
Ilen Array Offshore Wind Farm Foreshore Licence Application for Site Investigation Works

***European Protected Species Risk Assessment for
Annex IV Species***

Document Control

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List of Abbreviations

ADCP	Acoustic Doppler Current Profiler
API	American Petroleum Institute
BH	Borehole
CPOD	Cetacean Passive Acoustic Network
CPT	Cone Penetration Test
DAHG	Department of Culture, Heritage and the Gaeltacht
EC	European Commission
EEZ	Exclusive Economic Zone
EPS	European Protected Species
EU	European Union
GDG	Gavin and Doherty Geosolutions
IMO	International Maritime Organization
ISO	International Organization for Standardization
ITM	Irish Transverse Mercator
JNCC	Joint Nature Conservation Committee
LiDAR	Light Detection and Ranging
MARPOL	The International Convention for the Prevention of Pollution from Ships
MBES	Multibeam echosounder
Minister	Minister for Housing, Local Government and Heritage
MAP	Maritime Area Planning Act 2021
NM	Nautical Mile
NPWS	National Parks and Wildlife Service
PTS	Permanent Threshold Shift
SPL	Sound Pressure Level
SSS	Side Scan Sonar
TTS	Temporary Threshold Shift
UK	United Kingdom
UTM	Universal Transverse Mercator
VC	Vibrocore
WGS	World Geodetic System

Glossary of Terms

Acoustic Doppler Current Profiler (ADCP)	An Acoustic Doppler Current Profiler is a hydroacoustic current meter similar to a sonar, used to measure water current velocities over a depth range using the Doppler effect of sound waves scattered back from particles within the water column.
Boreholes	A borehole is a narrow shaft bored in the ground, either vertically or horizontally.
Cone Penetration Test (CPT)	The cone penetration or cone penetrometer test (CPT) is a method used to determine the geotechnical engineering properties of soils and delineating soil stratigraphy.
Exclusive Economic Zone	Marine area from the territorial seas boundary seaward to a distance of 200 miles or otherwise as agreed under international statute.
Foreshore	The foreshore of Ireland is classed as the land and seabed between the high water of ordinary or medium tides (shown HWM on Ordnance Survey maps) and the twelve-mile limit (12 nautical miles equals approximately 22.24 kilometres). Foreshore also covers tidal areas of rivers particularly estuaries.
Foreshore License Application Area	In this report means the area within the 12 NM limit of the Irish coastline where an Application for a Licence under Section 3 of the Foreshore Act 1933, as amended, is being submitted to the Department of Housing, Local Government and Heritage for a licence to undertake site investigation works.
Geophysical Surveys	Geophysical surveys are sound-based physical sensing techniques that produce a detail image or map of an area. Ground-based surveys may include: Seismic surveys - vibrations are recorded with geophones to provide information about the properties of rocks.
Geotechnical Surveys	Geotechnical investigation and evaluation which includes methods to acquire and evaluate subsurface information (i.e. drilling and sampling, laboratory testing, cone penetration testing, and pressure meter testing).
Grab Samples	A grab sample is a sample of sediment taken from the seabed.
Habitats Directive	Adopted in 1992, the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. It forms the cornerstone of Europe's nature conservation policy with the Birds Directive and establishes the EU wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging developments.
Interim Campaign	Site Investigation surveys designed to build on the level of detail acquired during the preliminary campaign with the aim of developing a detailed ground model of the site that will feed into the overall design of the windfarm. For this application it refers to the second geotechnical campaign.
Irish Transverse Mercator (ITM)	Irish Transverse Mercator (ITM) is the geographic coordinate system for Ireland. It was implemented jointly by the Ordnance Survey Ireland (OSi) and the Ordnance Survey of Northern Ireland (OSNI) in 2001. The name is derived from the Transverse Mercator projection it uses and the fact that it is optimised for the island of Ireland. ITM95 (EPSG:2157) is used to map the project area for the Foreshore Licence Map.

LiDAR	LiDAR is a method for measuring distances by illuminating the target with laser light and measuring the reflection with a sensor. Differences in laser return times and wavelengths can then be used to make digital 3-D representations of the target. It has terrestrial, airborne, and mobile applications.
Magnetometer	A magnetometer is a device that measures magnetism—the direction, strength, or relative change of a magnetic field at a particular location. The measurement of the magnetization of a magnetic material is an example
Maritime Area Planning Act 2021	Legislation reforming consenting within Ireland’s marine area, including introducing both an offshore specific consenting regime and extending the powers of the State to enable the State to operate a consenting regime across its entire EEZ and agreed continental shelf.
MARPOL	MARPOL is the main international convention aimed at the prevention of pollution from ships caused by operational or accidental causes. It was adopted at the International Maritime Organization (IMO) in 1973. The Protocol of 1978 was adopted in response to a number of tanker accidents in 1976–1977.
Metoccean	Metoccean conditions refer to the combined wind, wave and climate (etc.) conditions as found on a certain location. They are most often presented as statistics, including seasonal variations, scatter tables, wind roses and probability of exceedance.
Minister	In this report Minister means the Minister for Housing, Local Government and Heritage
Multibeam Echosounder (MBES)	An echosounder uses sound waves to measure water depth. A transducer mounted under the vessel emits a pulse which travels through the water to the seafloor and bounces back to a receiver. The time it takes for the signal to return is measured, and because the speed of sound through water (~1500 m/s) is known, the water depth under the boat is measured. This is the basic principle of hydrography and seafloor mapping. A multibeam echosounder (MBES) measures multiple echoes at a time.
Offshore Export Cable Corridor (OECC) Area	Area where site investigations will take place to determine the suitability of that area as a route for the export electricity cable from the windfarm to land.
Pollution Event	A 'pollution incident' includes a leak, spill or escape of a substance, or circumstances in which this is likely to occur.
Preliminary Campaign	Site Investigation surveys early in the project development programme designed to give an overview of the receiving environment with the aim of developing a first stage ground model. For this application it refers to the first geotechnical campaign.
Offshore Wind Farm (OWF) Area	Proposed area where site investigations will take place to determine the locations of the Offshore Wind Turbines.
Side Scan Sonar (SSS)	Side-scan uses a sonar device that emits conical or fan-shaped pulses down toward the seafloor across a wide angle, perpendicular to the path of the sensor through the water, which may be towed from a surface vessel or submarine or mounted on the ship's hull.
Sub-Bottom Profiler	A Sub-bottom profiler is a type of sonar system that produces a 2-dimensional stratigraphic cross section by using acoustic energy to image sub-surface features in an aquatic environment.
Universal Transverse Mercator (UTM)	The UTM (Universal Transverse Mercator) coordinate system divides the world into sixty north-south zones, each 6 degrees of longitude wide. UTM zones are numbered consecutively beginning with Zone 1 and progress

	eastward to Zone 19. UTM 29N (EPSG:32629) is used to map the project area.
Vibrocore	Vibrocore is the state-of-the-art sediment sampling methodology for retrieving continuous, undisturbed cores. Vibrocorers can work in a variety of water depths and can retrieve core samples at different lengths depending on sediment lithology and project objectives.
Wave Buoy	Wave buoy – used to measure the movement of the water surface as a wave train. The wave train is analysed to determine statistics like the significant wave height and period, and wave direction.
World Geodetic System (WGS)	The World Geodetic System (WGS) is a standard for use in cartography, geodesy, and satellite navigation including GPS. WGS84 is a geocentric reference ellipsoid and a geodetic datum, in that it defines the centre of mass of the earth as its origin, and the direction of the earth's axis as the minor axis of the reference ellipsoid. WGS84 (EPSG:4326) is used to map the project area.

1 Introduction

Ilen Array Ltd. proposes to investigate the feasibility of developing an offshore wind farm, Ilen Array Offshore Wind Farm (OWF), off the coast of County Kerry and County Clare.

Ilen Array Ltd. have commissioned Gavin and Doherty Geosolutions (GDG) to prepare this report in support of an application for a Foreshore Licence under Section 3 of the Foreshore Act 1933, as amended, to carry out site investigation activities to determine the suitability of the Foreshore Licence Application Area for the development of an offshore wind farm.

Ilen Array Ltd. intends to undertake a survey campaign at the proposed Foreshore Licence Application Area in order to inform the location and design of the proposed offshore wind farm and cable route to shore. The marine surveys will include geophysical, geotechnical, environmental, metocean and archaeological marine surveys.

1.1 Aim of this Report

This report is part of the Foreshore Licence Application to the Foreshore Section of the Department of Housing, Local Government and Heritage and includes information to inform a risk assessment for European Protected Species (Annex IV species) under the Habitats Directive (92/43/EEC).

This report aims to support the application process and provide the necessary information to the competent authorities to assist them in making an informed decision on the likely impact of this project on Annex IV species.

