaigns to determine site characteristics and ground conditions to determine optimum potential cable positioning. Surveys will be undertaken at any time of the year (subject to weather conditions). Campaigns are likely to be within a two-to-four-month period at any time of the year - (subject to weather conditions). Indicative geotechnical sample stations are provided in MUL Application Map 2 (Drawing Reference: P2578-LOC-002) however the precise positioning of sample stations will be informed by the geophysical survey. Obtaining the results of the geophysical surveys prior to undertaking the geotechnical site investigations ensures that the selection of the precise sample sites is made on an informed basis, minimising the risk of interacting with sensitive ecological or archaeological features in or on the seabed.
- **Environmental (benthic sampling) and Intertidal**: The benthic sampling campaign is likely to occur with the geophysical survey, however, if this is not possible, in the alternative the benthic sampling will be carried out during a separate 2–3-day period. A grab sampler will be used to retrieve a soil sample of the seabed by the lowering of a mechanical grab. Each grab samples a volume of approximately 0.015m^3. Grabs are required to obtain a sample greater than 5cm in depth, if less than 40% of the grab is acquired then samples will be repeated for up to three attempts. It is likely that three grab samples will be taken at each station (19 stations in total); two for faunal analysis and one for sediment and chemical analysis (57 samples in total). Additional drop-down camera and video transects will be acquired to characterise seabed habitats and sensitive features. Intertidal surveys will be undertaken separately and will take less than 1-week at each potential landfall. Terrestrial survey methods at the landfall (shoreline and hinterland) may include a topographic survey of the ground elevations using real-time kinematic (RTK) foot or vehicle traverses, laser-scanning and/or an aerial drone survey using photogrammetry techniques.

Terrestrial geophysical investigations may include seismic refraction of the cable route centreline and offset lines to provide information on sub-surface sediment layers and thicknesses using a ground penetrating radar survey, or similar.

- **Archaeological survey**: A qualified, Irish registered, marine archaeologist will review all geophysical survey data ahead of geotechnical sampling to evaluate sampling positions for features of underwater importance. Obtaining the results of the geophysical surveys prior to undertaking the geotechnical site investigations ensures that the selection of the precise geotechnical sample sites is made on an informed basis, minimising the risk of interacting with archaeological features in or on the seabed.
- **Birds and Marine Mammal Surveys -** Boat based and aerial/drone surveys will be conducted offshore and from landfall vantage points to determine usage of the survey area by birds, marine mammals, and other megafauna. Species type and distribution within the FLAA will be recorded. At the time of application, these surveys are not licensable activities under the Foreshore Act 1933 (as amended).

Indicative sample stations are provided in Maritime Usage Licence Map 2 (Drawing Ref: P2587M-LOC-002).

MARITIME USAGE LICENCE MAP 2

LOCATION OVERVIEW

MaresConnect Interconnector MUL Boundary Indicative Sampling Locations

Drawing No: P2578M-LOC-002	B

Upper Right Corner
Irish Tranverse Mercator
797,852.44 795,993.88

Lower Left Corner
Irish Tranverse Mercator
709,176.04 716,910.58

Area: 33296 ha

Legend

- Maritime Usage Area
- EEZ Boundary
- 12 NM Territorial Sea Limit
- Drop-down Camera, Grab and Box Core (5km intervals)
- Vibrocore and CPT (1km interval)

N W E S

19 Env Locations

93 Vibrocore and CPT Locations

Note: Coordinates listed in Irish Transverse Mercator EPSG 2157

Map prepared by:
[redacted] MRes Ecosystem-Based Management of Marine Systems, BSc (Hons) Marine Biology
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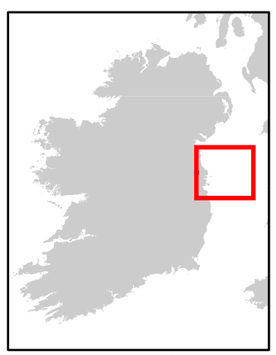

NOTE: Not to be used for Navigation

Date	25 June 2024
Coordinate System	IRENET95 Irish Transverse Mercator
Projection	Transverse Mercator
Datum	IRENET95
Data Source	GEBCO; ESRI, MaresConnect, MarineFind; DECC
File Reference	J:\P2578\Mxd_QGZ\00_OffshoreIreland\01_LOC\ P2578M-LOC-002.mxd
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A.1.3 GEOPHYSICAL SURVEY

The geophysical acquisition methodologies will comprise MBES, SSS, magnetometry and SBP surveys.