1.2 Structure of the Report

This report is structured into the following chapters to include information relating to the receiving environment, the potential impacts to Annex IV species and measures to ensure Annex IV species are protected. Specifically, the chapters of this report are as follows:

- Chapter 1 (this chapter): Description of the proposed site investigation activities
- Chapter 2: Legislation and regulatory background
- Chapter 3: Identification of the Annex IV Species that may be found on or near the Foreshore Licence Application Area
- Chapter 4: Identification of potential impacts on the basis of the proposed site investigation activities
- Chapter 5: Risk Assessment for protection of Annex IV species under Article 12 of the Habitats Directive
- Chapter 6: Proposed mitigation measures
- Chapter 7: Presents the conclusions from this report

1.3 Foreshore License Application Area

The Foreshore License Application Area is situated off the coast of county Kerry (Figure 1-1) and has a total area of 629.80 km².

Ilen Array Ltd. acknowledges that it is only possible at this time to obtain a Site Investigation Licence for that area situated within the 12 NM boundary. Ilen Array Ltd. is not proposing at this time to undertake any intrusive surveys outside the 12 NM limit regulated under the Foreshore Act 1933, as amended.

The site is defined as an irregular polygon which extends approximately 76 kilometres northeast-southwest at its longest point and 23 kilometres southeast-northwest at its widest point, with the depths ranging between 0 – 103 m. The north-western boundary is defined by the Irish 12 NM limit. The Foreshore Licence Application Area measures 629.80 km² in total. The Foreshore Licence Application Area is broken up into the Offshore Wind Farm (OWF) Area (322.66 km²) and the Offshore Export Cable Corridor (OECC) Area (307.14 km²). The OECC extends from the site area up the Shannon Estuary and makes landfall at three points.

The Foreshore Licence Application Area, OECC Area and OWF Area are shown in Figure 1-1. The coordinates of the site extent are set out (in UTM29N, WG84 and ITM95) in

Table 1-1.

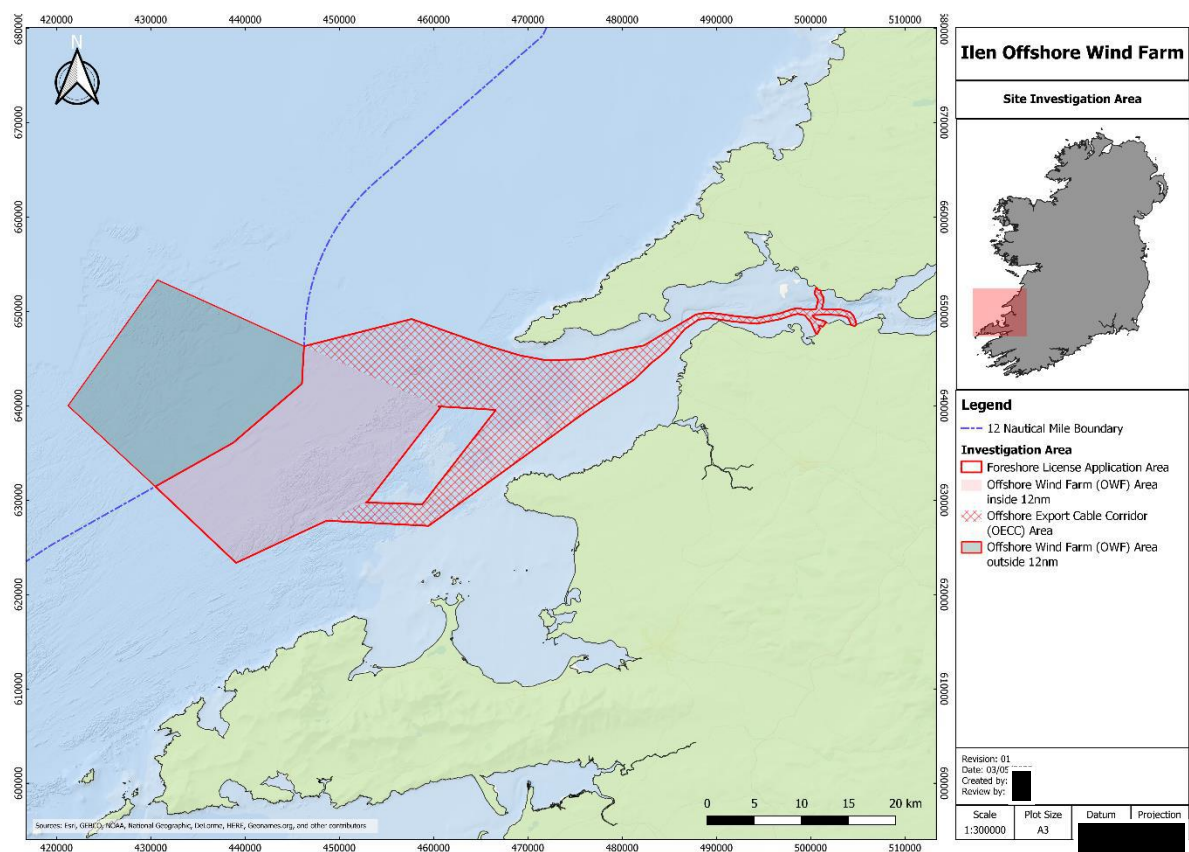


Figure 1-1: Foreshore Licence Application Area (red) and Offshore Wind Farm Area outside 12 NM (grey; for information purposes only)

Table 1-1: Foreshore Licence Application Area Coordinates

Point No.	WGS84 / UTM zone 29N EPSG:32629		WGS84 Geographic EPSG:4326		IRENET95 / Irish Transverse Mercator EPSG:2157	
	X	Y	Longitude	Latitude	X	Y
1	398534.58	5807493.87	-10.49165	52.40826	430483.70	631448.17
2	414091.21	5822564.04	-10.26690	52.54637	446254.36	646307.90
3	425459.39	5825607.96	-10.09997	52.57541	457668.32	649195.12
4	433364.32	5822938.96	-9.98281	52.55244	465538.58	646415.71
5	437007.75	5821912.04	-9.92888	52.54364	469168.83	645337.98
6	439764.57	5821439.89	-9.88815	52.53971	471919.88	644827.48
7	443721.20	5821592.09	-9.82984	52.54150	475879.72	644924.88
8	447721.76	5822663.12	-9.77103	52.55153	479896.21	645940.74
9	450116.63	5823140.76	-9.73578	52.55605	482298.34	646385.30
10	455608.70	5826509.53	-9.65523	52.58681	487838.55	649678.79
11	456554.17	5826689.24	-9.64130	52.58850	488786.75	649845.43
12	457124.41	5826705.72	-9.63289	52.58869	489357.36	649854.01
13	458178.68	5826599.20	-9.61731	52.58782	490410.42	649732.83
14	458677.05	5826530.84	-9.60995	52.58724	490907.97	649657.55
15	459629.24	5826406.45	-9.59588	52.58619	491858.66	649519.93
16	460522.32	5826328.55	-9.58269	52.58556	492750.89	649429.62
17	462022.84	5826215.27	-9.56053	52.58465	494250.21	649295.50
18	464468.59	5826731.20	-9.52449	52.58945	496703.70	649777.63
19	465633.43	5827151.09	-9.50734	52.59330	497874.64	650181.47
20	466334.68	5827329.03	-9.49700	52.59494	498578.53	650349.72
21	467271.16	5827172.52	-9.48316	52.59360	499513.06	650180.19
22	468309.21	5827222.63	-9.46784	52.59411	500552.04	650215.91
23	468408.10	5827660.49	-9.46643	52.59805	500657.03	650652.50
24	468501.11	5828124.56	-9.46510	52.60223	500756.50	651115.39
25	468511.33	5828306.40	-9.46496	52.60386	500769.24	651297.14
26	468122.04	5828911.49	-9.47077	52.60928	500388.26	651907.77
27	468249.92	5829418.79	-9.46893	52.61385	500523.20	652413.40
28	468346.50	5829532.06	-9.46752	52.61487	500621.37	652525.37
29	468820.01	5829225.14	-9.46049	52.61214	501090.74	652211.80
30	468767.21	5829017.19	-9.46125	52.61027	501035.05	652004.53
31	469121.07	5828467.16	-9.45598	52.60534	501381.36	651449.47
32	469097.55	5828048.42	-9.45628	52.60158	501352.02	651030.96
33	468994.80	5827535.75	-9.45775	52.59696	501242.13	650519.60
34	468932.23	5827257.46	-9.45865	52.59446	501175.69	650242.11
35	469171.05	5827270.78	-9.45513	52.59459	501414.75	650252.12
36	469930.60	5827270.08	-9.44391	52.59463	502174.47	650240.88
37	471044.24	5827225.35	-9.42747	52.59428	503287.74	650180.70