The objectives of the proposed geophysical survey are to:

- Map the seabed and sub-surface to assist in optimising the routing of interconnector cable within the MULA and to enable assessment of cable burial depth.
- Plan the scope and positioning of the geotechnical sampling programme in the MULA;
- Identify marine habitat areas from which the benthic survey can be undertaken;
- Identify sensitive marine habitats which will need to be avoided during geotechnical and environmental sampling and cable and wind turbine installation; and
- Provide the geophysical data from which a marine archaeological assessment can be undertaken as part of the consenting process.

To meet these objectives, the geophysical survey will undertake the following tasks:

- Measure intertidal topography and seabed bathymetry, surface morphology and identify the nature of the seabed sediments - in particular the height, length, and slopes of sand waves (topography, MBES, SSS);
- Identify the distribution and thickness of superficial sediments and rock head where possible (SBP);
- Identify the distribution of subsea geological features such as areas of exposed bedrock (MBES, SSS); and
- Identify the location, extent, and nature of any impediments to wind turbine installation and laying or burial of the cables such as wrecks, debris on seafloor, rock outcrop, other cables, pipelines etc. (magnetometer, MBES, SSS).

The interpretation of the geophysical survey for cable routing forms the basis of the scope of work for geotechnical and benthic surveys.

The bathymetric, side scan and sub-bottom profiling systems proposed are characterised by a limited acoustic footprint with the directional, high-frequency, short-duration output attenuated within a few hundred metres of the survey vessel. Proposed geophysical sample stations via the Device Detection Permit will be communicated to the National Monuments Service (NMS) – Underwater Archaeology Unit (UAU) for approval ahead of works commencing.

It is Good Industry Practice for geophysical surveys in Irish waters to follow the Department of Arts, Heritage, and the Gaeltacht “Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters” (2014). Section 4.3.4(ii) is applicable to the type of geophysical survey proposed and will be implemented by the survey contractor. This includes the following procedures:

- Sound-producing activities shall only commence during daylight hours where effective visual monitoring by the Marine Mammal Observer (MMO), is possible. Agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.
- Survey activities must not commence if marine mammals are detected within a 500m radius of the sound source.
- In waters up to 200 m deep, the MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing

activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within 500m radius by the MMO.

- A ramp-up procedure (i.e. soft start) will be used:

  a. Where it is possible according to the operational parameters of the equipment concerned, the device's acoustic energy output shall commence from a lower energy start-up (i.e., a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20 minutes.

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

  c. Where the acoustic output measures outlined in steps (a) and (b) are not possible according to the operational parameters of any such equipment, the device shall be switched "on" and "off" in a consistent sequential manner over a period of 20 minutes prior to commencement of the full necessary output.

- Once the ramp-up procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source.
- If there is a break in sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down, survey line or station change) then all pre-start monitoring, and a subsequent ramp-up procedure must be undertaken.

A.1.3.1 Location and survey spacing

The area of search (determining location of MUL boundary) for the possible development of the interconnector cable corridors are based on desktop assessments. Following a precautionary approach and to be judicious, it has been assumed that the geophysical surveys will be conducted across the potential cable routes within the MULA.

The swathe width for each piece of equipment will depend on the water depth encountered. It is anticipated that the width of each swathe will allow for a 50% overlap between each swathe.

A.1.3.2 Equipment

Specific equipment to be used during the geophysical survey have not yet been specified to date as the contractor has not been appointed. Examples of industry standard equipment for the purpose of geophysical and geotechnical survey have been used in this assessment. Frequencies and decibels used to obtain the data will be within similar ranges for all equipment used.

A.1.3.3 Multibeam echo sounder (MBES)

An MBES is a remote sensing acoustic device typically attached to a vessels hull. The purpose of this equipment will be to map the water depth to seabed (bathymetry) from a single transducer array that uses a fan of acoustic energy known as a swathe. MBES systems can be either hull-mounted or towed behind the vessel. MBES frequencies typically range from 12 kilohertz (kHz) to 500kHz. The Kongsberg EM2040 is an example of a MBES device that may be used for the proposed survey works (Figure A-2).