38	471951.63	5826971.67	-9.41405	52.59205	504191.81	649914.38
39	472295.81	5826594.12	-9.40894	52.58867	504530.84	649531.96
40	472539.83	5826069.39	-9.40530	52.58397	504767.64	649003.73
41	472627.26	5825637.82	-9.40397	52.58009	504849.10	648570.85
42	472019.01	5825619.52	-9.41294	52.57990	504240.47	648560.98
43	471966.09	5825880.79	-9.41375	52.58225	504191.15	648823.05
44	471790.70	5826257.93	-9.41637	52.58563	504020.95	649202.71
45	471624.36	5826440.40	-9.41884	52.58726	503857.11	649387.53
46	470950.20	5826628.87	-9.42881	52.58892	503185.40	649585.39
47	469918.28	5826670.32	-9.44404	52.58923	502153.83	649641.16
48	469187.46	5826670.99	-9.45483	52.58920	501422.85	649651.97
49	469112.37	5826666.81	-9.45594	52.58916	501347.68	649648.82
50	468816.93	5826646.67	-9.46030	52.58896	501051.89	649632.78
51	467918.77	5826603.25	-9.47355	52.58852	500152.92	649601.81
52	468254.46	5826235.81	-9.46856	52.58523	500483.59	649229.63
53	469343.78	5825953.57	-9.45245	52.58276	501569.26	648932.21
54	469418.69	5825833.25	-9.45134	52.58168	501642.51	648810.82
55	469067.93	5825405.47	-9.45647	52.57782	501285.73	648387.81
56	468594.07	5825528.22	-9.46348	52.57889	500813.47	648517.16
57	468770.18	5825142.13	-9.46084	52.57543	500984.26	648128.54
58	468476.10	5824611.17	-9.46513	52.57064	500682.76	647601.53
59	468304.62	5824717.65	-9.46767	52.57159	500512.71	647710.42
60	467781.77	5825863.99	-9.47550	52.58186	500005.64	648864.27
61	467120.96	5826589.53	-9.48532	52.58835	499354.74	649599.15
62	466360.08	5826716.70	-9.49657	52.58944	498595.44	649736.89
63	465809.30	5826576.94	-9.50468	52.58815	498042.59	649604.74
64	464632.97	5826152.91	-9.52200	52.58426	496860.10	649196.92
65	464006.77	5826020.81	-9.53123	52.58304	496231.92	649073.48
66	462062.97	5825610.77	-9.55987	52.57922	494281.96	648690.29
67	460473.69	5825730.75	-9.58333	52.58018	492693.95	648832.34
68	459564.30	5825810.07	-9.59676	52.58083	491785.44	648924.29
69	458597.45	5825936.37	-9.61105	52.58189	490820.11	649064.04
70	458107.76	5826003.53	-9.61828	52.58246	490331.22	649138.01
71	457884.36	5826026.11	-9.62158	52.58264	490108.08	649163.68
72	457102.84	5826105.07	-9.63313	52.58329	489327.45	649253.51
73	456619.24	5826091.09	-9.64026	52.58313	488843.54	649246.23
74	455849.02	5825944.70	-9.65161	52.58175	488071.10	649110.48
75	454422.48	5824933.32	-9.67252	52.57254	486630.17	648118.63
76	454214.12	5824680.38	-9.67556	52.57025	486418.24	647868.51
77	452658.88	5822792.41	-9.69824	52.55314	484836.43	646001.61
78	451853.24	5822031.97	-9.71001	52.54624	484020.04	645252.14
79	450931.74	5821307.90	-9.72349	52.53965	483088.25	644540.66

80	449412.77	5819786.10	-9.74565	52.52583	481547.80	643039.52
81	449161.56	5819534.43	-9.74932	52.52354	481293.04	642791.26
82	443943.29	5815957.73	-9.82562	52.49088	476023.80	639285.90
83	427560.29	5803727.38	-10.06422	52.37901	459466.77	627278.81
84	416745.38	5804129.56	-10.22317	52.38109	448654.05	627830.73
85	407210.11	5799527.98	-10.36195	52.33820	439052.01	623359.52
86	420845.61	5806108.30	-10.16341	52.39948	452782.96	629753.36
87	426878.49	5806010.24	-10.07473	52.39944	458816.35	629571.79
88	434527.87	5816107.33	-9.96430	52.49117	466607.80	639565.97
89	428630.64	5816383.06	-10.05120	52.49291	460712.65	639923.48
90	428381.31	5816397.44	-10.05488	52.49301	460463.44	639941.32
91	428642.91	5816284.55	-10.05100	52.49203	460723.56	639824.77
92	421069.14	5806216.17	-10.16015	52.40049	453008.06	629858.17

1.4 Site investigation works

The objective of the site investigation activities is to determine detailed site conditions including soil stability, the seafloor and subsurface geological characteristics, metocean conditions and environmental characteristics.

This includes detailed mapping of geology, seabed features (i.e. archaeology) and baseline environmental conditions within the site. This will provide all geotechnical design data for the proposed windfarm and export cable development and confirmation of seabed character. The data will also allow impacts to be predicted, and subsequently appropriate mitigation measures to be developed. It may also be used at a later stage to provide a baseline for the purpose of post construction and operational stage monitoring, as well as decommissioning studies.

The proposed programme of site investigations to be undertaken within the Foreshore Licence Application Area is summarised in Table 1-2 below and discussed in more detail in Sections 3 to 5 of the Schedule of Works document accompanying this application.

The exact technical specifications of the equipment to be used will not be known until the survey contract has been awarded. However, a description of the typical equipment and survey parameters is described in the Schedule of Works document accompanying this application. For the purposes of this risk assessment, typical acoustic properties of equipment are provided. The acoustic frequencies given below are typical of the frequencies used in surveys to obtain information suitable for offshore wind in these water depths. The vessel will be transiting at a relatively slow speed (c. 5 knots) throughout the survey activities and normal speeds whilst transiting to the survey site.

All efforts will be made to follow survey recommendations outlined in the Guidance on Marine Baseline Ecological Assessments & Monitoring Activities for Offshore Renewable Energy Projects Part 1 and 2 (DCCAE, April 2018), where the specific timeframes are indicated for the survey provision.

Table 1-2: Summary of proposed survey methodologies

Survey	Methods	Purpose
Hydrographical and Geophysical	Multibeam Echosounder (MBES)	MBES is a system for collecting detailed topographical data of the seabed. Typical equipment includes the Kongsberg EM3002D multi-beam system with mounting system including AML SV Smart Probe, Kongsberg EM 2040 or similar. For these surveys the equipment will operate at a typical central frequency of 200 - 400kHz (700kHz optional) with sound pressure levels in the range of 200-228dB re1μPa @1m.
	Side Scan Sonar (SSS)	SSS surveys are used to determine sediment characteristics and seabed features. The EdgeTech 4200 may be taken as an indicate example of an SSS device and for these surveys will have a potential operating frequency range of approximately 230/540kHz in the offshore area and 540/850kHz in the shallower nearshore area with sound pressure levels of 228dB re1μPa @1m.
	Magnetometer	A magnetometer is used to identify magnetic anomalies and hazard mapping for metal obstructions, shipwrecks and unexploded ordnance on the surface and in the shallow sub-surface. The Geometrics G-882 can be taken as an indicative equipment example, it is a passive device (i.e. it does not emit any sound waves into the marine environment).
	Sub-bottom Profiling (SBP)	SBP is used to develop an image of the subsurface, identifying different strata encountered in the shallow sediments. The Innomar SES-2000 Medium or Medium 100 are indicative examples of parametric system with primary and secondary frequency ranges of 85-115kHz and 2-22kHz, respectively, and sound pressure levels of up to 247 dB (typically operated at <200dB) re1μPa @ 1m, which would be used in both nearshore and offshore areas. The Applied Acoustics AA301 is an indicative example of a boomer, with sound pressure levels in the range of 208-215dB re1μPa @ 1m which would be used in the nearshore shallower area. The applied Acoustics Duraspark 400 is an indicative example of a sparker system used in sub-bottom profiling, with sound pressures in the range of 204-216dB re1μPa @1m.
Geotechnical	Boreholes	Up to 40 no. boreholes will be required for the Preliminary Campaign. Boreholes may be up to 80m deep within the OWF area however within the OECC area they will likely be around 20 m deep. All drilling equipment used will follow the relevant ISO and API technical specifications for drilling equipment.
	Cone Penetration Tests (CPT)	CPTs are a method used for testing the soils strength parameters. CPTs can be performed as either Seabed CPTs or as Down Borehole CPTs. Up to 247 no. CPTs will be required for the Preliminary Campaign. The spacing interval will be determined by the variability and level of understanding of the shallow geology. The final number and location of SI points will be informed by the geophysical survey results.
	Vibrocore / Gravity Corer	Vibrocore (VC) and Gravity Corer (GC) are two methods of collecting un-consolidated seabed samples. Up to 273 no. sample locations for either vibrocore or gravity sampling with a target depth of 6m BSF will be required for the Preliminary Campaign.
Metoccean	Floating LiDAR	Up to 2 floating LiDAR buoys will be deployed to measure the wind resource within the OWF Area. Deployment of this buoy will include anchor points on the seafloor. LiDAR may be deployed for a period of between 12 to 24 months.
	Acoustic Doppler Current Profiler (ADCP)	Up to 5 ADCPs may be used to examine wave and current conditions in the Foreshore Licence Application Area. This equipment is installed on the seabed and anchored with a suitable mooring

Survey	Methods	Purpose
		structure. It is generally a short-term deployment used to gather seasonal data (e.g. winter storm data) however may be deployed for longer.
	Wave Buoy	Up to 2 wave rider buoys may be deployed to measure wave heights and direction to feed into the detailed design of the project within the OWF area. They will be moored to the seabed by a suitably sized mooring structure.
Ecology	Bird Survey	Identify bird species distribution and behaviour within the Foreshore Licence Application Area using non-intrusive aerial surveys. This does not require a licence under the Foreshore Act 1933, as amended and is included for information only.
	Fisheries Survey	Identify fish species distribution within the Foreshore Licence Application Area. Exact details of monitoring required will be determined through engagement with the relevant authorities such as SFPA, the Marine Institute and through local knowledge where appropriate.
	Benthic Ecology (subtidal benthic survey, intertidal habitat walkover survey)	<p>This survey is designed to identify the expected benthic communities and habitats within the Foreshore Licence Application Area. This may consist of an intertidal walkover survey with a biotope mapping exercise of the intertidal part of the OECC and its proposed landfalls with identification of the existing habitats. Where appropriate, core/quadrat sampling and hard substrate quadrat sampling will be carried out.</p> <p>In the intertidal area features of conservation importance such as reefs will be identified by means of visual inspection and mapped. Where the Annex I Habitat reef is a qualifying interest for an SAC, MNCR Phase II surveys will be used to survey pre-selected sites within the SAC. MNCR Phase I surveys will be used for all other intertidal reef.</p> <p>Subtidal sample locations may be subject to drop down video in advance of sampling. In the subtidal area features of conservation importance such as reefs will be identified by means of visual inspection.</p> <p>There will be up to 273 no. subtidal locations within the Foreshore Licence Application Area and typically up to 4 samples will be taken at each location.</p>
	Marine Mammal Survey	Identify marine mammal species distribution within the Foreshore Licence Application Area. This does not require a licence under the Foreshore Act 1933, as amended and is included for information only. The marine mammal observational studies will be run concurrently with the at site bird surveys.
	Marine Mammal Acoustic Monitoring	Marine mammal acoustic monitoring using CPODs deployed on the seabed. SoundTrap hydrophones may be deployed alongside the CPODs for periods throughout the monitoring campaign. Either 2 permanent sites will be selected, or the 2 sites will be relocated every 3 months during battery change. The CPOD locations are subject to archaeological survey results.
Archaeology	Underwater Archaeology	Identification and assessment of metallic and other targets recorded during the marine geophysical surveys.

Figure 1-2 below shows the indicative survey locations across the application area.

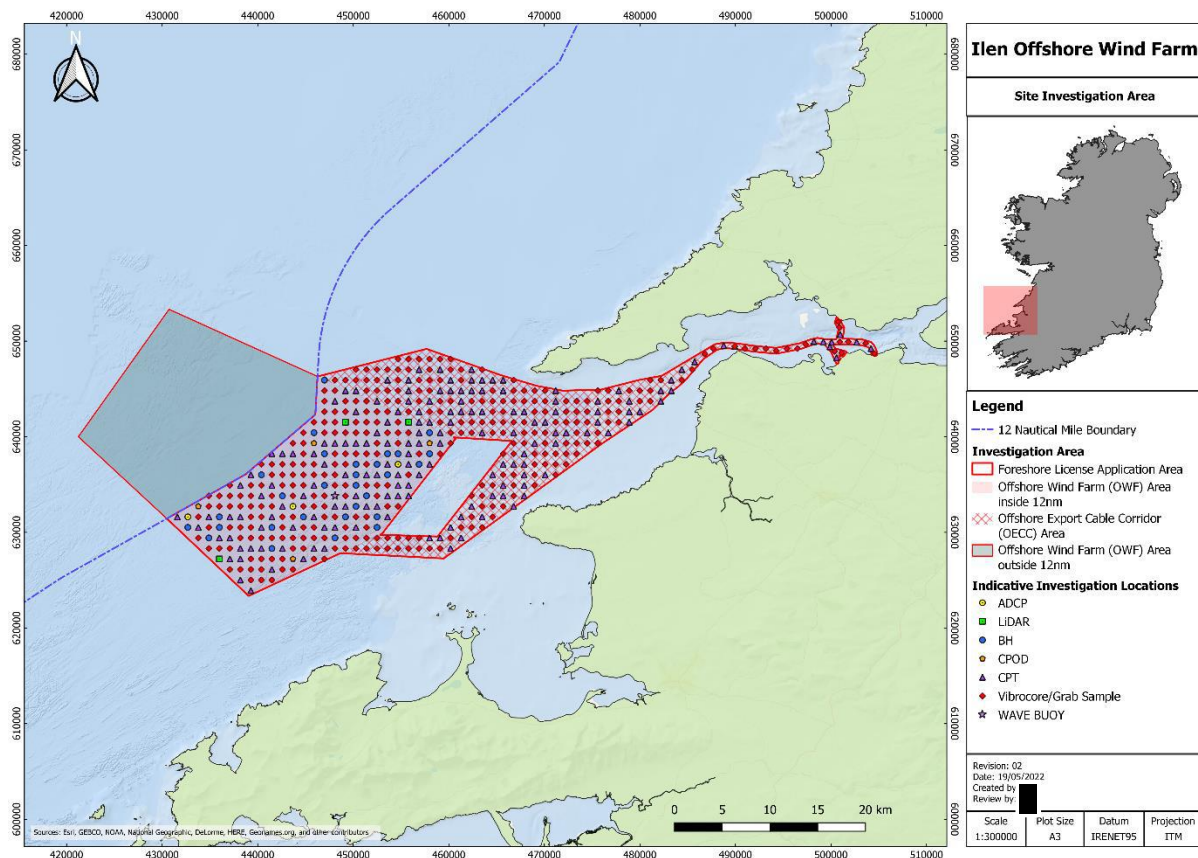


Figure 1-2: Indicative Geotechnical, Metocean and Ecological Survey Locations

1.5 Survey Schedule

Subject to the award of a Foreshore licence, as well as favourable weather conditions, Ilen Array Ltd. propose a survey works schedule that will be phased over a total of 5 years.

Given the current Covid-19 global pandemic and the uncertainty still associated with its evolution, as well as the uncertainty associated with the timing for obtaining a Foreshore Licence, it is not possible at the time of writing to provide exact details on the proposed survey schedule. However, the intention is to begin survey activities as soon as feasible following award of the Foreshore Licence, possibly in Spring of 2023 with a staged programme of investigations over the subsequent four years (2024, 2025, 2026, 2027), capitalising on suitable weather windows over the total period of five years. This phased approach will progress the overall development towards detailed design stage. Procurement of survey contractors will be undertaken to ensure that suitable weather windows can be utilised as soon as possible following licence award. The exact survey mobilisation dates will be known at that point in the process. For further details on the proposed site investigation activities please see the Schedule of Works document that has been provided in support of the application.

2 Legislation and Regulation

2.1 European Protected Species (EPS)

All species of cetacean (whales, dolphins and porpoises) occurring in European Union (EU) waters are considered European Protected Species (EPS) under Annex IV of the Habitats Directive (Council Directive 92/43/EEC). As directed by Article 12 of the Directive, species listed in Annex IV are considered species of community interest in need of strict protection across their entire natural range within the EU, both within and outside Natura 2000 sites. In addition to cetaceans, other EPS occurring in Irish waters are the Eurasian otter (*Lutra lutra*) and the leatherback turtle (*Dermochelys coriacea*).

The Habitats Directive has been transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No 477 of 2011). These consolidate the earlier European Communities (Natural Habitats) Regulations 1997 to 2005 and the European Communities (Birds and Natural Habitats) (Control of Recreational Activities) Regulations 2010.

These Regulations provide for the strict protection of Annex IV listed species, including all cetaceans, in their natural range. As such, it is an offence to:

- Deliberately capture or kill any specimen of these species in the wild;
- Deliberately disturb these species particularly during the period of breeding, rearing, hibernation and migration;
- Deliberately take or destroys eggs of those species from the wild;
- Damage or destroy a breeding site or resting place of such an animal; or
- Keep, transport, sell, exchange, offer for sale or offer for exchange any specimen of these species taken in the wild, other than those taken legally as referred to in Article 12(2) of the Habitats Directive.

‘Deliberate’ has been interpreted by the European Commission, in its 2007 ‘Guidance document on the strict protection of animal species of community interest under the Habitats Directive 92/43/EEC’, as

“‘Deliberate’ actions are to be understood as actions by a person who knows, in light of the relevant legislation that applies to the species involved, and the general information delivered to the public, that his action will most likely lead to an offence against a species, but intends this offence or, if not, consciously accepts the foreseeable results of his action”.

Therefore, anyone carrying out an activity which they should reasonably have known could cause injury as defined in the Regulations, could be committing an offence.

In Ireland, further protection is afforded to all cetaceans, as well as grey and harbour seals and the Eurasian otter under the Wildlife Act (1976) and its subsequent Amendments. Under the Wildlife Act and its amendments, it is an offence to hunt, injure or wilfully interfere with, disturb or destroy the resting or breeding place of a protected species (except in some instances under licence or Ministerial

permit). The Wildlife Act applies to waters within Ireland's Territorial Sea, i.e., out to the 12 nm limit from the baseline¹.

2.2 Guidance

In 2007, the National Parks and Wildlife Service (NPWS) of the Department of Arts, Heritage and the Gaeltacht produced a 'Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters' (NPWS, 2007). These were reviewed and amended in 2014 to produce 'Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters' (DAHG, 2014). This guidance aims to:

1. Give an understanding of selected sound sources introduced into the environment by specific human activities, which may impact detrimentally on protected marine mammal populations or individuals of those species,
2. Describe a structured, staged process for the informed assessment of risk and decision making with regard to such sources
3. Outline practical risk avoidance and/or risk reduction measures which must be considered in order to minimise the potential effects of sound sources on the natural ecology of marine mammal species

This DAHG (2014) guidance recommends that listed coastal and marine activities, including geophysical acoustic surveys, undergo a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species to address any area-specific sensitivities, both in temporal and spatial extent, and to inform the consenting process. This document also sets out a generalised framework for the consideration of risk from particular sound-producing activities in the waters of Ireland's Exclusive Economic Zone (EEZ) and offers guidance for planning and risk management, where necessary.

Additionally, 'The protection of marine European Protected Species from injury and disturbance: Guidance for the marine area in England and Wales and the UK offshore marine area', published in 2010 by the JNCC, Natural England and the Countryside Council for Wales (now Natural Resources Wales) (JNCC *et al.*, 2010), has been used as a complement to the NPWS (2014) guidelines.

¹ The baseline is the low water mark from which the limit of the territorial seas is measured (i.e. 12NM)

3 Annex IV species

Ireland has recorded 25 species of cetacean, all of which are recognised as protected species under the EU Habitats Directive and the Irish Wildlife Act 1976, as amended. Of these 25 species, only ten – Harbour porpoise, Bottlenose dolphin, White-beaked dolphin, Common dolphin, Risso’s dolphin, Killer whale, Minke whale, Long finned pilot whale, Fin whale and Humpback whale – are considered to be regularly found in the North-east Atlantic Ocean and may be present in the proposed survey area at least on a seasonal basis (O’Brien *et al.*, 2009; Wall *et al.*, 2013, Marine Atlas, 2019a). In addition, Leatherback turtle has also been observed off the West coast in recent years. The Otter may also interact with very small areas of the landfalls should they be present in any rivers within range of landfall areas, such as the Shannon Estuary or other minor rivers which fall within the range for coastal dwelling otters.

Table 3-1 presents a short synopsis of the Annex IV species that may be found within or near the proposed site investigation area.

Table 3-1: Annex IV species that may be found within or near the Foreshore Licence Application Area

Species	Species Information
Harbour porpoise <i>(Phocoena phocoena)</i>	Generally found in the northern latitudes of the Pacific and Atlantic oceans, mainly in the continental margins. They are the most widespread of any species in Ireland, observed in all inshore waters around the entire coastline and almost all records were within 10 km of the coast (Berrow <i>et al.</i> , 2010). The harbour porpoise is the smallest cetacean found in Irish waters and generally appears shy, avoiding other species and rarely interacting with boats, which can make observing it difficult in anything other than calm waters. Harbour porpoises are particularly abundant between Howth Head and Dalkey off Co. Dublin, where boat-based surveys conducted by IWDG produced the highest counts anywhere in Ireland. (IWDG, 2022a; NPWS, 2022; 2019). Harbour porpoises rarely occur over deep water but have been observed over relatively shallow (<200m) offshore banks (DAGH, 2009)
Bottlenose dolphin <i>(Tursiops truncatus)</i>	A large, robust, and gregarious dolphin found in tropical and temperate waters worldwide (Wall <i>et al.</i> , 2013). In Ireland, bottlenose dolphin shows both a coastal and offshore distribution with most sighting records off the western seaboard and in the Celtic Sea, although it is also found in the Irish Sea and in waters along the edge of the continental shelf (DAGH, 2009). Resident or semi-resident populations are known from the Shannon Estuary, Tralee Bay, the Mayo coast and Cork Harbour. Results from a study by Mirimin <i>et al.</i> (2011) comparing bottlenose dolphin biopsies indicate that there is a degree of isolation of the Shannon Estuary population from animals encountered elsewhere around the coast, and that a larger pelagic population exists that is also genetically distinct from the Irish coastal populations.
Common dolphin <i>(Delphinus delphis)</i>	Deemed the second most frequently reported species of cetacean after the harbour porpoise, and the most abundant of all cetacean species recorded in Ireland (Berrow <i>et al.</i> , 2010). Common dolphins occur in all Irish waters including offshore waters and the Irish Sea, but highest concentrations appear to occur off the south and west coasts (DAGH, 2009). There appears to be an eastward movement of this species along the south coast during autumn and winter, with sightings peaking off County Kerry towards late

Species	Species Information
	summer, off County Cork between September and January and off County Waterford between November and February (Berrow <i>et al.</i> , 2010).
Risso's dolphin <i>(Grampus griseus)</i>	In Ireland during the summer months Risso's dolphin favours inshore waters and offshore islands, especially The Saltee Islands off County Wexford, the County Cork coast and the Blasket Islands off County Kerry in contrast to deep-water habitats elsewhere in the world (IWDG, 2022b). According to Berrow <i>et al.</i> (2010), most sightings occur between May and July suggesting a late spring inshore movement. Although Risso's dolphins have been reported off all coasts in Ireland, their distribution is more clustered with regular sightings inshore off the northwest and southeast coasts, with most records of Risso's dolphins in the UK and Ireland being within 11 km of the coast (DAGH, 2009).
White-beaked Dolphin <i>(Lagenorhynchus albirostris)</i>	A very robust dolphin with a small beak and tall, curved dorsal fin. They have a complex colouration pattern with a white beak, dark grey along the back and white underneath with a diagnostic saddle patch behind the dorsal fin. Breaching sometimes occurs and they may be seen associating with other species. They bow-ride vessels infrequently. In Ireland, little is known about this species in Irish waters but as expected of a cold water shelf species, most sighting in Irish waters are from the Northwest region where they appear to be most abundant in offshore waters off counties Mayo and Donegal (IWDG, 2022d)
Killer whale <i>(Orcinus orca)</i>	Killer whales are the largest delphinid growing up to 9.5m. They are easily identified with striking coloration and large dorsal fins, particularly in the adult males. They are the most widely distributed cetacean in the world (Shirihai & Jarrett, 2006), and have been recorded off all Irish coasts in all seasons, with markedly fewer sightings in the Irish Sea (Wall <i>et al.</i> , 2013), but mainly in shallow continental shelf waters (DAGH, 2009). Photo identification has linked killer whales sighted off Ireland with the "West Coast Community" resident off Scotland (Berrow <i>et al.</i> , 2010).
Fin whale <i>(Balaenoptera physalus)</i>	Growing up to 24m, Fin whales are the second-largest animal in the world after the blue whale (<i>Balaenoptera musculus</i>) and the largest baleen whale likely to be present close to shore off Ireland. The Fin whale has a worldwide distribution in mainly temperate and polar sea (Shirihai & Jarrett, 2006). In Irish waters, nearshore sightings cluster to the south and southwest of the country with peaks in the number of animals in the autumn and early winter (DAGH, 2009), but they are also well-represented off the shelf edge in deeper waters (Wall <i>et al.</i> , 2013).
Humpback whale <i>(Megaptera novaeangliae)</i>	The Humpback whale is a global species found in all the major ocean basins. In Ireland, Humpback whales have been recorded in small numbers close inshore mainly off the south and southwest coasts, although all coasts are represented, including the Irish Sea; However, records offshore are relatively scarce (DAGH, 2009). Sightings of the iconic humpback have increased recently in Irish waters, with the Irish photo-ID catalogue of unique humpback whale sightings currently comprising 92 animals (IWDG, 2022c).
Long-finned Pilot Whale <i>(Globicephala melas)</i>	According to Berrow <i>et al.</i> (2010) the long-finned pilot whale was regularly reported with most sightings from the shelf edge and in deep water beyond the continental shelf. The species is less frequently recorded from inshore waters. However, Pilot whales have been stranded on all Irish coasts but mainly along the western seaboard and between counties Kerry and Mayo (Berrow <i>et al.</i> , 2010)

Species	Species Information
Minke whale <i>(Balaenoptera acutorostrata)</i>	The minke whale is the most common and widely distributed of the baleen whales in Ireland and the most likely to be encountered in shallow waters. It occurs off all coasts, including the Irish Sea, but most records are from southern and southwestern coastal waters. The species has also been observed over offshore banks (DAGH, 2009). The smallest of the baleen whales, their length averages 8.5 metres. Usually encountered singly or in small groups, sightings are most frequent off the Irish coast in spring and autumn (Wall <i>et al.</i> , 2013).
Eurasian otter (<i>Lutra lutra</i>)	The otter is a semi-aquatic mammal, which occurs in a wide variety of aquatic habitats such as rivers, streams, lakes, estuaries and on the coast. Coastal dwelling populations use shallow, inshore marine areas for feeding but they also require access to fresh water for bathing and terrestrial areas for resting and breeding, therefore their foraging range in the marine environment is limited to coastal areas. In Ireland, the territory of female otters is 6.5 ± 1.0 km in coastal environments (de Jongh <i>et al.</i> 2010) and males may have a larger extent; it has been suggested that the otter's range is approximately 12 km along the coast and 80 m seaward from the coast (NWPS, 2015; NPWS, <i>Lutra lutra</i> (1355) Conservation Status Assessment Report). Under water, hearing sensitivity is significantly reduced when compared to sea lions and other pinniped species, demonstrating that otter hearing is primarily adapted to receive airborne sounds (Ghoul <i>et al.</i> , 2014). Ireland continues to remain a stronghold for the Eurasian otter, with the densest otter population in western Europe. Over most of the continent the species is scarce to extinct, making the Irish population of otters particularly important (NPWS, 2019).
Leatherback turtle <i>(Dermochelys coriacea)</i>	<p>The leatherback turtle (<i>Dermochelys coriacea</i>) is the most widely distributed living reptile species, being found in all oceans except the Southern Ocean. Within the North Atlantic its range extends from the tropics to the high latitudes of Newfoundland right across to Europe's north-easterly fringe. It is a widely roaming species, with individuals making extensive pan-oceanic movements. Breeding is confined to warm tropical regions because of thermal constraints on egg incubation, but the species has many unique anatomical and physiological adaptations that permit it, unlike other marine turtles, to forage seasonally into cooler temperate waters. Consequently, leatherback populations have a very dynamic range. During the summer months their range is at its greatest extent with individuals located throughout the North Atlantic, whereas during the winter months their range is restricted to areas where the sea surface temperature is $>15^{\circ}\text{C}$. (NPWS, 2019)</p> <p>Recent studies have shown that after nesting in the tropics the majority of North Atlantic leatherbacks head north towards cooler temperate waters. Some of these individuals head north towards the north-east Atlantic and Irish waters where they forage on jellyfish for the summer months before turning south again in the autumn as water temperatures decline (NPWS, 2019). They are generally spotted off the south and southwest coasts of Ireland during the summer months, with live sightings peaking in August (NPWS, 2019; OSPAR, 2009; King and Berrow, 2009; Doyle <i>et al.</i>, 2007).</p>

The present assessment will only consider the species regularly found in relatively close proximity to the proposed survey site, as other species will be occasional. Although not considered specifically in this assessment due to their low likelihood of occurrence, any assessment of, or mitigation measures put in place for the species assessed here are considered to be appropriate/relevant for other less commonly occurring species. For more information on other species, please refer to IWDG website: <https://iwdg.ie/species/>

4 Potential Environmental Impacts

The following are the potential environmental impacts that have been identified given the nature of the site investigation activities proposed under this application:

- Disturbance from vibration and underwater noise associated with surveys
- Injury due to collision (Survey vessels/sampling equipment)
- Pollution event causing damage to Annex IV species

4.1 Disturbance from vibration and underwater noise associated with surveys

Geophysical surveys in the marine environment are a potential source of anthropogenic sound and therefore may have an impact on the marine environment. The level of environmental impact associated with this acoustic activity is variable depending on several factors including the type of equipment being used, its sound signal and propagation characteristics, and the depth in which it is operating (DAHG, 2014).

Cetaceans have evolved to use sound as an important aid in navigation, communication, and hunting (Richardson *et al.*, 1995). It is widely accepted that the main environmental concern relating to marine mammals is the potential effects of anthropogenic underwater noise/sound (see Nowacek *et al.*, 2007 for review). Such exposure can induce a range of effects on marine mammals: physical effects may include a temporary reduction in hearing sensitivity (Temporary Threshold Shift-TTS) which is reversible over time; or following intense noise exposure, Permanent Threshold Shift-(PTS). Other impacts include masking of biologically important noises by anthropogenic noise (perceptual impacts); behavioural changes such as displacement from feeding, resting, or breeding grounds; and stress (Southall *et al.*, 2007; 2019; DAHG, 2014).

Acoustic instruments and equipment used in targeted marine geophysical investigations produce sound at frequencies within the hearing range of marine mammals (Nowacek *et al.*, 2007). In order to evaluate the potential of the proposed survey equipment to cause harm to marine mammals, an assessment has been conducted using the approach described in Southall *et al.* (2007), in line with the current guidance from DAHG (2014). The Southall *et al.* (2007) noise exposure criteria have been updated by the US National Marine Fisheries Service (NMFS, 2016; NMFS, 2018) and Southall *et al.* (2019). It should be noted here that the NMFS (2018) / Southall *et al.* (2019) weightings and criteria are similar to those of Southall *et al.* (2007), although the naming of the hearing groups differs. Using the NMFS (2018) / Southall *et al.* (2019) criteria would constitute best practice for guidance on underwater noise exposure, however, in line with the current guidance from DAHG (2014), the criteria from the Southall *et al.* (2007) have been used in this report.

Southall *et al.* (2007) separated marine mammals into groups based on their functional hearing, namely low-frequency cetaceans, mid-frequency cetaceans, high-frequency cetaceans, pinnipeds in water and pinnipeds in air. For each of these groups sound pressure levels that would result in injury (PTS or TTS) were proposed for individuals exposed to single, multiple and non-pulsed sources (Table 4-1). For the purposes of this assessment, pinnipeds are not included as they are not an Annex IV species.

Table 4-1: Sound Pressure Level (SPL) injury criteria proposed by Southall et al. (2007), for individual marine mammals exposed to discrete noise events

Marine Mammal group	Injury Criteria	
	TTS	PTS
Low-Frequency Cetaceans (Baleen whales)	224dB re: 1µPa (peak)	230dB re: 1µPa (peak)
Mid-Frequency Cetaceans (including Bottlenose dolphins)	224dB re: 1µPa (peak)	230dB re: 1µPa (peak)
High Frequency Cetaceans (including harbour porpoise)	224dB re: 1µPa (peak)	230dB re: 1µPa (peak)

All geophysical surveys will adhere to international best practice, including the Department of Arts Heritage and the Gaeltacht (DAHG) 'Guidance to Manage the Risk to Marine Mammals from Man-made sound sources in Irish Waters' (DAHG, 2014). The DAHG (2014) report 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' addresses several key potential sources of anthropogenic sound that may impact detrimentally upon marine mammals in Irish waters. It incorporates a re-examination of the Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters (2007) and thereby provides replacement guidance and protective measures in this respect. The DAHG 2014 Guidance includes plan/project-specific guidance on Geophysical Acoustic Surveys in section 4.2.4 and will be followed throughout the site investigation activities.

The following auditory band widths for marine mammals which may be present in the vicinity of the Foreshore Licence Application Area are from Southall *et al.* (2007) cited in the DAHG (2014) guidance and are shown in Table 4-2. There is no data available for Eurasian otters, therefore underwater auditory detection thresholds are given for sea otter (*Enhydra lutris*) (Ghoul & Reichmuth, 2014). Leatherback turtle are known to hear in the very low frequency range, with a range of 50 - 1200 Hz with maximum sensitivity between 100-400 Hz in water (Piniak *et al*, 2012).

Table 4-2: Underwater Auditory Band Width for Marine Mammal Species (Southall et al., 2007), sea otter (Ghoul & Reichmuth, 2014) and Leatherback turtle (Piniak et al, 2012)

Frequency	Species	Estimated Auditory Band Width (kHz)
Low Frequency Cetaceans	Baleen whales (Minke whale, Humpback whale)	0.007 – 22
Mid Frequency Cetaceans	Most toothed whales and dolphins (including Common & Risso's Dolphin)	0.15 – 160
High Frequency Cetaceans	Certain toothed whales and porpoises (including Harbour porpoise)	0.2 – 180
Low Frequency	Sea otter (<i>Enhydra lutris</i>)	0.125 – 38
Very Low Frequency	Leatherback turtle	0.05 – 1.2

Noise characteristics of the various surveys are detailed in Table 4-3 below.

Table 4-3: Noise sources during site investigation activities

Noise Source	Frequency (kHz)	Sound Pressure Level (dB re 1µPa @ 1m)
Shipping Noise	0.05 - 0.3	160 - 175
Multibeam echosounder (MBES)	200 - 700	200 - 228
Side scan sonar – Dual Frequency (SSS)	230/540 or 540/850	228
Innomar Sub-bottom profiler (SBP)	85 - 115 / 2 - 22	247
Sparker system (SBP)	2 - 16	204 - 216
Boomer system (SBP)	2.5	208 - 215
Geotechnical drilling (Rotary Boreholes)	0.002 - 50	160

Comparing the data on Annex IV species auditory band width (Table 4-2) and the noise characteristics of the surveys (Table 4-3) it is deemed that the following will be audible to marine mammals and leatherback turtle:

- Shipping noise
- Sub-Bottom Profiler (SBP)
- Drilling

The Magnetometer (MM) is a passive device measuring magnetic fields and does not emit sound. Cone penetration testing (CPT) and Vibrocore are deemed not audible to marine mammals. Multibeam and side scan sonar surveys are typically at such high frequency and low power that they are deemed outside the audible threshold of marine mammals.

The relevant surveys which are within the audible band width for marine mammals are presented in Table 4.4.

Table 4-4: Annex IV species auditory band width and relevant surveys; marine mammals known in the area are also listed.

Frequency	Species	Estimated Auditory Band Width (kHz)	Audible Survey
Low Frequency Cetaceans	Baleen whales (Minke Whale, Humpback Whale)	0.007 – 22	Shipping, SBP, Drilling
Mid Frequency Cetaceans	Most toothed whales and dolphins (Common & Risso's Dolphin)	0.15 - 160	Shipping, SBP, Drilling
High Frequency Cetaceans	Certain toothed whales, porpoises (Harbour porpoise)	0.2 - 180	Shipping, SBP, Drilling
Very Low Frequency	Leatherback turtle	0.050 – 1.2	Shipping, SBP, Drilling

The criteria from Southall *et al.* (2007) detailed above is not considered appropriate to assess the behavioural response of marine mammals to continuous noise events as those emitted by geotechnical drilling, and therefore, alternative criteria are needed. As such, the dB_{ht} approach has been used in this report.

The dB_{ht}(Species) metric (Nedwell *et al.*, 2007) has been developed as a means for quantifying the potential for a behavioural impact on a species in the underwater environment. The dB_{ht} metric is a

measure of perception, which is defined as an objective measurement of the amount a noise is above the threshold of hearing of an animal, so the level is in “dBs referenced to hearing threshold”, hence the “ht” suffix. The dB_{ht}(*Species*) level therefore corresponds to the likely loudness of the sound perceived by that species. Since different species have different hearing abilities, a given sound will have a different level on this scale for each species, therefore the animal for which the level is calculated (for a given noise source) must be specified (Nedwell *et al.*, 2007).

In summary, where a specific animal is under consideration, the animal must be specified, for example, 90 dB_{ht}(*Phocoena phocoena*) would be interpreted as “a sound level 90 dB above the hearing of a harbour porpoise”. However, generalised comments are also possible, such as “animals will tend to react to sound at levels above 90 dB_{ht}” which means, above their own specific hearing threshold.

Table 4-5 summarises the assessment criteria for the dB_{ht}.

Table 4-5: Assessment criteria to estimate the potential behavioural responses by marine mammals to underwater noise (Nedwell *et al.*, 2007, Nedwell *et al.*, 2008)

Level in dB _{ht} (<i>Species</i>)	Effect
0-50	Low likelihood of disturbance
75	Significant avoidance reaction occurs in a majority of individuals
90 and above	Strong avoidance reaction by virtually all individuals
Above 110	Tolerance limit of sound; unbearably loud
Above 130	Possibility of traumatic hearing damage from single event

4.2 Injury due to collision (survey vessels/sampling equipment)

There is a risk of collision between marine mammals and survey vessels. However, it is largely recognised that the key factors contributing to collision between marine mammals and vessels is speed (see Schoeman *et al.*, 2020 for review). Injuries to marine mammals from vessel strikes are species-dependent but are generally more severe at higher impact speeds, with ships travelling at 14 knots or faster being the most likely to cause lethal or serious injuries (Wang *et al.*, 2007). The vessels undertaking these surveys are likely to be either stationary or travelling considerably slower (5 knots) than this while engaged in the survey activities, thus allowing both the vessel and any animal in the area time to avoid collision.

During transit times, the survey vessels will be travelling at speeds greater than 5 knots. However, these movements are not considered to deviate from normal vessel traffic in the Foreshore Licence Application Area. Cetaceans in the area are exposed to vessels of all sizes on a regular basis as the survey site is located close to the entrance to Foynes Port and several smaller fishing harbours. As a result, they are likely to maintain a distance from all survey vessels for the short time period of survey works, before returning to the area once survey work has finished.

Therefore, the collision risk posed by the proposed survey is likely to be significantly lower than that posed by commercial shipping activity.

4.3 Pollution Event

The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78, MARPOL is short for maritime pollution and 73/78 short for the years 1973 and 1978) is one of the most important international marine environmental conventions. It aims to prevent both operational and accidental discharge into the marine from sea going vessels. Ireland ratified the various elements of the MARPOL Convention through the Sea Pollution Act 1991, the Sea Pollution (Amendment) Act 1999 and the Sea Pollution (Miscellaneous Provisions) Act 2006. It was given further legal effect through several Statutory Instruments under these Acts. The Acts place a legal obligation upon operators of vessels to implement measures to prevent both operational and accidental discharges from ships of substances, which may damage the marine environment as well as human health.

While the site investigation activities will result in a temporary increase in vessels using the area, which would therefore theoretically increase the risk of accidents and resultant fuel spills, in light of the legal obligations outlined above an incidence of pollution, whether from operational activities or from an accidental occurrence, is considered not likely.

All vessels used during the survey campaign shall, as required by law, be MARPOL compliant and fully certified by the Maritime Safety Office. This is standard practice for all survey activities irrespective of the survey operator and as it is required by law is built into the survey design. Therefore, it is considered not likely that there would be any occurrence of a pollution event either accidental or otherwise that could directly or indirectly affect any Annex IV Species. It is not considered further as an impact to Annex IV species in this report.

5 Risk Assessment for the protection of Annex IV species under Article 12 of the Habitats Directive

The purpose of this section is to examine the possible impacts of the proposed activities on those Annex IV species identified as having the potential to be present in the area, and address protective measures aimed at reducing any impact to these species. According to Wall *et al.* (2013) and Berrow *et al.* (2010), these species have been recorded in the area previously, therefore it is assumed for the purpose of this appraisal that they could be present in the area at any time of the year.

5.1 Identification of Relevant Annex IV Species

According to Wall *et al.* (2013) and Berrow *et al.* (2010), the area subject to the activities proposed under this application for a Foreshore Licence is known to be within the range of the following Annex IV Species:

- Harbour porpoise
- Bottlenose dolphin
- Common dolphin
- Risso's dolphin
- White-beaked dolphin
- Killer whale
- Fin whale
- Humpback whale
- Long-finned pilot whale
- Minke whale
- Eurasian otter
- Leatherback turtle

5.2 Impact Assessment

The species identified in Section 5.1 may be affected by noise emitted into the marine environment which may cause a range of injuries and behavioural reactions including injury up to and including death and masking of behaviours in relation to foraging and navigation.

The species identified in Section 3 and listed above in Section 5.1 are most likely to be affected by:

- Disturbance from underwater noise associated with surveys; and
- Injury due to collision (survey vessels/sampling equipment).

According to Southall *et al.* (2007), harbour porpoise hear in the high-frequency range (0.2 – 180 kHz); humpback, fin and minke whale hear in the low frequency range (0.007 – 22 kHz); Risso's, white-beaked and common dolphin hear in the mid frequency range (0.15 – 160 kHz); Leatherback turtle hear in the very low frequency range (50-1,200 Hz). They all therefore can hear and are susceptible to the noise of shipping, SBP, UHRS, and drilling. Leatherback turtle has a very narrow hearing range and is only susceptible to the noise from shipping. There is no data available for Eurasian otters although studies with the sea otter (*Enhydra lutris*) show that they have much lower sensitivity underwater

than pinnipeds, with critical ratios at 10dB higher than pinnipeds, demonstrating that they are primarily adapted to hearing airborne sounds (Ghoul & Reichmuth, 2014). There is also a risk of injury to any of the twelve considered species due to collision with survey vessels.

Therefore, the geophysical survey equipment proposed (SBP) has the potential to be detected by some of the Annex IV species, with the potential for Temporary Threshold Shift onset in individuals in close proximity to the sound sources. It could therefore cause localised short-term behavioural impacts such as temporary avoidance. However, injury effects are not predicted, as an animal would need to remain in the very small zone of ensonification for a prolonged period, which is highly unlikely (JNCC *et al.*, 2010; JNCC, 2020). There is evidence by Thomson *et al.* (2013) that suggests that short-term disturbance by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises.

Geotechnical drilling and shipping noise are categorised as a non-impulsive, non-pulsed, or continuous noise source. Although the frequencies proposed fall within the hearing ranges of marine mammals and leatherback turtle (shipping only) occurring within the vicinity of the proposed works, their most likely response will be temporary behavioural avoidance.

Corroborating this is the study by Nedwell and Brooker (2008), who took a series of measurements of the underwater noise during underwater pin pile drilling operations as part of the installation of the SeaGen tidal turbine device in Strangford Lough, Northern Ireland. These recordings were made at ranges of 28 m to 2.13 km from the drilling operation and indicated a source SPL of 162 dB re 1 μ Pa @ 1 m, which is comparable to the proposed geotechnical survey work (see Table 4-3). The recordings also indicated that the perceived noise levels fall below background noise levels only a few hundred metres from the drilling operation.

Nedwell and Brooker (2008) assessed the likelihood of avoidance of the drilling noise using the dB_{ht} approach. The data indicated that the noise did not exceed the 90 dB_{ht} level (see Table 4-5) at any measured range. For harbour porpoise, the most sensitive to sound of all Annex IV Species likely to be present in the proposed survey area, the data indicated that perceived levels of background noise were generally higher than perceived levels of drilling noise, with drilling noise only occasionally increasing above minimum background noise levels. The most frequent level of perceived drilling noise was at 62 dB_{ht}(*Phocoena phocoena*), well below the threshold for significant avoidance reaction.

As such, Annex IV Species are considered unlikely to be disturbed by noise from drilling and therefore, comparable geotechnical survey activities such as boring and coring, unless they are in the close vicinity of the site investigations. Disturbance by the noise from the geotechnical site investigations is unlikely due to small-scale temporary displacement which is likely to occur as a result of the presence of the survey vessel itself.

There is also a risk of injury to any of the considered species due to collision with survey vessels. However, these vessels will be moving at slow speeds, in a predefined trajectory, while engaged in the survey activities, allowing for animals to predict movement of the vessels and avoid collisions. During transit times, the survey vessels will be travelling at speeds greater than 5 knots. However, these movements are not considered to deviate from normal vessel traffic in the Foreshore Licence Application Area. Annex IV species in the area are exposed to marine traffic on a regular basis and should therefore be accustomed to vessel movements. The small number of vessels that will be

required for these surveys will not significantly increase vessel traffic in the area. Accordingly, it is predicted that collisions between survey vessels and Annex IV species are extremely unlikely and there is no risk of significant effects to any of the species considered.

Furthermore, it is considered that standard mitigation measures, as detailed in the DAHG (2014) guidance, such as pre-works survey and soft start, will prevent individual animals from suffering physical or auditory injury. Protection measures proposed in relation to these surveys are outlined in the section 0 below.

6 Protection measures to prevent harm to Annex IV species

In line with Irish best practice guidelines 'Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters' from DAHG (2014) which are now being incorporated into the standard operating procedures of all noise emitting surveys in Irish waters, the measures detailed below will be applied to where possible prevent and if not reduce injury and disturbance to Annex IV species during all noise emitting site investigation activities. While these are not specifically aimed at leatherback turtle, the mitigation proposed for cetacean species, in particular the soft-start procedure, will also be relevant to these species.

Disturbance to any of the species considered in this report will be of a temporary nature. As previously stated, all geophysical surveys will adhere to international best practice, including the protocol 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' (DAHG, 2014) which will be followed at all times. This protocol is considered sufficient by the competent authority (NPWS) to mitigate for disturbance to marine mammal species. Again, while the protocol is not aimed at Leatherback turtle, they are known to have a small maximum sensitivity range for sound detection (100 - 400 Hz in water) (Piniak *et al*, 2012) and, as the protocol is sufficient to address disturbance to the most sensitive of marine mammal species, it can also be considered sufficient to address disturbance to Leatherback turtle.

In addition, the proposed works will be short in duration and of a temporary nature and survey vessels will be slow moving (c. 5 knots) while engaged in the survey activities, therefore any risk due to collision is unlikely.

6.1 Marine mammal monitoring

A qualified and experienced Marine Mammal Observer (MMO) will be appointed to monitor for marine mammals and to log all relevant events using standardised data forms provided by the DAHG. During daylight hours the MMO(s) will carry out visual observations to monitor for the presence of cetaceans before the soft-start commences and will recommend delays in the commencement of the site investigations should any species be detected within the relevant monitored zone as per the DAHG 2014 guidance (see below).

6.2 Pre-start monitoring

Visual (MMO) will be conducted for a pre-soft-start search of 30 minutes i.e. prior to the commencement of marine operations (MBES, SSS, sub-bottom profiling, geotechnical seabed sampling). This will involve a visual observation (during daylight hours) to determine if any cetaceans are within the relevant zone of the activities as per the DAHG 2014 Guidance.

6.3 Monitored zone

Should any Annex IV species be detected within a radial distance of the relevant zone of the survey vessel (as per the DAHG 2014 Guidance), commencement of site investigation activities will be delayed until their passage, or the transit of the vessel, results in the cetaceans being of sufficient distance

from the vessel to satisfy the DAHG 2014 Guidance. In both cases, there will be a 30-minute delay from the time of the last sighting within the relevant zone of the survey vessel (as per the DAHG 2014 Guidance) to the commencement / recommencement of the operations. The MMO will use a distance measuring stick or reticule binoculars to ascertain distances to Annex IV Species. Note: once started, site investigations will not cease should cetaceans approach the survey vessel.

6.4 Soft start

A soft start is the gradual ramping of power over a set period of time, to give any Annex IV species adequate time to leave the area.

Once the soft start commences, there is no requirement to halt or discontinue the procedure at night-time, if weather or visibility conditions deteriorate, or if Annex IV species enter the monitored zone (as per the NPWS 2014 Guidance for monitored zones – activity dependent).

In commencing a seismic survey operation, including any testing of seismic sound sources, where the output peak sound pressure level exceeds 170 dB re: 1µPa @1m, the following ramp up procedure will be undertaken in line with the DAHG (2014) guidance:

- a) Energy output will commence from a low energy start-up and be allowed to gradually build up to the necessary maximum output over a period of 20-40 minutes (the exact time period will be dependent on survey parameters and equipment and will be designed in consultation with an experienced marine ecologist).
- b) This controlled build-up of energy output will occur in consistent stages to provide a steady and gradual increase over the ramp-up period.
- c) If marine mammals enter or are detected within the monitored zone while the ramp-up procedure is under way but incomplete, the energy output will not be increased until the marine mammals are no longer within the monitored zone.

6.5 Line changes

Where the duration of a survey line or station change is greater than 40 minutes, the activity will, on completion of the line/station being surveyed, either cease (i.e., shut down) or preferably undergo a reduction in energy output to a lower state where the peak sound pressure level from any operating source is ≤ 170 dB re 1 µPa @ 1 m. Prior to the start of the next line/station, if the power was shut down, all pre-survey monitoring measures and soft start procedures will be followed as for start-up. If there has been a reduction in power, a soft start will be undertaken gradually from the lower output level. The latter sound reduction measure will be applied to line changes at night-time or in daytime conditions of poor visibility. Where the duration of a survey line/station change is less than 40 minutes the activity will continue as normal (i.e. under full output).

6.6 Breaks in survey periods

If there is a break in sound output from survey equipment for a period greater than 10 minutes (e.g., due to equipment failure, shut-down, survey line/station change) then all pre-start monitoring measures and ramp-up procedures will recommence prior to re-starting.

6.7 Reporting

All recordings of Annex IV species will be made using standardised data forms provided by the NPWS. Full reporting on operations and mitigation will be provided to the NPWS to facilitate reporting under Article 17 of the EC Habitats Directive and future improvements to guidance (DAHG, 2014). The report will also include feedback on how successful the measures were. This requirement will be communicated to the MMOs at project start up meetings and at crew change.

6.8 Survey vessels speed and course

The project survey vessels will be moving at a maximum speed of approximately 5 knots during surveys to allow Annex IV species to move away from the vessel should they be disturbed by the vessel presence or noise emissions. During transit times, the survey vessels will be travelling at speeds greater than 5 knots. However, these movements are not considered to deviate from normal vessel traffic in the Foreshore Licence Application Area. Should an Annex IV species be found to be in the direct path of a survey vessel, during or outside of survey times, the survey vessel will slow down or, if possible, alter course to avoid collision.

7 Conclusion

The proposed activities will be short in duration and of a temporary nature and compliant with DAHG (2014) (Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters) which will ensure that the proposed site investigation activities will not have a significant effect on the species considered in this report. In addition, the survey vessels will be slow moving (c. 5 knots) and therefore any risk due to collision is unlikely.

These measures ensure that the species listed in section 3 whose range overlaps the Foreshore Licence Application Area will not be significantly affected by the activities proposed under this application for a Foreshore Licence.

Therefore, it can be concluded that the proposed site investigation activities will not result in the committing of any offence under Article 12 of the Habitats Directive towards any of the species listed in Annex IV of the Habitats Directive that are likely to occur within the site and have been considered in this report.

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