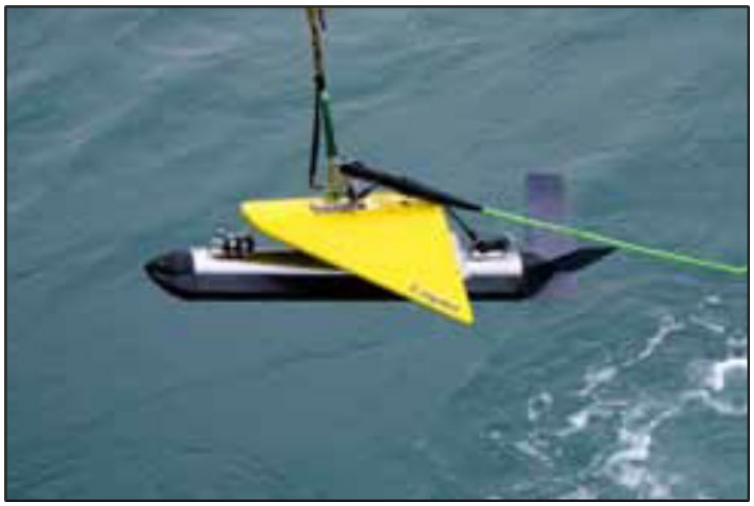
Figure A-2 Kongsberg EM2040 MBES

A.1.3.4 Side scan sonar (SSS)

SSS is a method of underwater imaging that uses acoustic energy to detect objects (e.g. pipelines and shipwrecks) and enable classification of surficial marine geology (e.g. sediment type, rock outcrop, sand ripples/waves). SSS instruments are often towed behind ships using a 'tow-fish' or mounted to a remotely operated vehicle (ROV). The instrument sends out acoustic energy in pulses perpendicular to the tow fish heading, looking sideways and down. Some of the sound sent out by the SSS reflects off the seabed and returns to the transducer with strong and weak echoes relative to the travel time. To obtain the best possible results most systems are dual frequency (dual channel high/low frequency). High-frequency systems up to 1600kHz give excellent resolution but the acoustic energy only travels a short distance (used to identify small seabed objects). Lower frequencies such as 50kHz or 100kHz give lower resolution but the distance the acoustic energy travels are greatly improved (used to detect changes in seabed sediments).

The EdgeTech 4200 is an example of SSS that may be used during the proposed survey works (FigureA-3). The SSS will be dual frequency hydrographic sonar with a minimum operating frequency of not less than 100kHz. Due to consent conditions in Irish waters, the higher frequency of the side scan sonar must be between 410kHz and 500kHz.

Figure A-3 EdgeTech 4200 SSS



Magnetometer

A magnetometer is a passive remote sensing device that detects ferrous objects, such as pipelines, cables, debris (wrecks) and potential unexploded ordnance (UXO), which may present an obstruction or risk to intrusive seabed works such as geotechnical surveys, and construction activities. Magnetometers are typically towed behind a survey vessel. An example of the marine magnetometer will be of is the Caesium Vapour type and capable of recording variations in magnetic field strength during survey to an accuracy of ±0.5 nanotesla (nT). The Geometrics G-882 is an example of magnetometer that may be used for the proposed survey works (Figure A-4).

Figure A-4 Geometrics G-882 magnetometer

Sub-bottom profiler (SBP)

SBP systems are used to image geological layers and sediment thicknesses beneath the seabed and typically have two categories. The first type is the transducer array which combine the source and receiver, as with MBES and SSS systems and is generally high frequency, identifying thin laminations of shallow geology. The second type has a separately towed source and receiver and is generally low frequency, identifying larger geological formations at lower depths. The source can be electrical or mechanical. The receiver is called a hydrophone which in most cases is physically separated from the source.

High frequency SBP's can either be either hull-mounted or towed from the survey vessel using a tow-fish or attached to a ROV. Low frequency SBP's require towed sources and receivers. The instrument sends out a pulse of acoustic energy which when recorded is known as a seismic profile. The acoustic penetration and resolution of a SBP system mainly depends on the shape and frequency of the acoustic pulse. High penetration of the seabed is only possible with low frequencies. High resolution data can be obtained with higher frequencies. SBP systems use frequencies of approximately 1kHz up to 200kHz. High frequency systems (e.g. chirp, a parametric echo sounder) can image approximately 5m to 30m below the seabed, with lower frequency systems (e.g. single channel sparker/boomer) imaging approximately 80m to 100m below the seabed. Examples of high frequency SBP systems include the Innomar SES 2000 and Edgetech 3100. Examples of low frequency SBP include Ultra High Resolution Seismic (UHRS) (sparker/boomer).

It is likely that two different systems will be used; a high-resolution profiler that will emphasise the top three to five m of sediment with a resolution of 0.25m or better in a variety of geological conditions; and a system that provides increased penetration of up to 20m. Three systems (pinger, boomer and chirp) will be made available so that the most appropriate system can be chosen dependent on the seabed conditions.

The EdgeTech 3200 is an example of a sub-bottom profiler that may be used for the proposed survey works (Figure A-5).

Figure A-5 EdgeTech 3200 SBP

A.1.4 GEOTECHNICAL SURVEY

The purpose of the proposed geotechnical survey is to evaluate the nature and mechanical properties of the superficial seabed sediments and intertidal sediments in the FLAA. The data will be used to inform future design studies e.g. to determine cable burial depth and methods.

The geotechnical survey techniques that may be used during the proposed marine survey include grab sampling, seabed CPTs, VCs, and boreholes. Boreholes will be used to determine deeper soil conditions at the export cable landfall. VC and CPTs will be used across the entire application area. VCs and CPTs will be acquired at the same or separate locations as determined by review and interpretation of SBP data.

A.1.4.1 Location and survey spacing

At this time the area of search for the possible development of the MaresConnect Interconnector cable corridors are based on desktop assessments. To be judicious it has been assumed that the geotechnical surveys will be conducted along the potential cable routes within the MULA. The below indicative sample numbers will be refined, following analysis of the geophysical data and by experienced contractor after contract award.

The exact location, quantity, type, penetration and spacing of the geotechnical samples will be determined following interpretation of geophysical data. The geotechnical sampling will be undertaken within the boundary of the of site and the potential cable routes. . Proposed geotechnical sample stations will be communicated to the National Monuments Service (NMS) – Underwater Archaeology Unit (UAU) for approval ahead of works commencing. Proposed locations will be accompanied by an assessment of the geophysical data by a qualified and experienced marine archaeologist. Following review of geophysical data only one export cable corridor and one landfall will be selected for geotechnical sampling.

The positioning of stations needs to take into consideration environmental constraints such as the position of sensitive habitats. The Dalkey to Rockabil SAC, designated for Annex I Reefs and Harbour porpoise *Phocoena phocoena* within the FLAA boundary. The geophysical data will be used to confirm the presence and positions of potential reef prior to locating geotechnical and environmental sampling stations. Sampling stations will be positioned to avoid reef habitat. If geophysical interpretation is not conclusive, DDC will be used to visualise the seabed prior to intrusive sampling to ensure reef features are avoided.

Geophysical data will be reviewed by a qualified and experienced archaeologist and, if necessary, archaeology exclusion zones will be identified and communicated to the survey contractor for the geotechnical sampling. The archaeologist will also carry out a walk-over survey of the intertidal area at the selected landfall. The archaeologist will review the geotechnical station positions and, if necessary, propose adjustments to ensure known and potential archaeological features are avoided.

The appropriate permits will be acquired from NMS ahead of the use of detection devices (e.g. geophysical equipment) and intrusive seabed works (geotechnical testing) and relevant notifications of works will be made in a timely manner.

In order to avoid interaction with the existing pipelines in the area, geotechnical and environmental sampling stations will be positioned a minimum of 250 m from the assets marked positions. The asset-owners will be contacted prior to the survey to determine if a proximity agreement is required.

During survey activities the deployment of equipment on the seabed will be kept to a minimum in order to minimise seabed disturbance.

A.1.4.2 Equipment

Vibrocore (VC)

A VC will be used to retrieve a soil sample by the lowering of a sample tube that is vibrated into the seabed. The VC will be launched from a vessel crane or A-frame. Samples will be taken at representative locations along the export cable routes and nominally will be every 1 km of survey.

- Shallow water VCs (up to 6m): Approximately 93, inclusive of an extra 20% contingency to provide conservative estimate. VCs may penetrate up to 6m into the seabed and have a diameter of 85mm. Therefore, sample volumes will be up to 1.6m^3. For 93 collected samples, the approximate volume of sediment removed will be 150.06 m^3. Indicative equipment to be used is a high-performance corer (HPC) or a modular vibrocorer.

Cone Penetrometer Test (CPT)

A CPT will be used to test the characteristics of the soil by pushing an instrumented cone into the ground at a constant speed, with continuous measurement of the cone end resistance, the friction along the sleeve of the cone, and the pore water pressure.

- Shallow water CPT: Approximately 93 samples will be taken, including extra 20% contingency to provide conservative estimate. Samples will be taken at representative locations along the export cable routes and nominally will be every 1 km of survey. Shallow water CPTs are likely to achieve penetrations of up to 6m. No sediment will be removed from the seabed. Indicative equipment to be used is a SEACALF seabed CPT system or similar and a deck mounted CPT.

The Fugro Seascalf is an example of a seabed CPT system that may be used for the proposed survey works Figure A-6.

Figure A-6 Furgo Seacalf CPT system

A.1.5 ENVIRONMENTAL SURVEY

The aim of the proposed environmental survey is to map the distribution and extent of marine benthic habitats, presence and distribution of bats, presence of otters and otter holts, intertidal birds nesting and foraging locations along the selected export cable corridor and across the prospect area . This will comprise a benthic sampling programme (using grab sampling) and video or still photographs. The sampling locations will be determined based upon interpretation of the geophysical data and selected to sample different habitats.

A grab sampler will be used to retrieve a soil sample of the seabed by the lowering of a mechanical grab. Each grab samples a volume of approximately 0.64m^3. Grabs are required to obtain a sample greater than 5cm in depth, to try and achieve this, samples will be repeated for up to three attempts. It is likely that three grab samples will be taken at each station; two for faunal analysis and one for sediment and chemical analysis. Up to 19 sampling stations (this number includes an extra 20% as a conservative estimate) at representative locations along the preferred cable route. Exact locations are subject to results of the geophysical and archaeological survey and are dependent on geology but nomically will be every 5km or where there is a change in habitat type. Indicative equipment to be used is a grab sampler e.g. Day or Hamond. The grab will be launched from a vessel crane or A-frame.

Boxcores may be used to characterise shallow soils if the sediment is found to be very soft. Up to 19 boxcores will be taken per export cable routes. Each boxcore will be taken at representative locations along the cable route (these numbers include an extra 20% as a conservative estimate).

DDC and video transect: At each geotechnical and environmental sampling station a DDC will be deployed to allow for further confirmation of sampling analysis. Additional photographs or video footage will be acquired along transects to characterise sensitive habitats or features. This technique involves no intrusive seabed sampling. Transect locations to be determined following review of geophysical data.

A.1.6 ARCHAEOLOGY SURVEY

In addition to obtaining the environmental conditions of the seabed, the geophysical survey is intended to determine the location of any features of archaeology interest. The magnetometer data acquired during the geophysical survey is a key component of this. The results of the geophysical survey will be interpreted by a licensed marine archaeologist to inform: the positioning of the intrusive features of the geotechnical surveys e.g., VCs, CPTs, geotechnical boreholes; and future environmental impact assessments. In addition to this, a qualified, Irish registered, marine archaeologist will carry out a walkover inspection of the intertidal area using a handheld magnetometer. The marine archaeologist will review all geophysical survey data ahead of geotechnical sampling to evaluate sampling positions for features of underwater importance. Geotechnical sampling stations will be moved if potential features of interest are identified.

A.1.7 BIRDS & MARINE MAMMALS SURVEY

Boat based and aerial/drone surveys will be conducted offshore and from landfall vantage points to determine usage of the survey area by birds, marine mammals, and other megafauna. Species type and distribution within the MULA will be recorded. At the time of application, these surveys are not licensable activities under the Foreshore Act 1933 (as amended).

A.1.8 SURVEY VESSELS

Geophysical survey vessels are typically between 15m and 60m in length and have an endurance of up to 28 days. These vessels are likely to use a local port for mobilisation and replenishment.

Geotechnical survey vessels are typically 55-90m in length and have an endurance of up to 28 days. Their port of mobilisation will depend on previous work but may be Irish, UK, or another European location.

The exact vessels to be used will be confirmed following a tender process to procure the survey contractor.

All vessels shall be fit for purpose, certified, and capable of safely undertaking all required survey work. The survey contractor and vessels will comply with international and national statute as appropriate. A non-exhaustive list of examples includes:

- S.I. No. 507/2012 - Merchant Shipping (Collision Regulations) (Ships and Water Craft on the Water) Order 2012.
- Sea Pollution Act 1991 which transposes into Irish statute the requirements of the International Convention for the Prevention of Marine Pollution from Ships (MARPOL 73/78)
- Sea Pollution (Amendment) Act, 1999 - which gives effect to the International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC).
- 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
- Sea Pollution (Miscellaneous Provisions) Act 2006 – which gives effect to the International Convention on Ballast Water Management 2004 (amongst others)

Notices to Mariners will be issued by the survey contractor ensuring that as well as the Maritime Safety Directorate, in particular local fishing organisations, Dublin Port Company and Drogheda Port Company, Malahide and Howth harbour master's or any other relevant harbour masters are included in the distribution list.

During the works other vessels will be requested to maintain a safe distance from the survey vessels due to the restricted manoeuvrability of the vessels.

A.1.9 GENERAL REQUIREMENTS

The exact environmental protocols to be followed during the survey will not be known until award of the survey contract. Notwithstanding, the international and national statute listed in Section 1.8 above will be complied with, and the following standard environmental procedures/protocols will be followed during the survey campaigns:

- All vessels will comply with the latest International Maritime Organization (IMO) and Safety of Life at Sea (SOLAS) and environmental requirements for their classification and with any national requirement of the territorial or offshore waters to be operated in.
- The contractor will maintain a suitably certified environmental management system.
- The contractor will take particular care when handling or storing hazardous materials, radiation sources and chemicals.
- Liquid or non-liquid pollutants or waste material will not be dumped, thrown, or otherwise disposed of into the sea.
- All refuse and materials shall be kept onboard the vessel and safely disposed of onshore according to the MARPOL convention.
- All substances handled and/or used whilst undertaking the works will be handled, used, stored, and documented in accordance with assessments and recommendations of the Control of Substances Hazardous to Health (COSHH) Regulations 1994.

- Where Fuels, Oils and Lubes are required to bestowed on boats, suitable containers will be used and stowed to allow ventilation and safe dissipation of any accidental leaked gas and retention of any leaked liquid.
- No liquid will be discharged into the water at any stage of the work on site. No smoking will be permitted in the vicinity of fuel in storage or when in use.

A.1.9.1 Health and Safety procedures

Health, safety, and environmental protection shall be given foremost consideration in the execution of the work and shall be promoted in a proactive and highly visible manner throughout the survey campaign.

Established safety procedures will be followed by both survey personnel and the vessels crew.

Notices to Mariners will be issued by the survey contractor ensuring that as well as the Maritime Safety Directorate, in particular local fishing organisations, Dublin Port Company and Drogheda Port Company, Malahide and Howth harbour master's or any other relevant harbour masters are included in the distribution list. During, the works other vessels will be requested to maintain a safe distance from the survey vessels due to the restricted manoeuvrability of the vessel.

APPENDIX B

Guidance to Manage the Risk to Marine Mammals from Man-made sound sources in Irish Waters: Section 4.3.4

B.1 GEOPHYSICAL ACOUSTIC SURVEYS

B.1.1 Multibeam, single beam, side-scan sonar & sub-bottom profiler surveys

1. A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms.
2. Unless information specific to the location and/or plan/project is otherwise available to inform the mitigation process (e.g., specific sound propagation and/or attenuation data) and a distance modification has been agreed with the Regulatory Authority, acoustic surveying using the above equipment shall not commence if marine mammals are detected within a 500m radial distance of the sound source intended for use, i.e., within the Monitored Zone.
3. Pre-Start Monitoring
4. Sound-producing activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.
5. An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.
6. **In waters up to 200m deep**, the MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO.
7. This prescribed Pre-Start Monitoring shall subsequently be followed by a Ramp-Up Procedure which should include continued monitoring by the MMO.
8. Ramp-Up Procedure
9. In commencing an acoustic survey operation using the above equipment, the following Ramp up Procedure (i.e., “soft start”) must be used, including during any testing of acoustic sources, where the output peak sound pressure level from any source exceeds 170 dB re: 1µPa @1m:
10. Where it is possible according to the operational parameters of the equipment concerned, the device’s acoustic energy output shall commence from a lower energy start-up (i.e., a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20 minutes.
11. This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period.
12. Where the acoustic output measures outlined in steps (a) and (b) are not possible according to the operational parameters of any such equipment, the device shall be switched “on” and “off” in a consistent sequential manner over a period of 20 minutes prior to commencement of the full necessary output.
13. In all cases where a Ramp-Up Procedure is employed the delay between the end of ramp-up and the necessary full output must be minimised to prevent unnecessary high-level sound introduction into the environment.

14. Once the Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source, i.e., within the Monitored Zone
15. Breaks in sound output
16. If there is a break in sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down, survey line or station change) then all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) must be undertaken.
17. For higher output survey operations which have the potential to produce injurious levels of underwater sound (see sections 2.4, 3.2) as informed by the associated risk assessment, there is likely to be a regulatory requirement to adopt a shorter 5–10-minute break limit after which period all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) shall recommence as for start-up.
18. Reporting
19. Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority.