Annex IV Risk Assessment

Maritime Usage Licence Application MUL230034

Document Number:

CWP-CWP-CON-02-01-09-ASM-0002

Document Classification
Not Confidential

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Record of Revisions

Issue	Document Date	Purpose of Revision
R00	10/04/2024	Outline draft for review
R01	29/04/2024	First draft for review
R02	17/05/2024	Second draft for review
R03	22/05/2024	Third draft for review
R04	24/05/2024	Final Issue

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ABBREVIATIONS

Abbreviation	Term
ADCP	Acoustic Doppler Current Profiler
BOEM	Bureau of Ocean Energy Management
CPT	Cone Penetration Test
CWP	Codling Wind Park
CWPL	Codling Wind Park Limited
DAHG	Department of Arts, Heritage, and the Gaeltacht
dB	decibel (sound pressure)
DDV	Drop Down Video
DHLGH	Department of Housing, Local Government and Heritage
ECC	export cable corridor
EEZ	Economic Exclusion Zone
EDR	Effective Deterrence Range
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environment Protection Agency
EPS	European Protected Species
FCS	Favourable Conservation Status
FLS	Floating LiDAR System
F-POD	full waveform capture-POD
HF	high frequency
Hz	hertz (frequency)
IAMMWG	Inter-Agency Marine Mammal Working Group
JNCC	Joint Nature Conservation Committee
kg	Kilogram (weight)
kHz	kilohertz (frequency)
km	kilometre (distance)
km^2	kilometre squared (area)

Abbreviation	Term
LF	low frequency
m	metre (distance)
m^2	metre squared (area)
mm	millimetre (distance)
MARA	Maritime Area Regulatory Authority
MBES	multibeam echosounder
MMMZ	marine mammal mitigation zone
MSFD	Marine Strategy Framework Directive
MWHS	mean high water springs
MU	management unit
MULA	Maritime Usage Licence Application
NIS	Natura Impact Statement
nm	nautical mile (distance)
NMS	National Monuments Service
NMPF	National Marine Planning Framework
NPWS	National Parks and Wildlife Service
OMB	operation and maintenance base
PAM	Passive Acoustic Modelling
PCW	phocids in water
PSSL	'P-S Suspension' Logging
PTS	Remanent Threshold Shift
SAC	Special Areas of Conservation
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SCPT	Seismic Cone Penetration Test
SEL	Sound Exposure Level
SBP	Sub-bottom Profiler
SPL	Sound Pressure Level
SSS	Sidescan Sonar
TTS	Temporary Threshold Shift

Abbreviation	Term
UK	United Kingdom
USBL	Ultra-short baseline
UHRS	Ultra-High Resolution Seismic
UXO	unexploded ordnance
VHF	very high frequency
ZoI	Zone of Influence

DEFINITIONS

Term	Definition
Annex IV Risk Assessment	Information provided to the competent authority to inform a risk assessment for Annex IV species under Article 12 of the Habitats Directive (92.43/EEC)
Array Area	The part of an Offshore Wind Farm which commonly includes wind turbines and their foundations, and internal electrical cabling and offshore substation. The current CWP array area is illustrated on Figure 2-1.
Cetacean	Collective term describing whales, dolphins and porpoises
Codling Wind Park (CWP)	Codling Wind Park is the name of the proposed Offshore Wind Farm being development by Codling Wind Park Limited. It encapsulates the area covered by the Foreshore Lease granted for the original Codling Wind Park in 2005, and the Foreshore Lease Application for Codling Wind Park Extension.
Environmental Impact Assessment (EIA)	A systematic means of assessing a development projects likely significant environmental effects undertaken in accordance with the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.
Licence Application Area	The area subject to the Marine Usage Licence Application under the Maritime Area Planning Act 2021.
Maritime Area Regulatory Authority (MARA)	MARA is a body under the aegis of the Department of Housing, Local Government and Heritage, whose functions are set out in the Maritime Area Planning Act 2021. MARA are responsible for managing the existing foreshore consent portfolio and processing Maritime Usage Licences (MUL) and Maritime Area Consents (MACs).
Maritime Usage Licence (MUL)	Licences granted under the MAP Act 2021 for a number of a number of marine based activities, including Marine Environmental surveys for the purposes of scientific discovery and site investigations.
National Parks and Wildlife Service	The National Parks and Wildlife Service manages the Irish State's nature conservation responsibilities. As well as managing the national parks, the activities of the NPWS include the designation and protection of Natural Heritage Areas, Special Areas of Conservation and Special Protection Areas.
Proposed Activities	All of the site investigations and baseline surveys the subject of the Maritime Usage Licence Application.
Receptor	Environmental component that may be affected, adversely or beneficially, by an impact.
Special Area of Conservation (SAC)	Areas of protected habitats and species as defined in the Habitats Directive.
Species	A group of interbreeding organisms that seldom or never interbreed with individuals in other such groups, under natural conditions; most species are made up of subspecies or populations.
Zone of Influence (ZoI)	Spatial extent of potential impacts resulting from a project or activity.

REFERENCE DOCUMENTS

1. 1270669 / CWP-CWP- CON-02-01-02-01-05-06-07-REP-0001, FILA Annex IV Risk Assessment, R03, 18/05/2023
2. CWP-CWP-CON-02-01-09-AM-0001, Supporting Information: Screening for Appropriate Assessment' document (SISAA)
3. CWP-CWP-CON-02-01-09-FRM-MULA Application Form
4. CWP-CWP-CON-02-01-09-REP-0001 Assessment of Impacts of the Maritime Usage (AIMU) Report

1 INTRODUCTION

1.1 Purpose of this report

Codling Wind Park (CWP) is a proposed offshore wind farm (OWF) in the Irish Sea, set in an area called Codling Bank, between approximately 13-22 kilometres (km) off the County Wicklow coast, between Greystones and Wicklow Town.

This report has been prepared on behalf of Codling Wind Park Limited (CWPL) in support of an application for a Maritime Usage Licence Application (MULA) to the Maritime Area Regulatory Authority (MARA) to carry out site investigation works and pre-construction monitoring surveys for the CWP project. The Licence Application Area (outlined in red on Figure 1-1) lies off the east coast of Ireland and extends from the Poolbeg Peninsula, situated on the east side of Dublin City to Wicklow Town and is contained entirely within Ireland's National Marine Planning Framework (NMPF) Area and Irish Exclusive Economic Zone (EEZ), both of which extend 320 km off the Irish coast. It covers approximately 477 km^2 encompassing the proposed array area, the proposed export cable corridor (ECC), the potential operation and maintenance base (OMB), the possible maritime reclamation area in an area known as Pigeon Park for an onshore substation location, and additional buffer zones.

Site investigation and baseline surveys, hereafter referred to as "Proposed Activities" (described in Section 2) are required to inform the detailed design of CWP OWF. The objective of the Proposed Activities is to understand the site conditions within the offshore and foreshore areas surrounding the proposed CWP OWF site including benthic characteristics, bathymetry, underlying geology, existing tidal conditions, and environmental characteristics.

The Proposed Activities will include:

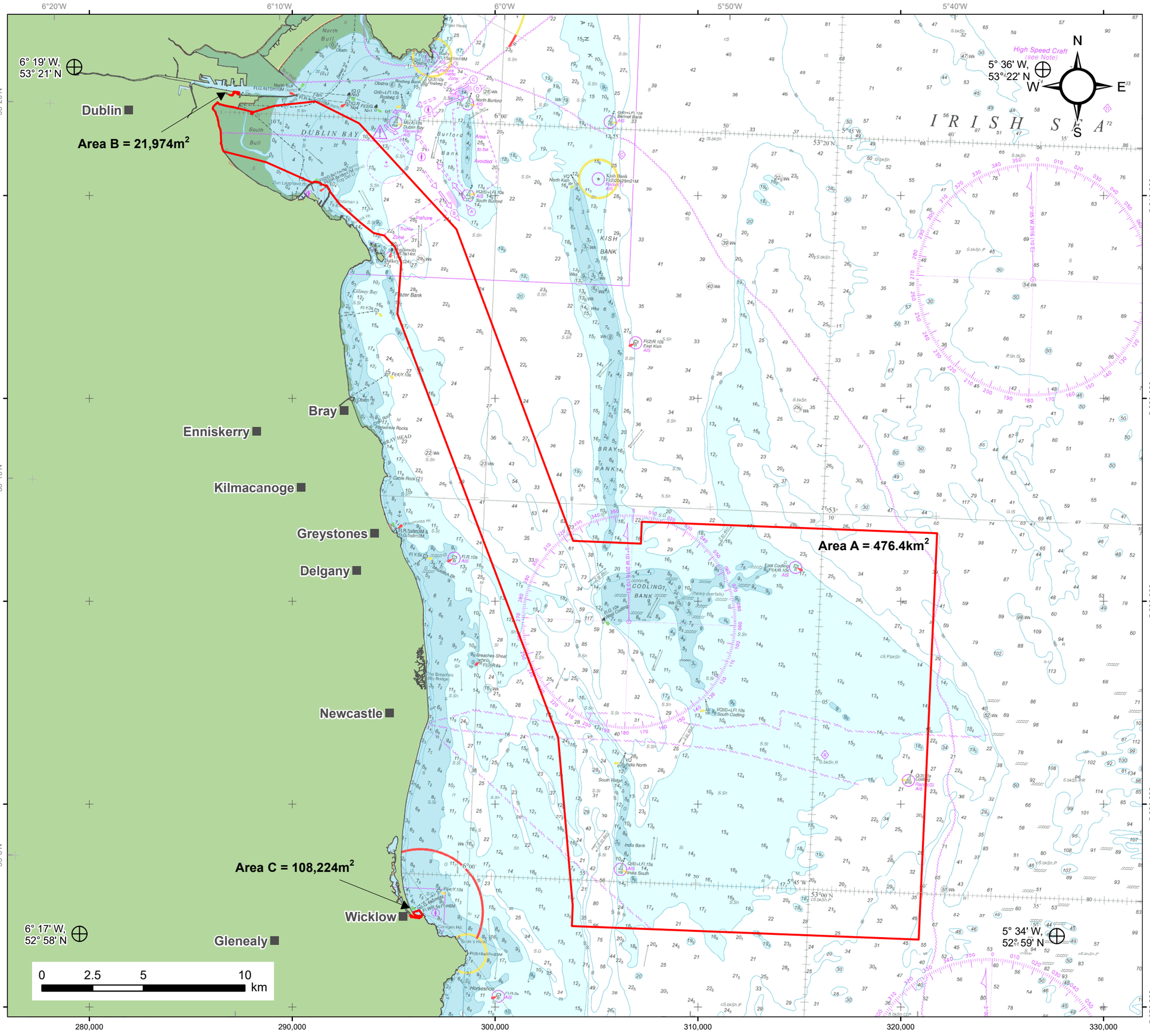
- Metocean and Floating LiDAR campaign
- Geophysical campaign and unexploded ordnance (UXO) surveys;
- Geotechnical campaign;
- Fish & Shellfish surveys;
- Benthic & Intertidal surveys;
- Marine Mammal Passive Acoustic Monitoring (PAM) survey; and
- Archaeological surveys.

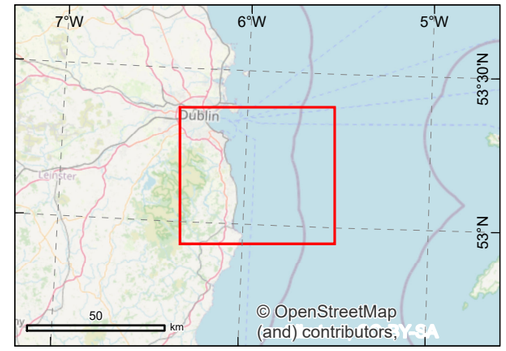
Full details of the Proposed Activities can be found in 'Assessment of Impact of the Maritime Usage (AIMU)' report which accompanies this application (CWP-CWP-CON-02-01-09-REP-0001).

CWPL has engaged GoBe Consultants Ltd. to conduct an Annex IV Species Risk Assessment for the Proposed Activities. Aspects of these Proposed Activities could potentially affect Annex IV species identified as having the potential to be present in the Licence Application Area (refer to Section 4). Article 12 of the Habitats Directive (92/42/EEC) lists all cetaceans (whales, dolphins, and porpoises), marine turtles, otters (*Lutra lutra*), and bats as Annex IV species. As Annex IV species are protected by law, any risk of impacts to such species because of the Proposed Activities must be assessed. Other species including pinnipeds (seals) and basking sharks (*Cetorhinus maximus*) are also included within this risk assessment as they are protected by law under the Wildlife Act, 1976 from killing and intentional or reckless disturbance. The potential for impacts on these species are mainly via the generation of underwater noise. Consequently, this Annex IV Species Risk Assessment has assessed the risk of impact from the activities associated with the proposed surveys and provides recommendations on mitigation measures if needed, and if a derogation licence is likely to be required.

This Annex IV Species Risk Assessment has been produced in accordance with the Department of Arts, Heritage, and the Gaeltacht (DAHG) 2014 'Guidance to manage the risk to marine mammals from man-made

sound sources in Irish Waters'. Furthermore, the Annex IV Species Risk Assessment also draws on the most recent relevant scientific publications and other guidance documents to inform the assessment and recommendations herein, as the DAHG (2014) guidance is in the process of being reviewed and updated.





Licence Area (CWP, 2024.05.20)

High Water Mark (TE, 2024.04.19)

codling wind park	*Project:* Codling Wind Park	*Contractor:* GoBe APEMGroup *Website:*
Map title: Fig 1.1: Maritime Usage Licence Application Area		
Codling doc. number: CWP-CWP-CON-02-01-09-MAP-1510		
Internal descriptive code: TBC	*Sheet size:* A3 *Scale:* 1:180,000	*CRS:* EPSG 25830

Rev.	Updates	Date	By	Chk'd	App'd
A	First issued	20/05/2024	BPHB	TT	NY

2 THE PROPOSED ACTIVITIES

2.1 Methodology

To inform the design phases for CWP, there is a need to carry out the Proposed Activities outlined in Table 2-1. Site-specific data are needed to provide additional geotechnical, geophysical, environmental, and metocean information. These data will be used to inform detailed design decisions about foundation type, sizing, and installation methodology, as well as cable routing, the methodology for laying and burying cables, cable landfall site selection, and to verify the validity of previously acquired data in light of the changing marine environment.

The geophysical survey data to be collected as part of the Proposed Activities will subsequently be analysed, the results of which will be used to inform the precise locations where the sampling/tests/deployments will take place (within the Licence Area). For this reason, it has been necessary to consider, and present, indicative locations within this document. This approach also allows for any site specific considerations (such as physical obstructions) to be avoided or taken into account at the time of carrying out the sampling/test. The assessment presented in this document has accounted for the survey/sample/deployment locations to be anywhere within the Licence Area, rather than at the indicative locations presented, and as such location changes within the Licence Area will not change the conclusions of this assessment.

Timing of the Proposed Activities is also indicative and dependent on many factors including weather, tidal flows, availability of vessels, ecology, and the granting of a licence. The granting of a licence will have a direct effect on the timing of the Proposed Activities. Indicative sampling, metocean and acoustic recording device locations are shown in Figure 2-1 and Figure 2-2.

This report identifies all necessary mitigation measures, including temporal and spatial restrictions, to ensure that no changes from the indicative locations and timings will cause an adverse effect on the integrity of any Natura 2000 site.

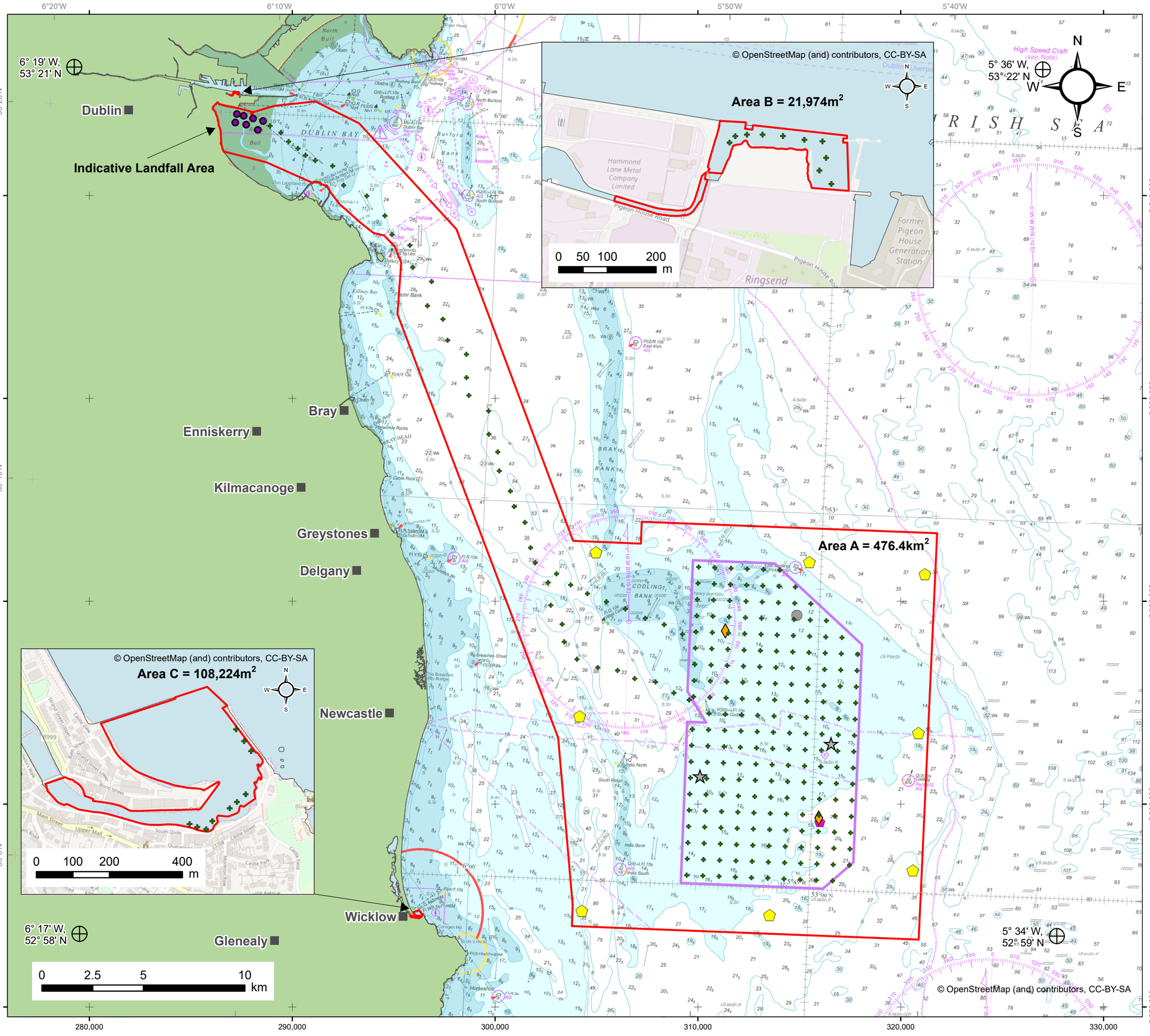
Table 2-1 Summary of Proposed Activities and Indicative Programme

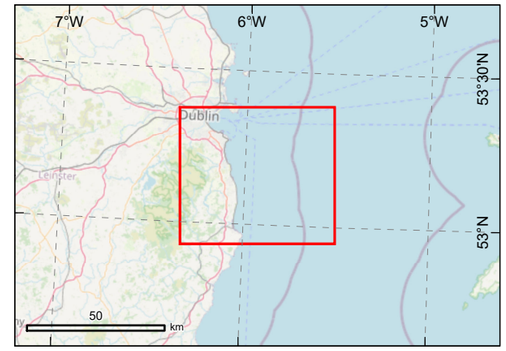
Activity	Proposed sample numbers / locations	Indicative timings
Metocean surveys	**Floating LIDAR system (FLS)** • Up to two devices to be deployed at any one time for up to 36 months deployment (indicative locations are shown in Figure 2-1. **Wave Buoys or MetOcean Buoys** • Up to two wave or MetOcean buoys located within the array area or along the export cable route. Predicted to use a clump weight anchors or drag anchors. Mooring can be single point or two-point mooring for systems. Buoys up to approximately 3 m diameter. **Acoustic Doppler Current Profilers (ADCPs)** • Up to two ADCPs placed on the seabed located within the array area or along the proposed export cable corridor (ECC).	Fixed 12 to 36 months period including the need for site access for data collection and servicing as required.
Geotechnical surveys	Indicatively 271 proposed survey locations have been identified across the Licence Area (including the Array Area, ECC, OMB and potential onshore substation location) which may require the use of	Two to eight months per mobilisation.

	boreholes, co-located Cone Penetration Tests (CPTs), and vibrocores (VCs), and may require multiple mobilisations. Trial pits will be used at the intertidal landfall area. The test locations are yet to be determined and will be informed by prior surveys, detailed engineering, and project design. Indicative locations for geotechnical tests within the Licence Area are provided in Figure 2-1. **Array Area** A conservative approach has been adopted which considers a maximum of 203 geotechnical survey locations consisting of up to 125 boreholes and up to 78 co-located CPTs and VCs. These are maximum figures (please refer to Figure 2-1). The most likely numbers of geotechnical survey locations will be significantly lower. (ie likely 60 or 75 boreholes to correspond with wind turbine generator (WTG) layouts with 78 co-located CPTs/VCs) Borehole indicative depths: 50 m. The maximum casing diameter of a borehole is typically 508mm. The diameter of sample recovered is approximately 105mm. Therefore, the maximum seabed penetration footprint from the boreholes, within the proposed array area is circa 25 m^2. CPT and VC indicative depths: 6 m. CPT penetration cone is approximately 50 mm in diameter housed within a seabed frame with a footprint of between 8-10m2. With a maximum of 78 locations, the maximum seabed penetration footprint over the proposed array area is less than 2 m^2 for the CPTs. Vibrocore typically has an outer diameter of 100-120mm, with an expected sample recovery of 96mm. With a maximum of 78 locations, the maximum seabed penetration footprint over the proposed array area is less than 2 m^2. **Export cable corridor and intertidal landfall area** A conservative approach has been adopted which considers a maximum of 48 geotechnical survey locations in the ECC. Indicative depths: 6 m with few extending to 12 m close to the proposed intertidal landfall area. Diameter of casings and recovered samples for BHs and VCs and CPTs within the ECC are the same specifications as for the array area. Seven trial pits at the proposed intertidal landfall area. Indicative sampling duration is < 12 hours. **Potential Operation and Maintenance Base (OMB)** Ten boreholes and ten CPTs. Borehole indicative depths: 6 m. CPT and VC indicative depths: 6 m. Indicative locations are shown in Figure 2-1. **Potential Onshore Substation Location** Ten boreholes and ten CPTs. Borehole indicative depths: 12 m. CPT and VC indicative depths: 6 m. Indicative locations are shown in Figure 2-1.	

Geophysical and unexploded ordnance (UXO) surveys	**Array Area** Surveys across the proposed array area to assess ground conditions and to identify possible UXOs. Techniques include Multibeam echosounder (MBES), side scan sonar (SSS), and a gradiometer system using several magnetometers, a sub bottom profiler, and multichannel high-resolution acoustic seismic surveys i.e., sparkers. Ultra Short Base Line (USBL), an underwater acoustic positioning system will be used for towed equipment. **Export cable corridor & OMB** Surveys across ECC and OMB to assess ground conditions and to identify possible UXOs. Techniques include MBES, SSS, and a gradiometer system using several magnetometers, a sub bottom profiler, and multichannel high-resolution acoustic seismic surveys i.e., sparkers. USBL will be used for towed equipment. **Potential onshore substation location** Surveys in Pigeon Park to assess ground conditions. Techniques include MBES, SSS, and a gradiometer system using several magnetometers, a sub bottom profiler, and multichannel high-resolution acoustic seismic surveys i.e., sparkers.	Two to eight months per mobilisation.
Fish & shellfish surveys	**Potting survey** Surveys will be designed to undertake investigative sampling. Indicatively may include ten locations for potting and trawl surveys within the proposed array area and/or along the proposed ECC and may be required at the potential OMB. Approximate duration of survey is three days. Indicative sampling duration is 24 hours per station. **Trawl survey** Surveys will be designed to undertake investigative sampling. Indicatively may include ten locations for potting and trawl surveys within the proposed array area and/or along the proposed ECC and may be required at the potential OMB. Indicative duration of survey is three days. Indicative sampling duration is one hour per station.	Periodically taking place over the following five year period. Potting surveys may be repeated up to quarterly; trawl survey sampling will occur no more than quarterly every annum. In total potting and trawl surveys will take approximately 4 weeks per year.
Benthic & intertidal surveys	**Benthic sampling** Benthic sampling will occur up to two times annually. Indicative duration of survey is five days (likely using a 0.1 m^2 mini Hamon grab, Day grab, or a Van-Veen grab). Up to 60 across the proposed array area. Up to 20 reference sites (see Figure 2-2 for indicative locations).	Periodically taking place over the following 5-year period. The survey duration will be approximately 3 weeks per year.

	Up to 20 along the proposed ECC up to mean high water springs (MHWS). Up to 10 around Wicklow Harbour for the potential OMB. Drop down videos (DDVs) may also be deployed at the same locations as the grab samples. Indicative locations are shown in Figure 2-2**.** Indicative sampling duration is < one hour per station. Note – grabs may be required to inform a potential Dumping at Sea Permit application. **Ecological intertidal walkover** survey One at the proposed intertidal landfall area per year. 10 samples (sediment and fauna) at the proposed intertidal landfall area. Indicative sampling duration is < one hour per station. **Epibenthic Trawls** Indicative 30 locations within proposed array area and/or along the proposed ECC. Single survey to establish baseline, and possibly repeated over several mobilisations Indicative duration of survey is two days. Indicative sampling duration is one hour per station.	
Marine mammal acoustics	**Echolocation click detectors (PODs) and potentially broadband sound recorders.** A maximum of eight moorings equally dispersed outside of the array area boundary, but within the Licenced Area. Indicative locations are shown in Figure 2-1.	Fixed 12 to 36 month period including the need for site access for data collection and servicing as required.
Intertidal archaeological walkover survey	Metal detector survey for archaeology at the proposed intertidal landfall area. Walkover at the proposed intertidal landfall area for archaeological features of interest.	Periodically taking place over the following 5-year period. Approximately 1 week per year.



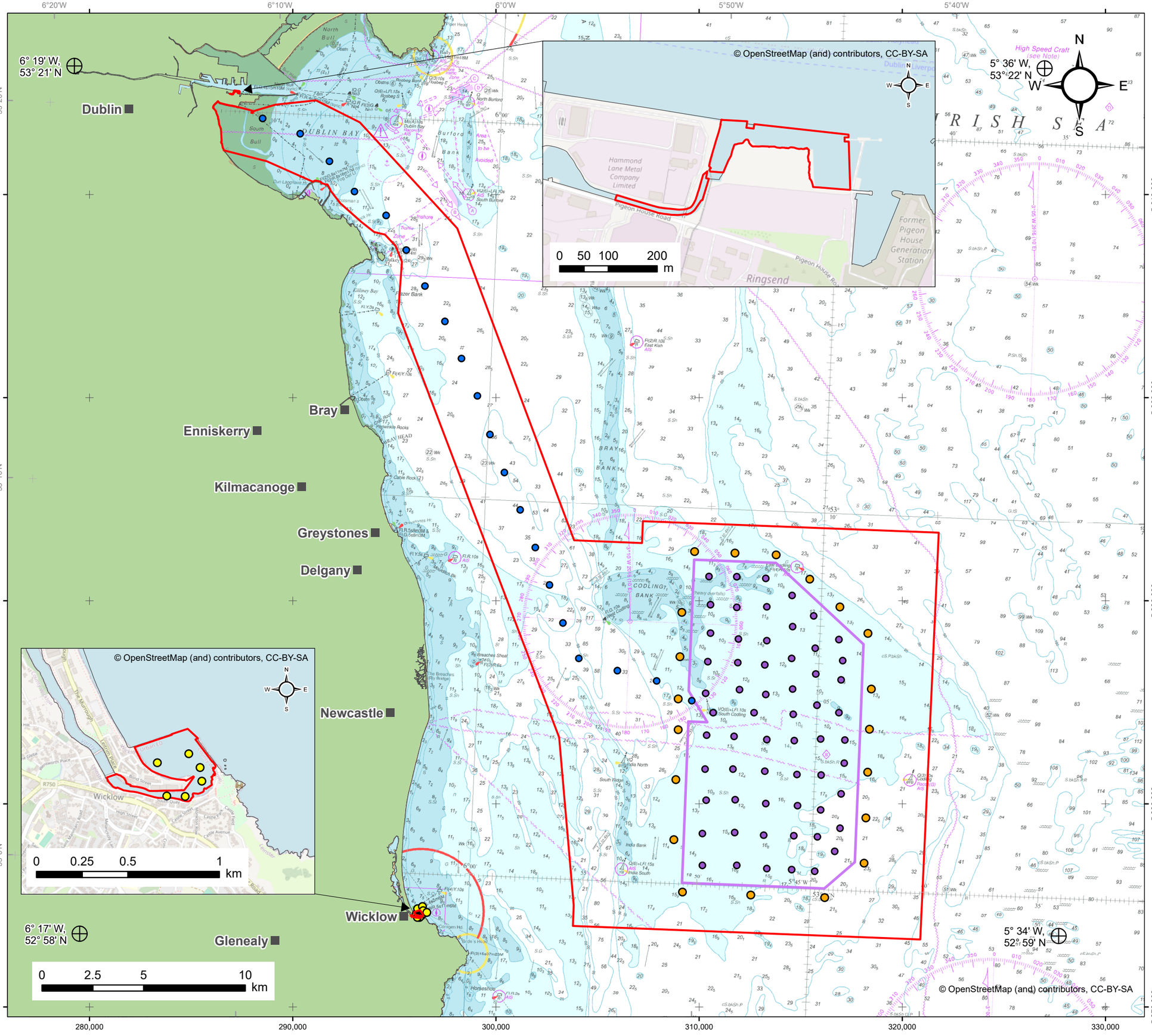


- Licence Area (CWP, 2024.05.20)
- Codling Wind Park Array Area (CWP, 2024.03.05)
- High Water Mark (TE, 2024.04.19)
- Proposed Geotechnical Survey Locations
- Proposed Trial Pit Locations
- Marine Mammal Acoustic Monitoring
- LiDAR buoy
- Metocean buoy
- Seabed frame
- Wave buoy

A conservative approach has been adopted which considers a maximum of 203 geotechnnical survey locations. The likely number of geotechnical survey locations is lower.

codling wind park	*Project:* Codling Wind Park	*Contractor:* GoBe APEMGroup *Website:*
Map title: Fig 2.1: Licence Application Area and Proposed Activities		
Codling doc. number: CWP-CWP-CON-02-01-09-MAP-1513		
Internal descriptive code: TBC	*Sheet size:* A3 *Scale:* 1:180,000	*CRS:* EPSG 25830

Rev.	Updates	Date	By	Chk'd	App'd
A	First issued	24/05/2024	BPHB	TT	NY



codling wind park	*Project:* Codling Wind Park	*Contractor:* GoBe	*Website:* APEM Group

Map title: Fig 2.2: Benthic Sampling Stations

Codling doc. number: CWP-CWP-CON-02-01-09-MAP-1514

Internal descriptive code:	*Sheet size:* A3	*CRS:*
TBC	*Scale:* 1:180,000	EPSG 25830

Rev.	Updates	Date	By	Chk'd	App'd
A	First issued	20/05/2024	BPHB	TT	NY

2.1.1 Metocean

The metocean campaign across the Licence Application Area will comprise the deployment of:

- Up to two Floating LiDAR System (FLS) units for wind measurements, which is used to map the topography of the seabed;
- Acoustic Doppler Current Profilers (ADCPs) placed on the seabed for subsurface wave and current measurements, which are 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; or
- Waverider Buoys and MetOcean Buoys, used to measure wave data such as height and spread.

The operating frequency of any ADCP deployed will be >200 kHz (typically around 500 kHz for many models).

2.1.2 Geotechnical survey

The 271 geotechnical survey locations across the Licence Area campaign will comprise:

- Cone Penetration Testing (CPT), a method of mapping and testing soil profiles on the seabed;
- Boreholes, a method of collecting sample from the seabed;
- Vibrocores (VCs), a method of rapidly retrieving continuous, undisturbed core samples from unconsolidated and semi-consolidated sediments; and
- Trial pits, a method of intrusive ground investigation for determining the condition and composition of the sediment. An estimation of seven trial pits to be used at the proposed intertidal landfall area for a duration of < 12 hrs.

Within the array area, there will be a maximum of 203 geotechnical locations consisting of up to 125 Boreholes and up to 78 co-located CPTs and VCs. These are maximum figures (please refer to Figure 2-1). The most likely numbers will be significantly lower (ie 60 or 75 boreholes to correspond with WTG layouts and 78 co-located CPTs/VCs). Along the ECC and intertidal landfall area there will be a maximum of 48 geotechnical locations, whilst there will be a maximum of 10 co-located boreholes and CPTs at both the potential OMB, and the potential Onshore Substation Location.

The aims of the geotechnical survey are to determine soil bearing capacity, increase confidence in modelled data collected from the geophysical survey, and assist in engineering the design layout of the turbines.

The number and location of the proposed geotechnical activities (Table 2-1) are indicative and will be informed by other work streams including geophysical survey campaigns. The maximum number of survey locations has been considered in this assessment to ensure that any risk to Annex IV species has been fully assessed.

In order to undertake these Proposed Activities, a maximum of eight to fifteen vessels will be mobilised at any one time with a suite of survey equipment andc devices within the Licence Area. Vessels for geophysical surveys are generally between 10-60 m in length and are also suitable for environmental surveys. For deeper water and geotechnical surveys, larger 55-90 m vessels may be required. For borehole operations, jack-up barges may be used in order to maintain position. The exact vessel types will be defined after the tender process has been completed.

With respect to underwater noise, as the equipment for the geotechnical surveys has yet to be determined, frequency ranges and source pressure level have been collated from a variety of different sources and are considered to be the worst-case (Table 2-2).

Table 2-2 Indications of proposed geotechnical survey equipment noise levels

Method / equipment	SPL_{peak} (dB re 1 µPa at 1 m)	Frequency (Hz)
Borehole[1]	148 – 151	120
CPT / seismic CPT	124 – 172	28
Vibrocore	194	50

The noise produced by different geotechnical methods can vary greatly in relation to the method used and the substrate being sampled. However, geotechnical survey equipment typically produce non-impulsive sounds, which are broadly regarded as a lower risk to marine wildlife, as compared to impulsive sound sources (see Section 7.2.2 for more information). For instance, BOEM (2012) provided a frequency of 120 Hz and a maximum Sound Pressure Level (SPL) of 145 dB re 1µPa @1m for borehole surveys. Campanella *et al*. (1986) gave an operating frequency of CPT of 28 Hz. In addition, geotechnical surveys typically have a small footprint (typical sample location 3 x 3 m) and are short in duration (generally no more than a few hours per location depending on conditions encountered).

2.1.3 Geophysical survey

The geophysical surveys across the Licence Area will comprise of the following:

- Multibeam Echosounders (MBES), which is used to provide detailed bathymetric mapping of the seabed;
- Sidescan Sonar (SSS), which is used to image the surface of the seabed for the detection of objects or structures;
- Sub-bottom Profiling (SBP)/Ultra-High resolution seismic (UHRS), which is used to produce a 2D image of the sub seabed geology;
- Marine Magnetometry/Gradiometer, used to locate and identify ferrous objects on or buried in the seabed; and
- Remotely Operated Vehicle (ROV), which is used to inspect certain areas of the proposed ECC or areas where there are features of interest within the proposed array area. An Ultra Short Base Line (USBL) system may be used to communicate the ROV's position relative to the vessel.

The aims of the geophysical survey are to deliver mapped features including water depths, the seabed sediments and sub-seabed lithology distribution, and topographical and geological features that could impact on the successful installation of the wind turbines and burying of the cable such as wrecks, UXOs, boulders, areas of sensitive benthic habitats such as Annex I reef, exposed bedrock, debris and areas of uneven seabed such as sandwaves.

The proposed geophysical survey equipment involved, and the indicative underwater noise levels (SPL_{peak} and operating frequencies) associated with the equipment are outlined in Table 2-3. The geophysical survey will cover the full extent of the array area, and approximately 500 m buffer zone (fully covered in the Licence Application Area). The potential export cable corridors will also be surveyed using a 500 m wide survey corridor but may be exceeded in isolated locations. This survey buffer zone allows for additional information on the seabed surrounding the potential installation areas to allow for a contingency plan if an area of seabed is found

[1] Borehole work may include 'down P/check-shot' and / or 'P-S Suspension' Logging (PSSL). Sound produced during check-shot logging is greater than that produced during PSSL. The source level of the check-shot logging equipment is comparable to that of the UHRS sparker (210 – 227 dB re 1 µPa @ 1 m) and is therefore assessed in the geophysical survey and positioning equipment section.

to be unsuitable for installation. Geophysical survey equipment is typically an impulsive sound source, one exception to this is magnetometers, which are a completely passive device, meaning they do not produce any sound while in operation.

Table 2-3 Geophysical survey equipment

Equipment type	SPL_{peak} (dB re 1 µPa at 1 m)	Frequency (kHz)
Multibeam Echo Sounder (MBES)	210 – 229	200 – 450
Side Scan Sonar (SSS)	115 – 230	> 200
Magnetometer(s) / gradiometer	No sound emitted	No sound emitted
Single channel Sub-Bottom Profiler (SBP) – chirp / pinger	208 – 225	0.2 – 16
Ultra-High Resolution Seismic (UHRS) – boomer / sparker[2]	210 – 227	0.2 – 16
Ultra-Short Base Line (USBL)	193 – 207	18 – 55

2.1.4 Fish and Shellfish Survey

Fish surveys may be undertaken to provide information on fish species distribution within the Licence Application Area (Table 2-1).

Examples of possible surveys are as follows:

- Potting survey, comprising fleets of pots (e.g. lobster pots) comparable with those used by local fishermen will be set over the Licence Area; and
- Trawl survey, the trawl survey would use comparable gear to that used locally. The sampling will occur no more than quarterly throughout the year. An estimated 10 locations for potting and trawl surveys within the proposed array area and/or along the proposed ECC and may be required at the potential OMB.

Indicatively, ten locations for potting and trawl surveys within the array area and / or along potential export cable corridors will be undertaken over three days. Indicative sampling duration is 24 hours per potting station, and one hour per trawl station.

2.1.5 Benthic and Intertidal Survey

The benthic survey will inform CWPL as to the nature and characteristics of the benthic habitats within the Licence Application Area. The benthic survey will be designed using analysis of geophysical survey data which will be reviewed to stratify sampling according to habitat types.

Survey techniques are likely to include (see Table 2-1 for further details):

- Deployment of a 0.1 m^2 mini Hamon grab, Day grab or a Van-Veen grab;

[2] Includes the geophysical survey technique down P/check-shot' and / or 'P-S Suspension' Logging (PSSL) used during geotechnical surveys.

- DDVs may also be deployed at the same locations as the grab samples, at stations where sensitive habitats or hard substrate may be found;
- Epibenthic Beam Trawls (if required following geophysical and DDV results); and
- Ecological intertidal walkover survey.

2.1.6 Marine Mammal PAM surveys

PAM may be conducted to determine baseline levels of whale, dolphin and / or porpoise occurrence, and / or to collect data on background noise levels. Echolocation click detectors (e.g. PODs) can be used to collect data on the dolphin and porpoise clicks, whereas broadband sound recorders can be used to collect data on dolphins and whales, and background noise levels. The same mooring arrangements and deployment techniques can be used for either device (Table 2-1).

PAM is a completely passive survey method, i.e. it does not produce any sound for monitoring purposes. These devices can be left on site for months at a time and can continue to monitor the site throughout the hours of darkness or periods of inclement weather when other survey techniques (e.g. visual boat-based surveys or digital aerial surveys) are less effective.

2.1.7 Archaeological Surveys

The archaeological surveys will be confirmed through the CWPL tendering process in consultation with the National Monuments Service (NMS); however, it is proposed that two survey methods are utilised across the Licence Application Area:

- Intertidal walkover survey, which is used to survey and record visible archaeological remains within the intertidal zone; and
- Metal detection survey, which is used to detect metallic objects that may be buried below the surface layers of the intertidal zone. A Detection Device Survey Licence will be applied for from the NMS prior to the surveys being undertaken.

The geophysical survey techniques can also be used to initially identify underwater objects or features of possible archaeological significance.

2.1.8 Timing and Duration of Activity

As part of the Proposed Activities, two forms of site investigation survey are proposed: remote sensing activities (e.g. geophysical survey) which typically do not contact the seabed, and direct sampling activities (e.g. geotechnical survey) which will directly interact with the seabed. The geophysical survey data to be collected as part of the Proposed Activities will subsequently be analysed, the results of which will be used to inform the precise locations for direct sampling activities within the Licence Area.

Therefore, the Proposed Activities will not take place across the entire Licence Application Area at the same time. It is anticipated that the Proposed Activities will take less than the indicative timings provided in Table 2-1, or in any case it is expected that the surveys will not be undertaken over the entirety of the proposed licence duration.

The boundary of the Licence Application Area is defined by the co-ordinates presented in ‘Co-ordinates of the Licence Area’ table contained within Table C, Appendix C of the SISSA document (CWP-CWP-CON-02-01-09-ASM-0001) and within Table L, Appendix A of the AIMU document (CWP-CWP-CON-02-01-09-REP-0001).The exact timing and duration of the surveys are yet to be determined but this assessment considers all seasons

and, where seasonal variation relevant to critical life-history stages of an Annex IV species is known, the worst-case scenario is assessed. Total survey duration for the geophysical and geotechnical surveys is approximately two to eight months per campaign; however, it is anticipated that the duration will be shorter.

Once the metocean equipment is deployed (ADCP, wave buoys and floating LiDAR buoy) they will remain in place for a fixed period (between 12 to 36 months) with servicing anticipated every three months. The other environmental / ecological surveys are planned to be spread out over the five-year period for which this MUL is proposed. It is currently unknown whether the surveys will be occurring simultaneously therefore an assessment of impact interactions has been carried out. Impact interactions are considered herein as there is the possibility for the interaction of potential impacts arising from the overlap of various elements of the Proposed Activities.

As each survey vessel will spend no more than a few days in any location, potential impacts and effects will be localised at any one time to a very small proportion of the total Licence Application Area. Equipment deployments (e.g. floating LiDAR) may be in place for longer periods; however their footprint is negligible in comparison to the overall Licence Application Area.

2.1.9 Proposed Survey Vessels

To undertake these Proposed Activities, a maximum number of 15 vessels at any one time will be mobilised with a suite of survey equipment and devices, this includes further extra tugs and support vessels, if required. Larger vessels will be used for offshore work (array area) and smaller vessels will be used closer to shore (export cable corridors). Typical vessels for geophysical surveys are generally between 10-60 m in length and are also suitable for fish / shellfish surveys, benthic surveys, and marine mammal acoustic monitoring (hereafter referred to as environmental surveys). For deeper water and geotechnical surveys larger 55-90 m vessels may be required. For borehole operations, jack-up barges may be used to enable them to maintain position. Jack-up barges typically consist of a self-elevating work platform and legs (normally four to eight) that are deployed onto the seabed to raise the work platform above the sea surface.

For the deployment of the metocean equipment, an anchor handling tug or similar vessel will be used. ADCP units will be deployed from a suitable vessel using a deck crane or winch. Wave or MetOcean buoys (with an optional incorporation of ADCP for the measurement of surface currents), will be deployed and recovered from a suitable vessel.

Marine mammal acoustic devices will initially need to be deployed using a suitable vessel with a deck crane to allow for the deployment of the mooring weights / chain (max 100 kg) along with the devices and marked buoys. The devices will be serviced every three months using an appropriate vessel with an A-Frame – a deck crane will not be required as the moorings do not need to be entirely lifted to complete the maintenance. When the full mooring is to be recovered a suitable vessel with a deck crane will be utilised.

Geophysical survey operations are normally conducted at a speed of approximately 3–4 knots with the sound source typically activated at 10-15 second intervals. For the geotechnical or environmental survey work the vessel will be stationary or moving at 1–2 knots during sampling, but otherwise moving at typical transit speeds of up to 8 knots.

The exact vessel types will be defined after the tender process has been completed.

3 LEGAL REQUIREMENTS

All species of cetacean, marine turtle, otter and bat in and around waters of Ireland and the United Kingdom (UK) are listed under the Annex IV of the Habitats Directive (Council Directive 92/43/EEC) which covers animal and plant species of community interest in need of strict protection, termed European Protected Species (EPS).

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), as amended.

Regulation 51 provides for the strict protection of Annex IV animals. The aim of the strict protection measures is that the species in question will reach and remain favourable conservation status (FCS). FCS is defined in the Habitats Directive as when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable element of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue be, a sufficiently large habitat to maintain its populations on a long-term basis.

It is an offence to do any of the following without first obtaining a derogation licence in accordance with Regulation 54:

a) Deliberately capture or kill any specimen of these species in the wild;
b) Deliberately disturb these species particularly during the period of breeding, rearing, hibernation and migration;
c) Deliberately take or destroy eggs of those species from the wild;
d) Deterioration, or destruction of a breeding site or resting place of such an animal; or
e) Keep, transport, sell, exchange, offer for sale 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.

Derogation licences for Annex IV species may be granted by MARA, which would allow otherwise illegal activities to go ahead, provided that:

- There is no satisfactory alternative.
- The action authorised will not be detrimental to the maintenance of the population of the species concerned at a FCS in their natural range.

The following guidance documents have been used when undertaking this risk assessment:

- Guidance on the Strict Protection of Certain Animal and Plant Species under the Habitats Directive in Ireland (NPWS, 2021)
- Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014)
- EU Commission's Guidance document on the strict protection of animal species of Community interest under the Habitats Directive (EU, 2021).

4 ANNEX IV SPECIES IN THE REGION OF THE PROJECT

This section provides a summary of the Annex IV species that are expected to be present in the Licence Application Area and reviews the available information that has been used to inform this Annex IV Risk Assessment for each of the receptor groups.

As all species of cetacean and marine turtle, bat and otter are Annex IV species protected by law, any risks of impacts to such species because of the Proposed Activities must be assessed. Aspects of these Proposed Activities could potentially affect Annex IV species identified as having the potential to be present in the Licence Application Area, as well as other protected species including pinnipeds (seals) and basking shark (*Cetorhinus maximus*).

Although basking sharks and pinnipeds are not Annex IV species, they have been included in this assessment as they are protected under the Wildlife Act, 1976, as amended, where it is an offence to hunt, injure or wilfully interfere with, disturb or destroy the resting or breeding place of a protected (listed) species in Irish territorial seas. Further legal protection of seals in Ireland is provided by the Habitats Directive where they are listed as an Annex II species whose conservation requires the designation of Special Areas of Conservation (SACs). Any proposed mitigation measures for the species included in this assessment will also be appropriate and / or relevant to seals and basking sharks, as well as any other species of cetacean, turtle and shark not taken forward in this assessment.

4.1 Cetaceans

More than 24 cetacean species have been recorded in Irish waters; however only five are regularly found in the Irish Sea. Of these, five species are thought to be present year-round, harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), and Risso's dolphin (*Grampus griseus*). Minke whales (*Balaenoptera acutorostrata*) are considered seasonal visitors with highest relative abundances in the western Irish Sea recorded in summer months (Berrow, 2001; NPWS, 2008; Wall *et al*., 2013). Killer whale (*Orcinus orca*), fin whale (*Balaenoptera physalus*), and humpback whale (*Megaptera novaeangliae*) also occur in the Irish Sea as seasonal / occasional visitors (NPWS, 2008; Ryan *et al*., 2015).

4.2 Marine Turtles

There have been five species of marine turtle recorded in UK and Irish waters, with most records being on the west and south coasts of Ireland (Botterell *et al*., 2020). Of these, the leatherback turtle (*Dermochelys coriacea*) is the only species that is considered resident, and sightings are concentrated off the southwest coast of Ireland (King and Berrow, 2009; Doyle *et al*., 2007).

4.3 Otters

The Eurasian otter (*Lutra lutra*) in Ireland is geographically widespread and is found within a diverse range of aquatic habitats. The adult population of otters is thought to be 12,000 to 15,000 individuals (Reid *et al*., 2013). Otters usually feed in shallow, sheltered waters within 100 m of the shore (Kruuk *et al*., 1998) and avoid deeper waters (Scottish Executive, 2007). Otters are particularly sensitive to disturbance in the vicinity of natal dens or holts, and they usually have multiple dens located up to 500 m from watercourses. Any changes to holts or dens may have a larger scale effect on otter populations.

4.4 Bats

Bats are often associated with the terrestrial environment but have been observed over the ocean and using coastal environments to forage (BSG Ecology, 2015). Solick and Newman (2021) reviewed studies assessing offshore bats records near California, USA that could potentially be impacted by the growing offshore wind developments. Highlighted bats utilising the marine environment were found to be long-distance migratory species that could suffer from increased exposure risk of collision.

Most bat species are widely distributed in Ireland. The most widespread species is the *Soprano pipistrelle* which has been found in most surveyed 10 km grid squares across the island. It is occasionally absent from coastal areas in the west. The second most widespread species is the common pipistrelle, although this species is more frequently absent from parts of the extreme north and northwest (Bats Conservation Ireland, 2024)

Other bat species are generally widespread, but more localised. Many species show a slight southern bias favouring warmer temperatures that are found in the south. The resident species with the most restricted distribution is the lesser horseshoe bat which is mainly found in Mayo, Galway, Clare, Limerick, Kerry and Cork. It has also been recorded in Sligo and Roscommon. The *Nathusius*' pipistrelle has the second most restricted distribution of the Irish bat species. Its stronghold is in Northern Ireland, particularly around Lough Neagh, although it has been recorded from many lake-land areas across the island (Bats Conservation Ireland, 2024).

4.5 Other (non-Annex IV) protected species

4.5.1 Pinnipeds

Two species of pinniped, the grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*), inhabit Irish waters year-round. Both are listed as species of Least Concern on the IUCN Red List (Bowen, 2016; Lowry, 2016). Harbour seals are present in the Irish sea; however, gaps in harbour seal distributions on the south and east coasts of Co. Wexford and Waterford have been observed in a 2003 population assessment (Cronin *et al*., 2004). High densities of grey seal occur on the east and southeast coasts of Ireland; however, densities are highest on the western coasts. Both species have established haul-out sites along all coastlines of Ireland for resting, breeding, and engaging in social activity (Cronin *et al*., 2004; Ó Cadhla *et al*.,2007).

The largest proportion of the grey seal population is hauled out ashore during the annual moult which begins in November and continues until April (Ó Cadhla and Strong, 2007). Grey seals also aggregate in large colonies during the breeding season between August and December (Ó Cadhla *et al*., 2013), with peak pup production during October and November (Lyons, 2004). Grey seals tend to breed on exposed rocky shores, on sandbars or in sea caves with ready access to deeper water.

Haul-out sites for harbour seals have tended historically to be found among inshore bays and islands, coves and estuaries (Cronin *et al*., 2007), particularly around the hours of lowest tide. Seasonal and critical life-history events are shown to influence haul-out behaviour, with a maximum time ashore occurring during the moult and post-moult season between July and October. The females give birth to their pups in June and July (Lyons, 2004).

The diet of grey and harbour seals in Irish coastal waters are broadly similar, with both species having a highly variable diet. Sandeels make up a large percentage of prey for both grey and harbour seals, with other prey species including salmonids, squid, dragonets and flatfish species (Hernandez-Milian *et al*., 2012). The majority of foraging trips for grey and harbour seals fall within 100 km and 50 km from a haul-out site, respectively (Carter *et al*., 2022, Cunningham *et al.* 2009; Cronin, 2010; SCOS, 2021).

4.5.2 Basking Sharks

Basking shark sightings in the Irish Sea and neighbouring regions predominantly occur at three 'hotspots' off the coast of the Isle of Man, southwest England, and northwest Scotland, with peak sightings from June to August (Witt *et al*., 2012). Therefore, the presence of this species appears to be seasonal, with peaks in abundance coinciding with peaks in zooplankton abundance which, as filter feeders, is their primary prey source (Sims and Quayle, 1998). Although the Licence Application Area is not within a 'hotspot' region, the wider Irish Sea is an area used by basking sharks and distribution may overlap with the Proposed Activities during summer and autumn months (Berrow and Heardman, 1994; Southall *et al*., 2005; Witt *et al*., 2012; Doherty *et al*., 2017). They are listed as Endangered on the IUCN Red List (Rigby *et al*., 2021). Their distribution patterns are relatively well studied around Ireland and the UK; however, there are no density or abundance estimates for populations of basking sharks anywhere in the world (Sims, 2008).

5 APPROACH TO RISK ASSESSMENT

The general approach and terminology used in this document is consistent with the EIAR guidelines produced by the Environment Protection Agency (EPA, 2022, Section 3 Table 3.4 and Figure 3.4 therein), in terms of describing the effects and determining significance.

The approach is complemented by the receptor specific guidance 'Guidance to Manage the Risk to Marine Mammals from Man-Made Sound Sources in Irish Waters' (DAHG, 2014) which has been used to inform this risk assessment. Where appropriate, this guidance will also be applied to other protected species that are included within this risk assessment but are not explicitly considered within the guidance. DAHG (2014) recommends that coastal and marine activities undergo a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species to address any area-specific sensitivities, both in timing and spatial extent, and to inform the consenting process. The guidance states that an evidence-based risk assessment for each marine mammal species that occurs in and around the Proposed Activities area needs to consider the nature of the sound source, its likely and / or potential effects on individuals and / or populations and on their likely habitats, and could usefully address the following questions where appropriate:

- Do individuals or populations of marine mammal species (or marine turtles, basking sharks, otter, and bat) occur within the proposed area?
- Is the plan or project likely to result in death, injury or disturbance of individuals?
- Is it possible to estimate the number of individuals of each species that are likely to be affected?
- Will individuals be disturbed at a sensitive location or sensitive time during their life cycle?
- Are the impacts likely to focus on a particular section of the species' population, e.g., adults vs. juveniles, males vs. females?
- Will the plan or project cause displacement from key functional areas, e.g., for breeding, foraging, resting or migration?
- How quickly is the affected population likely to recover once the plan or project has ceased?

Where appropriate, consideration is given to the sensitivity of marine mammals, marine turtles, otter, bat, and basking sharks to the potential impacts. The magnitude and likelihood of potential impacts is also considered, the latter relating to the probability that an impact will occur as a result of a receptor being exposed to a discernible impact. The risk is then determined by considering the sensitivity of a receptor along with the magnitude and likelihood of the impact to which the receptor is exposed.

Where the risk of an impact on an Annex IV species (or any other protected species assessed) from the Proposed Activities is considered likely and therefore significant, appropriate mitigation is proposed to mitigate the risk.

6 BASELINE

6.1 Data sources

Information on Annex IV species, pinnipeds and basking shark occurrence, distribution and abundance in the Licence Application Area was collected through a detailed review of existing studies and datasets. These desk study sources are summarised below.

- Monthly site-specific visual boat-based surveys (April 2013 – April 2014 and October 2018 – January 2020) and DAS (May 2020 – March 2021; CWP FILA Annex IV, 2022);
- Review of Management Unit boundaries for cetaceans in UK waters (IAMMWG, 2023);
- Small cetacean abundance in the North Sea (SCANS) III (Hammond *et al.,* 2017, 2021);
- Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys (Lacey *et al*., 2022);
- Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys (Gilles *et al.,* 2023);
- Sightings (1980-2020) in Irish waters submitted to National Biodiversity Data Centre (NBDC, 2023);
- Irish cetacean review (2000-2009) (Berrow *et al.,* 2010);
- Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017 (Rogan *et al*., 2018);
- Irish Whale and Dolphin Group offshore marine mammal atlas (IWDG, 2022);
- Atlas of the Marine Mammals of Wales (Baines and Evans, 2012);
- The Natural Environment and Research Council (NERC) appointed Special Committee on Seals' (SCOS) most recently available annual report (SCOS, 2022; 2023); and
- Habitat-based predictions of at-sea distribution for grey and harbour seals in the UK and Ireland (Carter *et al*., 2022).

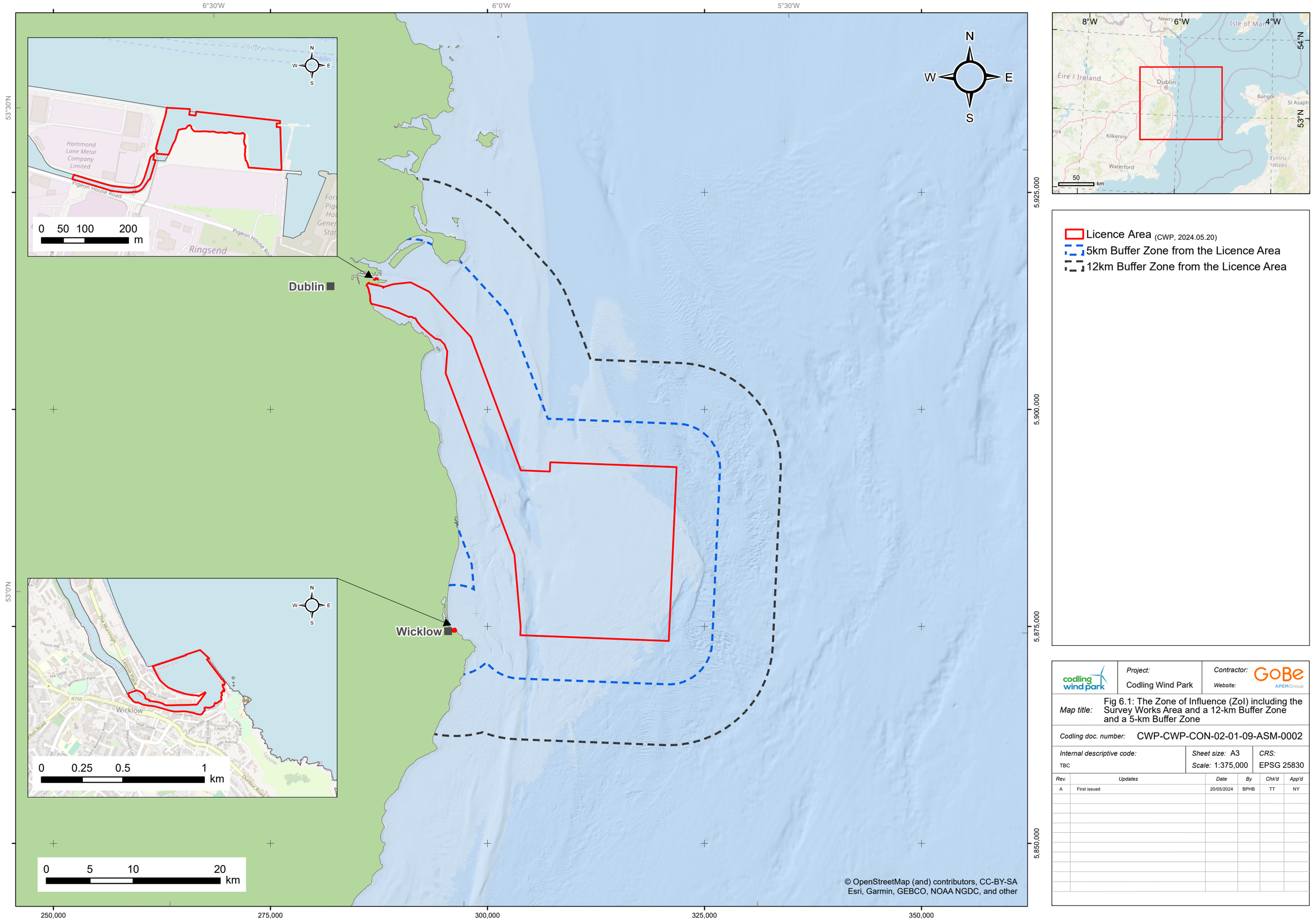
SCANS are robust large-scale aerial and vessel-based surveys which provide estimates of cetacean abundance and distribution to help inform the Marine Strategy Framework Directive (MSFD) assessment of European Atlantic waters. This forms part of the information essential to assess the impact of anthropogenic threats on these populations. These surveys were carried out in 1994 (SCANS-I), 2005/07 (SCANS-II), 2016 (SCANS-III; Hammond *et al.,* 2017; 2021; Lacey *et al*., 2022), and the most recent SCANS survey (SCANS-IV) was undertaken during summer 2022. The Proposed Activities are located within SCANS-IV Block CS-D, which was surveyed by air and covers 34,867 km^2 of the Irish Sea (Gilles *et al.* 2023). Although these blocks are commonly used for abundance assessment purposes (like those utilised in this report), they have no biological significance, rather, they are logistical considerations with respect to carrying out the surveys (e.g. the allocation of such blocks enables a consistent approach when assessing abundance in large bodies of water). Nonetheless, for each block a density estimate is calculated for those cetacean species that have been recorded in sufficient numbers, which can be used to give a broadscale density estimate relating to the Study Area and the surrounding area.

The ObSERVE programme consists of aerial surveys to investigate the occurrence, distribution and abundance of key marine species in Irish waters, with a focus on marine mammals. Surveys were conducted in the summers of 2015 and 2016 and the winters of 2015-2016 and 2016-2017 in offshore waters around Ireland (Rogan *et al*., 2018). The Proposed Activities are located withing ObSERVE Stratum 5.

As marine mammals have a highly mobile nature, the approach to assess impacts consider species at a population level using Management Units (MUs) as presented in the updated abundance estimates for cetacean MUs in UK waters (IAMMWG, 2023). It should be noted that the most recent Inter-Agency Marine Mammal Working Group report (IAMMWG, 2023) presents abundance estimates using SCANS-III data from 2016.

6.2 Defining the Zone of Influence (ZoI)

The environmental baseline for Annex IV species and other protected species reviews the available information on the occurrence and distribution of cetaceans, marine turtles, otters, bats, pinnipeds and basking sharks within or near to the Proposed Activities and surrounding Irish waters. For this desk-based review, the zone of influence (ZoI) was defined as the survey area plus a 12-km buffer zone (Figure 6-1). This area has been determined following a precautionary approach considering the potential impacts of the Proposed Activities on the receptors identified in this report, as further detailed below.



codling wind park

Project: Codling Wind Park

Contractor: GoBe APEM Group

Website:

Map title: Fig 6.1: The Zone of Influence (ZoI) including the Survey Works Area and a 12-km Buffer Zone and a 5-km Buffer Zone

Codling doc. number: CWP-CWP-CON-02-01-09-ASM-0002

Internal descriptive code: TBC

Sheet size: A3

Scale: 1:375,000

CRS: EPSG 25830

Rev.	Updates	Date	By	Chk'd	App'd
A	First issued	20/05/2024	BPHB	TT	NY

During the Proposed Activities, the main impact pathways of concern to Annex IV and other protected species relate to underwater noise. Therefore, in defining the ZoI, consideration was given to the propagation of noise, from activities such as geophysical surveys, and the potential impact on Annex IV and other protected species. For geophysical surveys in the North Sea, studies have shown that harbour porpoise (the most acoustically sensitive species of marine mammals in Irish and UK waters) were deterred from the area, up to 12 km from the source (measured by a reduction in acoustic activity) during seismic airgun surveys (Sarnocińska *et al*., 2020). More is known on the impacts of geophysical surveys and other impulsive sound activities not relevant to these Proposed Activities, such as pile-driving (see Tougaard *et al*. (2013) and Dähne *et al.* (2013)). Conversely, there are few studies (Erbe and McPherson, 2017; Huang *et al*., 2023) investigating potential impact ranges of underwater noise resulting from geotechnical activities such as drilling and seismic CPT. Available information on the noise levels from geotechnical survey equipment, both broadly and specific to the Proposed Activities, shows that they will not exceed geophysical surveys in amplitude and footprint.

Guidance in the UK considers that for other geophysical surveys (including SBP) a 5 km effective deterrent range (EDR) from geophysical survey equipment to be precautionary (JNCC, 2020). On cessation of activities, it is considered that usage of the 5 km EDR for cetacean species will return to pre-impacted levels, as has been observed following other noise emitting activities such as seismic surveys and piling events (Thompson *et al*., 2013; Vallejo, 2017). Although these activities do differ from those proposed, the characteristics of the noise emissions are comparable (i.e. pulsed sound of higher or comparable magnitudes) and as such it is reasonable to confer comparable behaviours in this case.

In the absence of specific guidance in Ireland, both an extended 12-km precautionary approach and a 5-km ZoI are represented in this risk assessment, highlight the both the possible and worst-case impact scenarios for these Proposed Activities on Annex IV species (Figure 6-1) following neighbouring example guidance (JNCC) and scientific examples.

Therefore, the addition of a 12 km buffer zone to the Proposed Activities area is considered as a precautionary ZoI considering the:

- activity likely to have the greatest impact (i.e., geophysical surveys);
- most recent available information on potential impact zones for such activities (up to 12 km from sound source); and
- uncertainties regarding important site-specific variations that will influence noise propagation (e.g., water depth, sediment type) and variations in project design.

It is important to note that the actual immediate ZoI during each survey activity associated with the Proposed Activities will be localised and often short in duration. The ZoI used here is to ensure that the baseline study considered the area in which an impact may occur at any point in time during the Proposed Activities, and in doing so, taking a precautionary approach to extending that boundary beyond the range in which an impact would occur. As such, there is confidence in the assessment with respect to detailing relevant designated sites in the area and the Annex IV and other protected species present.

6.3 Management Units and densities

MUs for cetaceans were adopted when considering population-level impacts resulting from the Proposed Activities (IAMMWG, 2023). SCANS-IV and ObSERVE abundance data were taken forward in this assessment due to their highest density estimates for the species. For marine turtles and basking sharks, sighting data collated in relevant literature (King and Berrow, 2009; Botterell *et al*., 2020), from the ObSERVE aerial surveys (Rogan *et al.,* 2018) and those submitted via the National Biodiversity Data Centre (NBDC, 2023) during the last 12 months have been used to inform species occurrence, distribution and abundance. Abundance and density information for the five most common species recorded in Irish waters is presented in Table 6-1.

For seals, the National Parks and Wildlife Service (NPWS) abundance data from counts at haul-out sites and breeding colonies (Morris and Duck, 2019; Ó Cadhla *et al*., 2013; Lyons, 2004; Cronin *et al*., 2003) have been used to provide broad-scale information on seal ecology and regional population estimates.

For pinnipeds, considering the typical foraging distances of seals (Carter *et al.,* 2022) the MU population is defined by survey regions presented in Morris and Duck (2019) as the East and South Region of the Republic of Ireland, and the Welsh and Northern Irish Sea Management Units (SCOS, 2022):

- Grey seal population 9,936
- Harbour seal population 1,378

6.4 Cetaceans

6.4.1 Harbour porpoise

Harbour porpoise is the most common cetacean species within the ZoI, and the most widespread and frequently recorded species off the east coast of the Republic of Ireland, sighted throughout the year with an increased presence in July and August (Ó Cadhla *et al*., 2004; Berrow *et al*., 2010; Wall *et al*., 2013; Kavanagh *et al.,* 2017; Rogan *et al*., 2018). Monthly site-specific visual boat-based surveys support these studies results as harbour porpoise were the most frequently sighted species (CWP FILA Annex IV, 2022). They are listed as a species of Least Concern on the International Union for Conservation of Nature (IUCN) Red List (Braulik *et al*., 2020).

Harbour porpoises are opportunistic foragers with a varied diet and are known to forage at high energy, near-shore sites, where their distribution is linked to year-round proximity to small shoaling fish species, such as sandeel (*Ammodytidae*; Santos and Pierce, 2003). In Irish coastal waters, *Trisopterus* spp. are known to make up nearly half of harbour porpoise diet (Hernandez-Milian *et al*., 2012).

Harbour porpoise abundance and density estimates are presented in Table 6-1 using data collected during the ObSERVE aerial surveys (Rogan *et al*., 2018) and SCANS-IV (Gilles *et al*., 2023). No model-based abundance estimates were available for harbour porpoise in Stratum 5 during winter months due to too few sightings (Rogan *et al.,* 2018).

Harbour porpoise is a primary citation feature of the three SACs located inside the ZoI (Table 6-2): Rockabill to Dalkey Island SAC, Codling Fault Zone SAC and Lambay Island SAC. These SACs have been designated due to consistently high densities of the species in these areas (NPWS, 2013). Juvenile harbour porpoises have regularly been recorded in the Rockabill to Dalkey Island SAC which is thought to be an important nursery area for this species (O'Brien and Berrow, 2016). In Irish waters, the calving period for harbour porpoise is typically from May to August. A reduced encounter rate between March to June suggests a seasonal movement offshore to calving and breeding grounds (IWDG, 2019a).

6.4.2 Common Dolphin

Common dolphins are widely distributed within Irish waters, with higher abundances off the south and southwest coasts as well as in deeper waters and over the continental shelf (Reid *et al*., 2003; Berrow *et al*., 2010; Wall *et al*., 2013; IWDG, 2019b). They are listed as a species of Least Concern on the IUCN Red List (Braulik *et al*., 2021).

It is reported that common dolphins have a seasonal presence in the Irish Sea, occurring in low densities over summer and autumn and are almost absent over the winter period due to an eastward movement along the south coast (Berrow *et al*., 2010, Wall *et al., 2013*). They prey on a variety of fish and cephalopod species,

particularly schooling fish such as herring and sprat (Brophy *et al.*, 2009). Common dolphins are thought to calve in Irish waters, with calves primarily sighted from late summer to late autumn (Wall *et al*., 2013).

Monthly site-specific visual boat-based surveys recorded three sightings of common dolphin, suggesting they occasionally use the array area (plus 4 km buffer zone; CWP FILA Annex IV, 2022).

Common dolphin abundance and density estimates are presented in Table 6-1. Common dolphins were not recorded in Stratum 5 during the ObSERVE project surveys (Rogan *et al.*, 2018). However, SCANS-IV shows an increase in occurrence in the Celtic and Irish Seas, as well as southwest of the UK suggesting that the population range may be expanding further north (Gilles *et al*., 2023).

6.4.3 Bottlenose Dolphin

Bottlenose dolphins are one of the most frequently recorded cetaceans in Ireland (NPWS, 2019) and have been observed throughout Irish waters year-round. They are listed as a species of Least Concern on the IUCN Red List (Wells *et al*., 2019).

In Ireland, there are thought to be at least three distinct populations of bottlenose dolphin, as determined by genetic studies (Mirimin *et al.*, 2011). One of these populations is highly mobile and the same individuals have been recorded off all Irish coasts, with individuals recorded in Dublin Bay recaptured (i.e., sighted and identified through photographic identification (hereafter 'photo-ID') using distinctive features) in Galway Bay (O'Brien *et al.,* 2010). Comparison of images within bottlenose dolphin photo-ID catalogues confirm movement of individuals through prospective corridors linking designated SACs in the Moray Firth (Scotland), Cardigan Bay (Wales) and Shannon Estuary (Ireland) (Robinson *et al.*, 2012). Recent photo-ID of bottlenose dolphins by IWDG have recorded same individuals off counties Dublin, Cork, Kerry, Galway, Mayo, Donegal and Antrim (Berrow *et al.,* 2010), suggesting that inshore dolphins recorded within and / or near the Licence Application Area potentially use the entire Irish coast. Most coastal sightings around Ireland fall within 10 km from shore (O'Brien *et al.*, 2010; Robinson *et al*., 2012). Irish coastal bottlenose dolphins have a widely variable diet including benthic and pelagic species; prey includes, but is not limited to, hake (*Merluccius merluccius*), whiting (*Merlangius merlangus*), haddock (*Melanogrammus aeglefinus*), conger eel (*Conger conger*), gadoids, flatfish, and cephalopods (Hernandez-Milian *et al.*, 2012; 2015). Bottlenose dolphins in Irish waters with calves were recorded primarily in the summer months (Berrow *et al.*, 2010).

Corrected design-based and model-based bottlenose dolphin abundance and density estimates are presented in Table 6-1. Using data collected during the ObSERVE aerial surveys, the abundance estimates for Stratum 5 were only available during winter 2016-2017 as the species was only sighted once (five individuals) in the western Irish Sea during the survey programme (Rogan *et al.,* 2018). In comparison, the most recent SCANS-IV shows a much higher abundance estimate within the MU, indicating a growing presence within the Celtic and Irish Seas in 2022 (Gilles *et al*., 2023).

6.4.4 Risso's Dolphin

Risso's dolphins are primarily recorded in oceanic waters off the continental shelf in the Celtic Sea (Berrow *et al.*, 2010; Rogan *et al.,* 2018). They are known to seasonally migrate to coastal waters in late spring to summer around the entire Irish coast, with higher relative abundances recorded off the southwest and southeast coasts (Berrow *et al.*, 2010). They have a relatively localised distribution, forming a wide band running through the Irish Sea on a southwest-northeast axis (Baines and Evans, 2012). Monthly site-specific visual boat-based surveys recorded two sightings of Risso's dolphin, suggest only an occasional use of the array area (plus 4 km buffer zone; CWP FILA Annex IV, 2022). Risso's dolphins are listed as a species of Least Concern on the IUCN Red List (Kiszka and Braulik, 2018).

Risso's dolphins primarily feed on cephalopods, including squid, octopus, and cuttlefish (Clarke, 1996). Young calves have been sighted within Irish waters, with numbers peaking between March and June (Wall *et al.*, 2013; IWDG, 2018).

Design-based abundance and density estimates of Risso's dolphins are presented in Table 6-1. For the ObSERVE survey programme during the 2016 summer, these estimates could not be corrected for availability bias and are therefore underestimates by an unknown amount (Rogan *et al.*, 2018). Whereas more recent SCANS-IV has a higher occurrence of Risso's dolphin than ObSERVE data, they are suggested to be occasional visitors to the area (Gilles *et al.,* 2023).

6.4.5 Minke whale

Minke whales are the most abundant baleen whale species within Irish waters and occur throughout the coast of Ireland (Berrow *et al.,* 2010; Wall *et al.,* 2013; NPWS, 2019). They use both coastal and offshore waters around southern Ireland (Healy *et al.,* 2013), and can be seen off the southern Irish coast through autumn and early winter (Berrow *et al*., 2010). In the Irish Sea, minke whales show seasonal variation in abundance, suggesting movement related to foraging and / or calving grounds. They are present in the Irish Sea from late April through to early August but are largely absent in the winter months where they migrate to lower latitudes to breed (MacLeod *et al.*, 2007; Anderwald *et al.*, 2011; Wall *et al*., 2013). The highest abundance of minke whales has been recorded off the south and southwest coasts of Ireland in autumn and in the western Irish Sea in the spring, where foraging activity on concentrations of pelagic schooling fish is often reported (Wall *et al.,* 2013, Rogan *et al.,* 2018). Monthly site-specific visual boat-based surveys recorded minke whale sightings between April and September suggesting a prolonged presence in the survey area over the summer months (CWP FILA Annex IV, 2022). The minke whale is currently listed as a species of Least Concern on the IUCN Red List (Cooke *et al.,* 2018).

Corrected design-based minke whale abundance and density estimates are presented in Table 6-1. With the ObSERVE data, no density or abundance estimates were available in winter as no animals were detected in Stratum 5. Minke whales were only recorded within Stratum 5 during summer 2015 and summer 2016, and only design-based abundance and density estimates are available due to the low sample size (Rogan *et al.*, 2018). The updated abundance estimates from SCANS-IV shows a slight reduction in presence of minke whales compared to SCANS-III within the Celtic Greater North Seas MU (Gilles *et al.,* 2023).

6.4.6 Beaked whale (all species)

There are at least four species of beaked whales that are found in Irish Waters; Cuvier's beak whale (*Ziphius cavirostris*), Sowerby's beaked whale (*Mesoplodon bidens*), True's beaked whale (*Mesoplodon mirus*) and northern bottlenose whale (*Hyperoodon ampullatus*). These are deep-diving cetacean species and are highly mobile, making them challenging to quantify their distribution and abundance (Hernandez-Milian and Rogan, 2011; Kowarski *et al*., 2018). No beaked whales were sighted within ObSERVE surveys in Irish waters, but the species had a few opportunistic sightings within SCANS-IV possibly showing an expanding presence within the region; however, it is difficult to quantify their full distribution into Irish waters without future acoustic monitoring (Gilles *et al*, 2023).

Table 6-1 Management Units (MUs) and abundance and density estimates for cetacean species considered in this assessment for all the seasons in which there were sightings in Stratum 5 (Rogan *et al.*, 2018) and SCANS-IV data (Gilles *et al*. 2023).

			ObSERVE Stratum 5				SCANS-IV** Block CS-D July-August 2022	
Species	MU abundance (IAMMWG, 2023)	Season	Abundance		Density (animals/km^2)		Abundance	Density (animals/km^2)
			Design-based	Model-based	Design-based	Model-based		
Harbour porpoise	Celtic and Irish Seas MU: 62,517 animals (CV=0.13; 95% CI=48,324 – 80,877)	Summer 2015	7,734 animals (CV= 35.1; 95% CI = 5,247.7 – 11,398.3)	7,494.6 animals (CV=35.7; 95% CI= 4,789.0 – 11,728.8)	0.696	0.675	9,773 (CV=0.316; 95% CI = 4,764 – 18,125	0.2803
		Winter 2015-2016	9,636.2 animals (CV= 46.6; 95% CI = 5,633.6 – 16,482.7)	-	0.867	-		
		Summer 2016	11,624.5 animals (CV= 24.2; 95% CI=8,725.8-15,486.0)	10,465.9 animals (CV= 21.8; 95% CI= 7,928.1-13,816.3)	1.046	0.942		

			ObSERVE Stratum 5				SCANS-IV** Block CS-D July-August 2022	
Species	MU abundance (IAMMWG, 2023)	Season	Abundance		Density (animals/km^2)		Abundance	Density (animals/km^2)
			Design-based	Model-based	Design-based	Model-based		
		Winter 2016/2017	10,263.5 animals (CV= 29.5; 95% CI=7,555.3-13,942.596	-	0.924	-		
Common dolphin	Celtic and Greater North Seas MU: 102,656 animals (CV=0.29; 95% CI=58,932 – 178,822)		-		-		949 (CV=0.814, 95% CI= 32 – 2,990	0.0272
Bottlenose dolphin	Irish Sea MU: 293 animals (CV=0.54; 95% CI=108-793	Winter 2016/2017	401 animals (CV= 93.55 95% CI = 76 – 2,105)	223 animals (CV=82.55; 95% CI= 0 – 828)	0.036	0.0201	8,199 (CV=0.353, 95% CI= 3,595 – 15,158	0.2352

			ObSERVE Stratum 5				SCANS-IV** Block CS-D July-August 2022	
Species	MU abundance (IAMMWG, 2023)	Season	Abundance		Density (animals/km^2)		Abundance	Density (animals/km^2)
			Design-based	Model-based	Design-based	Model-based		
Risso's dolphin	Celtic and Greater North Seas MU: 12,262 (CV=0.46; 95% CI=5,227 – 28,764)	Summer 2015	35.1 animals (CV= 96.16; 95% CI = 7-188) *	-	0.0032*	-	75 (CV=1.012, 95% CI= 2 – 259)	0.0022
Minke whale	Celtic and Greater North Seas MU: 20,118 animals (CV=0.18; 95% CI= 14,061 – 28,786)	Summer 2015	494.7 animals (CV= 68.75; 95% CI = 221.5 – 1,105)	--	0.045	-	477 (CV=0.632, 95% CI = 85-1,425	0.0137
		Summer 2016	180.1 animals (CV= 106.13; 95% CI= 58.6-552.9	-	0.016	-		

Note: Where relevant, the highest density estimate for the species has been carried forward in the assessment following a highly precautionary approach. It should be noted that latest IAMMWG data uses SCANS-III data (Hammond *et al*. 2021) as that was most recently published data at the time of publication.

*uncorrected estimates available only.

** SCANS surveys were carried out between July-August, only

6.5 Marine turtles

Leatherback turtles have been recorded around the Irish coast, with most sightings off the south and west coasts of Ireland (King and Berrow, 2009; Botterell *et al.*, 2020). Leatherback turtles are most commonly recorded between June and October when they forage on jellyfish (*Medusozoa spp*.) within this region (Doyle, 2007; Botterell *et al*., 2020). They are listed as a vulnerable species on the IUCN Red List (Wallace *et al.*, 2013). It has been estimated that 0.06 leatherbacks are found per 100 km^2 in the Celtic and Irish Seas (Doyle *et. al*., 2008). No marine turtles were sighted during the ObSERVE surveys in the Irish Sea (Rogan *et al*., 2018). There were no leatherback turtle sightings reported to the IWDG in the last twelve months (between 1st April 2023 and 1st April 2024; IWDG, 2024).

6.6 Otters

There is a potential for the Eurasian otter to be present in coastal environments which overlap with the Licence Application Area, and sightings have been recorded near to Dublin Bay and in the Wicklow area (Lysaght and Marnell, 2016).

Online information from otter surveys (Maps - Biodiversity Maps (biodiversityireland.ie); (data from 1969-2017) show four sightings of six individuals within the Vartry River / Broad Lough area, and one individual otter sighted within Wicklow harbour. Three of these sightings occurred within 500 m of the export cable corridor or landfall site. At Poolbeg, many of the sightings are located within the River Liffey or around Dun Laoghaire harbour. One sighting was within Dublin Bay near Donnybrook from the 1982 survey.

In 2021, otter surveys were conducted at each potential landfall site by CWPL. Otter surveys were undertaken along suitable habitat within the onshore development boundary, plus a 150m buffer (where feasible) following methodologies outlined within the NRA (2006) and Chanin (2003). Any evidence of otter such as tracks, spraints, couches, slides, feeding remains or holts, were recorded. No otter sightings or evidence of otter activity (droppings, holts, couches, footprints, etc.) were found at the Poolbeg landfall area. During surveys at Wicklow, mammal tracks were identified outside the Licence Application Area along the Vartry River (CWP FILA Annex IV, 2022).

Otter are likely to forage and commute along the estuaries around the Poolbeg Peninsula.and the rock armour around the perimeter of the potential onshore substation site may provide suitable resting sites for otter.

6.7 Bats

There are nine species of bats established in Ireland (Roche *et al.*, 2014; Aughney, 2022). All nine bat species resident in Ireland are protected under Annex IV of the Habitats Directive, with Liesler's bat (*Nyctalus leisleri*), Nathusius' pipistrelle (*Pipistrellus nathusii*) and soprano pipistrelle (*Pipistrellus pygmaeus*) likely to migrate or forage out to sea (Arnett *et al.*, 2015).

Bat migration and offshore foraging habits are understudied and there is a lack of data on bat migrations between the UK (including Wales, England, Scotland and the Isle of Man) and Ireland.

6.8 Other (non-Annex IV) protected species

6.8.1 Pinnipeds

Aerial surveys of the Irish Sea show that grey seals are more common than harbour seals within this region; however, more broadly the east coast had the lowest count of both species compared to the south, north and west (Morris and Duck, 2019). This may be an indication that this region is not as preferable to seals; however, in some regions to the east of Ireland, there is evidence of a decline in harbour seals, yet grey seal numbers in this region are generally stable or increasing (Culloch *et al*., 2018; Morris and Duck, 2019).

It is possible that seals using the closest SAC (Lambay Island SAC), for which they are a qualifying feature, could be using areas within the Licence Application Area for foraging and / or transiting through. Carter *et al*. (2022) used telemetry data of harbour and grey seals tagged around the UK and Ireland to produce habitat-based distribution estimates which indicated that the region on the south coast of Ireland does not support high densities of grey seals or harbour seals, as compared to southwest and southeast of Ireland. With respect to harbour seals, the areas around Lambay Island, Strangford Lough, and Murlough (all of which are SACs with harbour seal as a qualifying feature) do have higher densities predicted, but these are localised, and are still low when compared to key regions for this species, such as the west of Scotland and The Wash in southeast England (Carter *et al*., 2022).

The closest known breeding site for grey and harbour seals is within the Lambay Island SAC (for which grey and harbour seals are qualifying features); this SAC is 17.49 km from the Licence Application Area (Table 6-2). Surveys of this area in 2009 estimated a minimum pup production for grey seals of 77 pups and an overall population size of 270-347 (Ó Cadhla *et al.,* 2013). Thermal imaging surveys in 2017 and 2018 recorded 60 harbour seals hauled out in the SAC (Morris and Duck, 2019).

Both species are also present within and around the Rockabill to Dalkey Island SAC which overlaps the Licence Application Area; however, neither are listed as a qualifying feature of the SAC.

For pinnipeds, the MU is calculated based on the potential population foraging range of 100 km around the ZoI of the Licence Application Area. For the purposes of this impact assessment, grey seals have been assessed within the east and southeast region of Ireland, as well as Wales and Northern Ireland using scaled estimates from Morris and Duck (2019) resulting in an estimate of 9,936 individuals.

For the purposes of this impact assessment, harbour seals have been assessed within the east and southeast region of Ireland, as well as Wales and Northern Ireland using scaled estimates from Morris and Duck (2019) resulting in an estimate of 1,378 individuals.

6.8.2 Basking sharks

Basking shark is a large, filter-feeding species that is predominately solitary but may also occur in aggregations where there is dense zooplankton abundance (Speedie, 1999). Basking sharks migrate through the Irish Sea during spring and summer, with migration routes covering large distances from the north of Scotland to North Africa, and occasionally between the UK and America (Johnston *et al*., 2019). A tagging study of basking sharks found that half of the tagged individuals entered the EEZ of Ireland, including the Irish Sea, indicating the importance of this area for overwintering and migration (Doherty *et al.,* 2017).

Whilst their distribution patterns are relatively well studied around Ireland and the UK, there are no density or abundance estimates for populations of basking sharks anywhere in the world (Sims, 2008). During the ObSERVE surveys only one basking shark sighting was recorded, which was off the east coast of Ireland (Rogan *et al.*, 2018). In the last twelve months (since April 2023) 150 sightings of basking sharks were reported to the

IWDG, with group sizes ranging from one to 80 individuals (IWDG, 2024). Very few sightings were recorded in the Irish Sea (IWDG, 2024).

6.9 Designated sites

Marine mammals are highly mobile and tend to range outside the sites designated to protect them. The SACs with Annex IV and other protected species as qualifying interest features within the ZoI and their distances from the Licence Application Area are presented in Table 6-2. It is noted that the Codling Fault Zone SAC is located just outside of the proposed ZoI utilised in this assessment, however this has been included for consideration in the interest of completeness.

Table 6-2 Designated sites with Annex IV and other protected species as qualifying interest features within the ZoI.

Site	Distance from Licence Application Area (km)	Qualifying Features
Rockabill to Dalkey Island SAC (IE003000)	0	[1351] Harbour Porpoise (*Phocoena phocoena*)
Codling Fault Zone SAC (IE003015)	13.89	[1351] Harbour Porpoise (*Phocoena Phocoena*)

6.10 Summary of baseline

Considering Annex IV and other protected species' sightings, distribution, and density within the ZoI and nearby, the species taken through to the risk assessment are harbour porpoise, bottlenose dolphin, minke whale, common dolphin, leatherback turtles, grey seal, and harbour seal. There is potential for otters to be present in coastal environments which overlap with the Licence Application Area, so as a precaution, they have also been taken forward to the risk assessment.

Risso's dolphin, beaked whale and basking sharks have been excluded due to their infrequent occurrence and (where data exist) their relatively low density and abundance within the ZoI and the wider region.

The Proposed Activities constitute vessel-based surveys, deployment of monitoring buoys and walkover surveys, and despite these surveys taking place over both day and night-time, there are limited impact pathways to bats. Disruption will be temporary and short term (buoys to be in place for 12-36 months then removed, vessel-based geophysical surveys will take place over 2-8 months per campaign and other vessel-based surveys such as fish and benthic will take between 3-5 days per survey). The surveys will take place in a marine area already used by commercial vessels, fishing boats and recreational craft. No impacts on migration pathways of bats or on foraging bats from the Proposed Activities are envisaged and therefore bats are not considered further in this assessment.

Nonetheless, any proposed mitigation measures for the species assessed will also be appropriate and / or relevant to the species not taken forward in this assessment.

7 RISK ASSESSMENT

As previously listed in Section 3, there is no requirement of a derogation licence or risk of offence to categories (c) to (e) of Regulation 54 of the Habitats Directive for all surveys because:

- The Annex IV species present in the area and considered to be at risk from the Proposed Activities (i.e. cetaceans, marine turtles, and otters) do not produce eggs, with the exception of marine turtles, which do not nest in this region (and therefore do not produce eggs in this region);
- Proposed Activities will not destroy or deteriorate a breeding site or resting place of an Annex IV species; and
- Proposed Activities will not keep, transport, sell or exchange any species.

The aim of this risk assessment is to provide all necessary information in order that the competent authority can establish if an offence will be committed requiring a derogation licence due to categories (a) and (b) below:

- Deliberately capture or kill any specimen of these Annex IV species in the wild; and
- Deliberately disturb these Annex IV species particularly during the period of breeding, rearing, hibernation and migration.

The risk assessment will assess the risk to Annex IV species and other protected species outlined in Section 6 during the Proposed Activities, with the intention of addressing two key questions:

- Is the activity likely to result in death, injury or disturbance of individuals?
- Is mitigation required?

7.1 Introduction

The potential for an offence under the European Communities (Birds and Natural Habitats) Regulations 2011, as amended (i.e. the implementing legislation for the Habitats Directive), as outlined in Section 3, has been assessed for all noise generating activities (i.e. geophysical surveys, geotechnical surveys, ADCP equipment operation, and vessel noise) and for increased collision risk from vessel activity from all Proposed Activities are outlined in Section 2.1.

During the Proposed Activities conducted within the Licence Application Area there is potential for EPS (i.e. cetaceans) and other protected species (i.e. pinnipeds) to be affected.

The potential impact pathways are:

- Underwater Noise;
- Change in Water Quality;
- Vessel Collision; and
- Pollution Events

The definition of terms relating to the risk assessed of the potential impact utilised in this assessment for these Proposed Activities is defined in Table 7-1.

Table 7-1 Definition of terms relating to risk of impact assessment (adapted from EPA, 2022).

Potential of impact pathway to induce change on individuals within the population	Description
Major	The impact would have a permanent change in the behaviour and distribution of sufficient numbers of individuals, with sufficient severity, to affect the long-term viability and / or favourable conservation status of the population.
Moderate	The impact would have a temporary change in behaviour and / or distribution of most individuals, and permanent changes on a small portion of the population although not at a level that would affect the long-term viability of the population.
Minor	The impact would have short-term and / or intermittent change to a small proportion of the population, which is unlikely to impact the population trajectory.
Negligible	The impact would result in very short-term and recoverable effect on the behaviour and / or distribution in a very small proportion of the population. No change to the population size or trajectory is expected.
No Change	The impact would no result in any adverse or beneficial effect to the population or supporting habitat.

7.1.1 Marine Mammal Hearing Sensitivities

It is widely documented that marine mammals are sensitive to underwater noise (Hildebrand, 2009; Nowacek *et al.*, 2007; OSPAR 2009; Richardson *et al.*, 1995; Southall *et al*., 2019; Southall *et al*., 2021), with a wealth of evidence that many anthropogenic sound sources, such as vessels and related construction activity (Culloch *et al.*, 2016; Dunlop, 2016; Pirotta *et al*., 2012; Wisniewska *et al*., 2018), impact pile driving (Brandt *et al*., 2011; Graham *et al.*, 2019), seismic surveys (Pirotta *et al*., 2014; Stone *et al*., 2017) and acoustic deterrent devices ((ADDs); Basran *et al*., 2020; Schaffeld *et al.*, 2019) do have impacts on marine mammals. Indirect impacts may also occur through direct impacts to prey species (Sivle *et al*., 2021). These impacts have varying degrees of observed and / or predicted severity, ranging from changes in behaviour and masking (affecting communication and listening space, and / or locating prey; Basran *et al.*, 2020; Dunlop, 2016; Erbe *et al.*, 2016; Heiler *et al.*, 2016; Pine *et al*., 2019; Pirotta *et al*., 2012; Wisniewska *et al*., 2018), to displacement and disturbance (Brandt *et al.*, 2011; Culloch *et al.,* 2016; Graham *et al*., 2019; Pirotta *et al*., 2014; Stone *et al*., 2017) to injury and even mortality (Reichmuth *et al.*, 2019; Schaffeld *et al.*, 2019). The severity of these potential impacts will depend, in part, on the hearing range of the species affected. These are divided into generalised hearing ranges across broad species categories, based on various data sources, such as captive studies (e.g. harbour porpoises) and anatomy-based predictions (National Marine Fisheries Service (NMFS), 2018;Table 7-2).

Marine mammal species have different hearing sensitivity thresholds resulting in different species detecting underwater noise at varying frequency bands (Table 7-2). These differences in hearing thresholds allows for the assessment of how certain noise sources will be detected, and thus affect, the marine mammal species identified in the vicinity of the Proposed Activities. To assess impacts of underwater noise, marine mammal species are separated into functional hearing groups, which reflect the broad differences in hearing capabilities among the taxa (e.g., Southall *et al.*, 2019). The classifications by Southall *et al.* (2019) have used the most recent data on marine mammal hearing; it is considered current best practice and supersedes previous works (i.e., Southall *et al.* (2007), which has been used in the DAHG (2014) guidance). There are five functional hearing groups, with the harbour porpoise hearing group categorised as ‘very high frequency (VHF)’, bottlenose dolphin and common dolphin as ‘high frequency (HF)’, minke whale as ‘low frequency (LF)’ and both seal (phocid) species covered

by two groups (phocids in air and phocids in water) (see Table 7-2). As the in-air thresholds for seals are not relevant to underwater noise assessments, these are not presented here. Southall *et al*. (2019) also applied weighting functions, which account for the frequency-dependent effects of noise, to each of the different functional hearing groups (see Southall *et al.*, 2019 for more details on how weightings were derived).

Table 7-2 Generalised hearing ranges for species groups (adapted from NMFS, 2018 and Southall *et al*., 2019)

Species Group	FHG	Species examples	Generalised hearing ranges	Estimated region of peak sensitivity
Balaenoptera	Low Frequency (LF)	Minke whale	7 Hz – 35 kHz	200 Hz – 19 kHz
Dephinidae	High Frequency (HF)	Bottlenose dolphin, common dolphin and Risso's dolphin	150Hz – 160 kHz	8.8 kHz – 110 kHz
Phocoenidae	Very High Frequency (VHF)	Harbour porpoise	275 Hz – 160 kHz	12 kHz – 140 kHz
Phocids (in water)	Phocid Carnivore in Water (PCW)	Harbour seal and grey seal	50 Hz – 86 kHz	1.9 kHz – 30 kHz

7.1.2 Marine turtles

Studies have shown that species of marine turtle can detect sounds at frequencies under 2 kHz (Dow Piniak 2012; Dow Piniak *et al*., 2012a; Dow Piniak *et al*., 2012b; Lavender *et al*., 2012; Lavender *et al*., 2014; Martin *et al*., 2012; Ridgeway *et al*., 1969). However, little to no studies have been conducted on the physiological effects of anthropogenic noise on marine turtles. Popper *et al*., (2014) provide mortal injury thresholds for marine turtles from explosives between SPL_{peak} 229 – 234 dB re 1 µPa and >207 dB re 1 µPa for seismic.

7.1.3 Otters

Otters are semi-aquatic species who use the marine environment for foraging. Otters do not utilise sound in the underwater environment in the same way as cetaceans. The number of otter sightings along the coast is low with individuals recorded no more than 100 m from shore. In-air hearing ranges for Eurasian otters is thought to between 0.2 and 32 kHz (Voight *et al.*, 2019).

7.1.4 Anthropogenic noise background

The following section introduces the potential effects and behavioural responses of marine mammals. Information on the sound sources and exposure criteria used within this risk assessment is also presented.

7.1.4.1 Sound sources, exposure criteria, and temporary and permanent threshold shifts (TTS / PTS) in hearing

With respect to noise assessments using the criteria outlined in Southall *et al*. (2019), there are often two impacts assessed: a temporary threshold shift (TTS) in hearing and a permanent threshold shift (PTS) in hearing, the

latter of which is typically regarded as injury. To assess this, sound sources are typically divided into two categories, 'impulsive' and 'non-impulsive', based on attributes of the sound source:

- **Impulsive sound sources**, such as impact pile driving and seismic airguns, are transient and brief (less than a second), broadband and typically consist of high peak pressure with rapid rise time and decay.
- **Non-impulsive sound sources**, such as shipping, cone penetration testing (CPT) and rotary core borehole, can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent and typically do not have a high peak pressure with rapid rise time.

Consequently, the criteria used by Southall *et al*. (2019) for TTS and PTS have different thresholds (see Table 7-2) where the different exposure metrics are required to account for different aspects of exposure level and duration. The exposure metrics used by Southall *et al*. (2019) are:

- frequency weighted Sound Exposure Level (SEL), to the reference value of 1 μPa^2_s; and
- unweighted peak Sound Pressure Level (SPL_{peak}), to the reference value of 1 µPa,

SEL is a measure of sound energy over multiple exposures and exposures accumulated over time and SPL is a measure of absolute exposure. In relation to the TTS and PTS thresholds, for impulsive sound sources, both metrics are used, and for non-impulsive sound sources only the SEL exposure metric is used. The rationale being, for non-impulsive sounds, given the very high peak SPL values required to induce TTS or PTS, the SEL criterion would be met before an exposure exceeding the peak SPL criteria (which are not presented by Southall *et al.* (2019) for this reason).

With respect to undertaking a quantitative assessment, should one be required, the SEL values would be calculated over the duration of a discrete noise exposure and would be cumulative over multiple repeated noise exposures occurring in relatively quick succession, and would be weighted for the relevant functional hearing group. For example, SEL could be calculated for impulsive sound sources; this could be multiple hammer strikes during installation of a monopile or several air guns firing on a transect line during seismic surveys, and for non-impulsive sound sources, this could be operational noise of vessels.

In terms of instantaneous onset of TTS or PTS, the peak SPL exposure metric is used and as explained above, is applied to impulsive sound sources only. Loud instantaneous noises, particularly if the animals are close to the source, such as a high-order detonation when clearing unexploded ordnance, air guns firing on a seismic survey, or hammer strikes during pile driving, all have the potential to induce TTS or PTS instantaneously.

The VHF functional hearing group is the most sensitive to both impulsive and non-impulsive sound sources. We can conclude this because all the exposure criteria for this group are lower than those of the other functional hearing groups for the respective sound source and exposure criteria (Table 7-3). In the context of the Proposed Activities, the only VHF cetacean species in this region is the harbour porpoise, which is considered abundant in inshore waters in the Irish Sea (Ó Cadhla *et al*., 2004; Berrow *et al*., 2010; Wall *et al*., 2013; Rogan *et al.,* 2018). Typically, a risk assessment would consider the most acoustically sensitive species first and, if it is concluded that the risk of TTS and PTS to VHF species is negligible, then the risk to less acoustically sensitive functional hearing groups would be reduced as a result.

Table 7-3 Noise exposure criteria from Southall *et al*. (2019) for temporary threshold shift (TTS) and permanent threshold shift (PTS) in hearing by the respective functional groups.

Functional hearing group	Species examples	Impulsive				Non-impulsive	
		TTS		PTS		TTS	PTS
		SEL	Peak SPL	SEL	Peak SPL	SEL	SEL
Low Frequency (LF)	Minke whale	168	213	183	219	179	199
High Frequency (HF)	Bottlenose dolphin, common dolphin	170	224	185	230	178	198
Very High Frequency (VHF)	Harbour porpoise	140	196	155	202	153	173
Phocids in water (PCW)	Harbour seal, grey seal	170	212	185	218	181	201

7.1.4.2 Behavioural responses to underwater noise

Behavioural responses to underwater noise are challenging to assess for a number of reasons (Gomez *et al.*, 2016; Southall *et al*., 2021). Changes in behaviour can be driven by the condition of individuals, the age-class of individuals, the context (e.g., transiting an area vs. present at an important foraging ground). As such, deriving a threshold for disturbance has proven far more challenging than for TTS and PTS onset (Gomez *et al.*, 2016; Southall *et al*., 2021). There is a growing body of literature on experimental and observational studies which has expanded our understanding of behavioural responses to discrete underwater noise events, such as vessel presence (e.g., Nowacek *et al.*, 2001; Hastie *et al*., 2003; Lusseau, 2003; Benhemma-Le Gall *et al*., 2022; Pirotta *et al.,* 2012; Culloch *et al.*, 2016), across situations and contexts, for individuals and groups. However, these studies only serve to highlight that attempts to derive thresholds for single noise exposure parameters and behavioural responses across broad taxonomic and sound categories is unlikely to be appropriate and can lead to significant errors in predicting impacts (Southall *et al.*, 2021).

There are more studies on the impacts of underwater noise on harbour porpoise (e.g., Brandt *et al*. 2011, Carstensen *et al*. 2006, Dyndo *et al.* 2015, Lucke *et al*., 2009, Schaffeld *et al.* 2019) than on other marine mammal species, in part because they are the most acoustically sensitive, and because they are the most ubiquitous marine mammal species in Irish and UK waters. In a recent study, Benhemma-Le Gall *et al*. (2021) investigated the broad-scale responses of harbour porpoises to construction works at an offshore windfarm site and found that porpoise displacement (assessed using passive acoustic monitoring) was observed up to 12 km from pile-driving activities and up to 4 km from construction vessels. A study in Danish waters investigated the high intensity pulses from an air gun on a small sample size (n = 5) of harbour porpoises that were captured and tagged with high resolution location and dive loggers (van Beest *et al.* 2018). They used a single 10 inch^3 underwater air gun producing high intensity noise pulses (2-3 second intervals) for one minute, at ranges of 420 to 690 m, with noise level estimates of 135-147 dB re 1µPa^2$_s$ SEL. They reported noise-induced movements (directly away from the sound source and / or shorter and shallower dives than usual) for three of the five individuals, with the effects lasting less than eight hours. There was no quantifiable behavioural response for the other two individuals. These examples, and particularly the latter study by van Beest *et al.* (2018), illustrate the challenges in the experimental design of *in situ* studies, obtaining these data, analysing them (e.g.,

accounting for extrinsic and confounding parameters, spatial and temporal autocorrelation) and making inferences on behaviour based on the context of the situation.

7.2 Underwater noise assessment

None of the following aspects of the Proposed Activities require sound generating equipment, *i.e.*, trawls, benthic sampling, ecological/archaeological intertidal walkovers, metocean, or marine mammal passive acoustic monitoring, as such there is no route to impact on marine mammal species relating to underwater noise from these activities.

Lethal effects, such as gas and fat emboli, stem from either physical injury resulting from pressure waves from underwater explosions (Danil and. Leger, 2011), or through change of behaviour in deep diving species such as beaked whales (D'Amico et al., 2009; Filadelfo et al., 2009; Parson, 2017), rather than physical impact from the noise source. There is no potential for the levels of anthropogenic underwater noise predicted to arise from the Proposed Activities to cause any direct lethal effects or physical injury in marine mammals. Furthermore, the relatively shallow water depths (9 – 33 m) and maximum distance of 12 nm from the coast of Ireland excludes the potential for actively deep diving species in the area. Therefore, it is considered that the potential lethal effects and physical injury from increased anthropogenic noise from geophysical survey equipment, geotechnical survey work or ADCP equipment are **not possible**, and there is no risk of lethal effects or physical injury to Annex IV species.

7.2.1 Geophysical survey assessment

Geophysical survey equipment is typically an impulsive sound source, which is broadly regarded as a higher risk to marine wildlife. It should be noted that sonar-based systems (e.g. MBES, SSS, SBP) have very strong directivity which means that an individual would need to be within the beam of the sound source for injury to occur. Of the geophysical equipment (outlined in Section 2.1.3 and Table 2-3) some can be excluded from further consideration in this assessment as they are passive or operate outside the hearing range of the Annex IV and other protected species included in this assessment.

7.2.1.1 TTS and PTS (auditory injury)

Five types of equipment (pingers excluded) operate within the auditory ranges of the functional hearing groups of Annex IV and other protected species included in this assessment and are capable of producing a peak SPL which exceeds the onset thresholds for instantaneous TTS and PTS (Table 7-4). This risk matrix is based on the animal being close to the sound source (within 1 m), which is highly unlikely and, therefore, extremely precautionary. It should also be noted that the geophysical surveys are expected to last for a short period of time and that high frequency noise at shallow waters (<200 m) is likely to attenuate more quickly. Although some of the equipment types may produce noise in the hearing range of marine mammals, directionality must also be considered, as well as the potential for sound propagation into the wider marine environment. For example, sound propagation through the water column on the horizontal plane from the side-scanning sonar is minimal; therefore, noise levels in this direction would decrease more rapidly with distance from the source (Trabant, 2013). As such, once the sound pulse has been emitted, the intensity is greatly reduced within a few metres due to scattering and absorption (Medwin 1970; Deane and Stokes 2010; Farcas *et al.,* 2016).

Table 7-4 The risk of instantaneous TTS and PTS from impulsive noise sources for each of the functional hearing groups where Y (orange) indicates onset is possible (using an extremely precautionary approach) and N (green) indicates that onset is not possible.

Equipment	LF (minke whale)		HF (bottlenose dolphin and common dolphin)		VHF (harbour porpoise)		PCW (harbour and grey seal)	
	TTS	PTS	TTS	PTS	TTS	PTS	TTS	PTS
Multibeam Echo Sounder (MBES)	N	N	N	N	N	N	N	N
Side-scan sonar (SSS)	N	N	N	N	N	N	N	N
Sub-Bottom Profiler (SBP)	Y	Y	Y	N	Y	Y	Y	Y
Ultra High Resolution Seismic (UHRS)	Y	Y	Y	N	Y	Y	Y	Y
Ultra-Short Base Line (USBL)	N	N	N	N	Y	Y	N	N

The MBES and SSS operate outside of the hearing range of the Annex IV and other protected species included in this assessment. Furthermore, sound from high frequency equipment is considered lower risk as it will attenuate quickly in shallow (<200 m) water (JNCC, 2010; JNCC, 2017). The maximum water depth throughout the survey area is less than 33 m. In the case of magnetometers, these are a completely passive device and do not produce any sound during operation. Therefore, there is no impact pathway associated with magnetometers, MBES, and SSS and, on this basis, they have been scoped out of this assessment.

The USBL has negligible potential to induce instantaneous PTS or TTS in both low and high frequency cetaceans as it does not exceed the Southall *et al.* (2019) thresholds (Table 7-4). However, there is potential to induce PTS and TTS in very high frequency cetaceans. The SBP and UHRS operate across a lower range of frequencies (e.g. 0.2 kHz – 16 kHz) and thus overlap all species groups hearing ranges. These pieces of equipment can also emit sound at relatively high intensities (up to and including 247 dB re 1 µPa) and as such have the potential to lead to PTS and TTS in cetaceans in the absence of mitigation, most at risk is the harbour porpoise.

To calculate the SEL and therefore assess the risk of cumulative TTS or PTS would require additional information on the specific source levels of geophysical survey equipment, the distance of the animal from the source, and the duration of the exposure, and to apply the weighting for the relevant functional hearing group. Whilst there is a theoretical potential for instantaneous and / or cumulative TTS and PTS, these impact zones are expected to be very localised and temporary, and the likelihood of such impacts is greatly reduced due to the likely displacement of animals from the area within which TTS and PTS onset would occur (see Section 7.2.1.2 for further information on behavioural responses). Through the implementation of mitigation measures (as discussed in Section 8.1), specifically ensuring separation of animals from the survey equipment using visual surveys (MMOs) or acoustic surveys, and through the reduction of operation times of higher risk equipment, there is **Negligible** potential for PTS or TTS to occur from survey works for the relevant species and no adverse effects is predicted due to the Proposed Activities.

Otters are semi-aquatic species who use the marine environment for foraging. Otters do no utilise sound in the underwater environment in the same way as cetaceans. The number of otter sightings along the coast is low with no individuals recorded no more than 100 m from shore within the Licence Application Area in 2021. Therefore, there is limited potential for interaction between this species and the Proposed Activities. The potential for PTS or TTS is therefore considered to be **Negligible**.

Due to the very low density of marine turtles likely to be found in the area, and the embedded mitigation highlighted in Section 8.1, it is unlikely that marine turtles will be within the close ranges from the survey vessels required to have the potential for PTS or TTS to arise from the geophysical surveys (e.g. SBP or UHRS). There is no potential for PTS or TTS from the MBES, SSS or USBL equipment because their operating frequencies fall outside the hearing ranges of marine turtles. Therefore, there is **Negligible** potential for PTS or TTS to occur.

7.2.1.2 Behavioural responses

As described in Section 7.1.4.2, behavioural responses to underwater noise can vary greatly, both within and between species. Considering Thompson *et al.* (2013) and Sarnocińska *et al.* (2020), the impact ranges for seismic survey airguns, with respect to behavioural responses monitored by passive acoustics, can occur up to 12 km from the source of the noise. The airgun array size and acoustic output of the equipment described by Thompson *et al.* (2013) and Sarnocińska *et al.* (2020) are likely to exceed that of any of the geophysical equipment to be used for the Proposed Activities at CWP. Harbour porpoise displacement from offshore piling noise source up to 12 km was also observed by Benhemma-Le Gall *et al.* (2021), assessed using passive acoustic monitoring. It is possible that the SBPs, UHRS and USBL may be detected by cetaceans and therefore their use may have the potential to cause behavioural effects, the most likely behavioural response will be temporary avoidance.

For the four cetacean species, the relevant management units (MU) population estimate and the density estimate from the relevant region in the ObSERVE survey (Rogan *et al.,* 2018) or SCANS-IV (Gilles *et al.,* 2023) have been used alongside the impact the impact of the activity to estimate number of animals potentially impacted (Table 7-5). The highest estimated animal density per km^2 of the two survey methods was taken forward, equivalent to the highest abundance count at one point to determine worst-case scenario and comply with the precautionary measures used. This assessment is precautionary at each stage; for example, based on the survey equipment used in Thompson *et al*. (2013) and Sarnocińska *et al.* (2020), the 12 km impact range for the geophysical survey will be larger than for the equipment used in the Proposed Activities. Following an extremely pre-cautionary approach, both a 5 km and a 12 km ZoI is added to the Licence Application Area, highlighting the different ranges of potential impact for individuals from the geophysical survey carried through to the assessment (Table 7-5).

As the geophysical surveys will occur in campaigns for two to eight months over the survey period (accounting for bad weather and downtime such as equipment failure) this method of estimating the percentage of the reference populations which have the potential to be affected is thought to be proportional to the work being conducted and shown in Table 7-5 for scoped in cetacean species and Table 7-6 for pinnipeds. It should be noted that IAMMWG (2023) uses SCANS-III data and new versions released later this year will contain SCANS-IV and ObSERVE data, potentially impacting Table 7-5 results which will need to be reviewed.

Table 7-5 The number of individuals estimated to have the potential to be disturbed by geophysical survey equipment at both 5 km and 12 km.

Species	5 km Impact radius		12 km Impact radius	
	Number of individuals within the area of potential impact	Percentage of reference population which has the potential to be affected	Number of individuals within the area of potential impact	Percentage of reference population which has the potential to be affected
Harbour porpoise	1,273	2.036%	2,611	4.176%
Common dolphin	33	0.032%	68	0.066%
Minke whale	55	0.272%	112	0.558
Bottlenose dolphin	286	97.692%	587	200%
		3.438%*		7.051%*

Source: SCANS-IV density estimates / ObSERVE estimates used in calculations from Gilles *et al*. (2023) and Rogan *et al.* (2018), reference abundance estimates used in calculations from IAMMWG (2023).

*Secondary Bottlenose dolphin reference abundance used in calculations from combined SCANS-III and SCANS-IV (Gilles *et a*l., 2023; Hammond *et al*., (2021), estimates from the Irish Sea at 8,326 rather than 293 from MU populations in IAMMWG (2023) to provide more realistic populations relevant to the Proposed Activities.

In reference to the large percentage of potential impact to the estimated bottlenose dolphin population in Irish waters, it should be noted that the reference population does not take into account the connectivity of the reference population with other areas. Studies have shown large scale movement of bottlenose dolphins around Ireland and indicated connectivity with the population on the west coast of the Republic of Ireland (O'Brien *et al.*, 2010). Long distance movements from the Atlantic to the North Sea between populations in the UK and Ireland have also been reported by Robinson *et al.* (2012). Therefore, the size of the reference population used from the Irish Sea MU is likely to be an under-representation of the number of bottlenose dolphins that may be present in the Irish and Celtic Seas. Equally, the most recent abundance estimates from the semi-resident population at Cardigan Bay in West Wales (which is within the Irish Sea MU) alone were 147 individuals (95% CI: 127 to 194; (Natural Resource Wales (NRW), 2018). The design of broad scale surveys, such as SCANS, used to derive MU population estimates are not able to capture localised, coastal populations such as that of Cardigan Bay, providing further evidence to suggest that the reference population size has been under-estimated.

Furthermore, it is important to highlight the significant difference between the SCANS-III and SCANS-IV abundance estimates of bottlenose dolphins in the Irish Sea. The SCANS-IV abundance estimate for the Irish Sea (blocks CS-D and CS-E) is 8,326 animals (Gilles *et al.,* 2023) whereas the MU population is derived from the lower SCANS-III abundance estimates, resulting in a population size of 293 (IAMMWG, 2023). As a result, the number of animals predicted to be disturbed using the density estimate from SCANS-IV is not compatible with the MU population size, resulting in a highly unrealistic proportion of the MU population estimated as impacted given that the population size is under-estimated hence the large population potential impacts in Table 7-5. When estimated number of individuals were quantified against combined SCANS abundance estimates rather than MU population size, these resulted in a much more realistic population comparison for the relative Irish MU unit until IAMMWG is updated and taken forward into this assessment.

Whilst not quantifiable in this assessment due to their low likelihood of occurrence (and thus lack of population density information), the conclusions in relation to the species assessed are considered to be appropriate / relevant for other less commonly occurring species of cetacean, and all functional hearing groups have been assessed.

Table 7-6 shows the population estimates for the two seal species that occur within the ZoI and highlights the estimated percentage of the populations potentially impacted.

Table 7-6 The estimated number of seals to have the potential to be disturbed by geophysical survey equipment at both 5 km and 12 km.

Species	5 km		12 km	
	Number of individuals within the area of potential impact	Percentage of reference population which has the potential to be affected	Number of individuals within the area of potential impact	Percentage of reference population which has the potential to be affected
Grey Seal	180	1.812%	381	3.835%
Harbour Seal	9	0.653%	22	1.597%

There is potential for otters to be present in coastal environments which overlap with the Licence Application Area and there is therefore the potential for behavioural effects due to increased noise levels and visual stimuli from Proposed Activities in the intertidal or shallow subtidal area. Effects may include reduced foraging opportunities, reduced resting and breeding locations, and unfavourable commuting routes. However, due to the coastal preference of this species, a small proportion of the population could be affected across a very short duration of the geophysical surveys. Therefore, for otters, the impact of behavioural disturbance from underwater noise during site surveys has been assessed as **Negligible.**

It has been estimated that 0.06 leatherback turtles are found per 100 km^2 in the Celtic and Irish Seas (Doyle *et al.,* 2008). It is highly unlikely due to the low densities of marine turtles found in the Irish Sea and sighted during site specific surveys that individuals will be found close enough to the noise emitting sound sources (e.g., a couple of meters) used in the geophysical surveys or any of the other Proposed Activities to be impacted. Therefore, for marine turtles, the impact of behavioural disturbance from underwater noise during site surveys has been assessed as **Negligible**.

Any effect from geophysical survey and positioning equipment is likely to be localised, short term and reversible and, where it could be estimated, the percentage of the reference population, which has the potential to be affected is typically less than 1%. Grey seals, harbour porpoises and bottlenose dolphins impacts at the population-level equates to less than 4%, 5% and 10% respectively, using the precautionary 12 km ZoI, meaning their risk is highest compared to the other species; therefore, for these species the risks relating to behavioural responses is **Minor**. For the other species assessed, the risk was assessed as **Negligible**.

7.2.1.3 Conclusion

The impact assessment concludes there is some risk of instantaneous or cumulative TTS or PTS to Annex IV species or other protected species during geophysical surveys; therefore, this effect is assessed as **Minor**. Through the implementation of mitigation measures such as utilising visual surveys (MMOs) or acoustic

monitoring (PAMs) to ensure the separation of animals from survey equipment, and through the reduction of operation times of higher risk equipment (*e.g.,* UHRS), the potential for PTS or TTS to arise from survey work is considered **Negligible** for the relevant species and no adverse effects is predicted due to the Proposed Activities.

The effect of behavioural responses from Annex IV species or other protected species as a result of the geophysical activities is assessed as **Negligible** or **Minor**, depending on the species; noting any such behavioural responses from the geophysical survey is likely to be localised, short-term and reversible.

The proposed geophysical works **are considered unlikely to present a risk** to Annex IV species and other protected species after applying the mitigation measures described in Section 8.

7.2.2 Geotechnical survey assessment and other non-impulsive sound sources / activities

Activities from the intertidal surveys (e.g. intertidal geotechnical surveys) all have the potential to result in visual and / or noise related disturbance and displacement.

Geotechnical surveys, which only emit non-impulsive sound, i.e. continuous sound, have the potential to increase anthropogenic noise in the marine environment, which in turn has the potential to affect marine mammals. However, potential effects of geotechnical surveys on marine mammals are thought to be of relatively low concern as any drilling / coring activity is generally short in duration and occurs over a small spatial scale (JNCC, 2010).

Currently, there are no specific deterrence ranges noted or predicted for geotechnical surveys, and none are outlined in any guidance documents. The lack of such guidance on deterrence ranges for geotechnical equipment is attributable to the fact that these deterrence ranges, based on the operating frequencies and SPL, will be negligible at worst, and not comparable to any geophysical survey equipment in either amplitude or footprint. The highest predicted SPL measurement is for rotary core borehole activities, which is 151 dB re 1µPa @1m. This value is based on the animal being close to the sound source (within 1 m), which is unlikely and, therefore, extremely precautionary. Therefore, the likelihood of Annex IV species and / or other protected species being disturbed by noise from geotechnical survey work is extremely low unless they are in close vicinity to the Proposed Activities. This is unlikely due to small-scale temporary displacement caused by the presence of the survey vessel itself.

7.2.2.1 TTS and PTS (auditory injury)

Geotechnical equipment types and associated activities incorporated in these Proposed Activities are CPT, vibrocore and rotary core borehole (see Geotechnical survey 2.1.2 and Table 2-2). This equipment typically produces non-impulsive sounds, which are broadly regarded as a lower risk to marine wildlife, as compared to impulsive sound sources (see section 7.1.4.1 for more information). There are few estimates of operating frequencies and SPLs of these equipment and activities published in the public domain (but see e.g. Campanella *et al*., 1986; Erbe and McPherson, 2017; Willis *et al*., 2010). For all activities the SPL range is between 124 and 194 dB re 1µPa @ 1 m, and in the case of the operating frequencies vibrocore is outside the generalised hearing range of low frequency animals such as minke whales, and on the cusp of seals in water but neither is in their estimated range of peak sensitivity (Table 7-7). In the case of the minke whales, the rotary core borehole and CPT is within the lower frequency ranges but is not within their estimated range of peak sensitivity, meaning at lower SPLs (or received levels, relative to the distance the animal is from the source) they are unlikely to be detected. Meaning this would be audible to minke whales, but would not be in the peak sensitivity range, further highlighting the precautionary approach taken to this assessment.

Table 7-7: Cross-referencing geotechnical survey equipment frequency ranges (Table 2-2) and marine mammal hearing ranges (Table 7-2) where red indicates the equipment can operate within the peak sensitivity range of the relevant functional hearing group, orange indicates it is the hearing range but not in the peak sensitivity range and green indicates it is not in the hearing range.

Equipment	Low Frequency (Minke whale)	High Frequency (Bottlenose dolphin)	Very High Frequency (Harbour porpoise)	Phocid in water (Grey and harbour seals)
Rotary Core Borehole				
Cone Penetration Test (CPT)				
Vibrocore				

Instantaneous TTS or (auditory injury in the form of) PTS is not possible for these non-impulsive sound sources. It would require additional information on the specific source levels of the equipment, the distance of the animal from the source, the duration of the exposure (which is expected to be short given borehole installation will last up to eight months with grab sampling occurring concurrently), and to apply the weighting for the relevant functional hearing group to calculate the SEL, and therefore assess the risk of cumulative TTS or PTS. Given the source levels of the equipment types to be used in the Proposed Activities, and that individual animals are likely to be displaced locally from the area primarily due to vessel presence of jack-up barge, the risk of cumulative TTS or PTS to marine mammals during geotechnical surveys is **Negligible**.

7.2.2.2 Behavioural responses

As described in Section 7.1.4.2, behavioural responses to underwater noise can vary greatly, both within and between species. The impacts of the geotechnical surveys are thought to be of low concern in relation to Annex IV species (JNCC, 2010). Nedwell and Brooker (2008) assessed the likelihood of avoidance of drilling noise and concluded that a strong reaction by the majority of individuals may occur within 1.5 m of the source, but that habituation may limit this effect, and that a mild reaction in the minority of individuals, which would probably not be sustained, could occur to 85 m from the source. Therefore, marine mammals are considered to be unlikely to be displaced by noise from geotechnical survey work unless they are in very close proximity of the source. This is unlikely due to small-scale temporary displacement which may occur as a result of the presence of any survey vessel. Individual geotechnical locations have not been assessed due to the low resolution of marine mammal data and the small spatial extent of the geotechnical surveys which allows assessment to be undertaken at the Licence Application Area scale.

It has been estimated that 0.06 leatherback turtles are found per 100 km^2 in the Celtic and Irish Seas (Doyle *et al.,* 2008). It is highly unlikely due to the low densities of marine turtles found in the Irish Sea and sighted during site specific surveys that individuals will be found close enough to the noise emitting sound sources (e.g., a couple of meters) used in the geotechnical surveys or any of the other Proposed Activities to be impacted. As such there is **Negligible** potential for behavioural responses from the Proposed Activities.

In order to ensure no non-negligible effects to otters, CWP conducted surveys in 2021 to determine whether or not otter holts are present within suitable habitat up to 100 m landward of the high-water mark at the potential landfall area. No otter sightings or evidence of activity (droppings, couches or footprints) were found. Therefore, alongside other suggested mitigation, there will be **Negligible** potential for behavioural effects resulting from underwater noise or visual disturbance on otters.

7.2.2.3 Conclusion

In view of the non-impulsive nature of noise arising from geotechnical and other intertidal surveys, as well as the localised, temporary and intermittent nature of the Proposed Activities, the impact assessment concludes there is no risk of instantaneous or cumulative TTS or PTS to Annex IV and / or other protected species during geotechnical surveys; therefore, this impact is assessed as **Negligible**.

The effect of behavioural responses from Annex IV and / or other protected species as a result of the geotechnical activities is assessed as **Negligible**. Therefore, the proposed geotechnical works are considered unlikely to present a risk to Annex IV species and / or other protected species and do not require specific mitigation.

7.2.3 Vessel Noise

Survey vessels are not considered to significantly increase vessel noise in the area above that already experience due to the baseline vessel traffic. Marine mammal responses to vessel noise will likely vary according to the vessel size, activity and speed (Sini *et al.*, 2005). Modelling estimates indicate avoidance of ranges of approximately 20 m (Inch Cape Offshore Limited (ICOL), 2013), though acclimatisation to vessel presence and noise has also been observed (Koschinski and Culik, 1997; Richardson *et al.,* 1995; Laist *et al*., 2001; Sini *et al.,* 2005; Leung and Leung, 2003). There is **Negligible** potential for behavioural responses from the Proposed Activities.

7.3 Change in water quality

The Proposed Activities have the potential to increase sediment suspension in the marine environment through the generation of sediment plumes from seabed disturbance from construction and may result in disturbance or displacement of certain mobile prey species which, in turn, may affect their availability for Annex IV species or other protected species. Impacts upon prey species may also occur through increased suspended sediment levels that may cause fish and mobile invertebrates to avoid the area effected by the Proposed Activities and may smother and hide immobile benthic prey. As marine mammals are generalist feeders and as a highly mobile species, have the ability to move elsewhere within the MU to other foraging grounds, this impact should be **Negligible**.

Sedimentation and increased turbidity are unlikely to have a direct effect on Annex IV species or other protected species and put a strain on some organism's ability to survive, that would otherwise be unaffected. However, studies have shown these effects are generally short-lived (dispersed within a few tidal cycles) and are confined mainly to an area of a few hundred metres from the point of discharge (Newell *et al.,* 1998; Hitchcock and Bell, 2004). As marine mammals often inhabit turbid and dark environments, increased turbidity from construction is thought to not impact marine mammals significantly and that instead they can use other senses when foraging (Todd *et al.,* 2015). Harbour porpoises, the most abundant cetacean species within ZoI, use echolocation to navigate and locate prey and thus would not be affected by increased turbidity. Even when increased turbidity has been shown to substantially reduce visual acuity in seals, which do not use sonar for prey detection, there is no evidence of reduced foraging efficiency (Todd *et al.*, 2015). Furthermore, the duration of the Proposed Activities is short-term in duration and has a small footprint, with sediment material likely to fall out of suspension relatively quickly. For instance, water used in the drilling process will be recycled and suspended solids settled out. Any sediments will be disposed to an appropriate licenced waste facility on land.

7.3.1 Conclusion

The potential effect of changes in water quality is assessed to be **Negligible** and the risk to Annex IV species and other protected species is unlikely; therefore, no specific mitigation is required.

7.4 Vessel Collision

Vessel strikes are a known cause of mortality in marine mammals and marine turtles (Laist *et al*., 2001). Non-lethal collisions have also been documented (Laist *et al*., 2001; Van Waerebeek *et al*., 2007). Injuries from such collisions can be divided into two broad categories: blunt trauma from impact and lacerations from propellers. Injuries may result in individuals becoming vulnerable to secondary infections. Slower vessels, following a consistent trajectory, allow animals the opportunity to avoid collisions. The risk of fatality is also reduced if vessels are moving slowly.

Avoidance behaviour by cetaceans is often associated with fast, unpredictable boats such as speedboats and jet-skis (Bristow and Reeves, 2001; Gregory and Rowden, 2001; Leung and Leung, 2003; Buckstaff, 2004), while neutral or positive reactions have been observed with larger, slower moving vessels such as cargo ships (Leung and Leung, 2003; Sini *et al*., 2005). The species under consideration are considered to be more agile than the large whales and have been shown to avoid ships (Palka and Hammond, 2001).

Marine turtles have been shown to have reduced behavioural responses to fast speed vessels and a reduced percentage of turtles avoid an oncoming vessel at faster speeds (Hazel *et al*., 2007).

Otters are found very close to shore (up to 100 m) therefore any vessels working in this area will be limited in manoeuvrability, speed, and size to allow work at these shallow depths. These factors will allow otters to avoid collisions with vessels and / or temporarily move out of the area whilst surveys are active.

Shipping activity in waters off the east coast of Ireland primarily consists of movement along shipping routes across the Irish Sea between ports in Northern England (Liverpool and Morecambe), Northern Wales (Anglesey), mainland Europe, Northern Ireland (Belfast) and the Republic of Ireland (Dundalk, Carlingford Lough, Dublin; EMODnet, 2021). Shipping routes across the Irish Sea consist of cargo routes running west to east and north to south across the Licence Application Area (EMODnet, 2021). National and international commercial fishing fleets are also present off the east coast of Ireland and throughout the Licence Application Area, including dredge, net, and pot fisheries (EMODnet, 2021). As this area is busy with respect to vessel traffic, it is likely that Annex IV species and other protected species in this region are habituated to the presence of vessels.

Slow speeds and predictable movement are known to be key factors in minimising collision risk between vessels and marine mammals (Nowacek *et al*., 2001; Lusseau, 2003; Lusseau, 2006). Once on site for geophysical surveys, the vessel is anticipated to travel slowly e.g. 4.5 to 5 knots, and in consistent and predictable patterns, following predetermined survey lines. When considering slow speeds and the predictable movement, animals have the opportunity to react to the vessel, greatly reducing the risk of collision. This has been demonstrated with similarly slow vessels as used in dredging (Todd *et al.*, 2015). The tugboat manoeuvring the jack-up barge (if required) is expected to move slowly for geotechnical surveys, allowing time for animals to respond, if necessary.

The vessels to be used for these surveys are yet to be confirmed but due to the nature of the surveys at least two different vessels will be required. When surveying, these vessels will either be stationary (geotechnical survey) or travelling at slow speeds; in a predefined trajectory (geophysical survey, benthic surveys, fish and shellfish survey) or travelling at slow speeds; in a predefined trajectory (geophysical survey, benthic surveys, fish and shellfish survey and equipment deployment (e.g. metocean), allowing animals to predict movement of

the vessels and avoid collisions. The small number of vessels that will be required for these surveys will be not significant increase vessel traffic in the Licence Application Area.

7.4.1 Conclusion

Marine mammals occur at relatively low abundance in the area of the Proposed Activities whilst marine turtles are very infrequent visitors. The addition of a small number of extra vessels associated with the Proposed Activities (i.e. transits and mobile vessel surveys such as geophysical surveys) will not significantly increase above the high level of vessel traffic which already uses the western Irish Sea, and therefore will not present a more significant risk of collision than animals already experience. In combination with the predictable movements, the slow vessel speed allows the animals to predict their path and avoid them, greatly reducing the risk of collision.

Considering the negligible risk of collision which is not elevated beyond the baseline arising from the high level of vessel traffic already in the area, it is considered no adverse effects on any conservation objectives will occur, and no adverse effects on the integrity will arise from the project alone. A risk of non-negligible effects on otters is only considered possible if a holt is present within 100 m of non-mobile survey work (i.e., environmental or geotechnical surveys).

The potential effect of vessel collision is assessed to be **Negligible** and the risk of collision between vessels and Annex IV species and / or other protected species is assessed to be unlikely; therefore, no specific mitigation is required.

7.5 Pollution events

Marine mammals, marine turtles and otters can be affected by pollution events or marine litter that can lead to death or a reduced level of health or fitness (e.g., through reduced breeding or feeding success) in populations. Should any litter and pollutants be released in the marine or intertidal environments within the Licence Application Area during the process of Proposed Activities these would have the potential to result in injury or mortality to marine mammals. In order to ensure no adverse effects on marine mammals resulting from littering or pollution associated with the Proposed Activities, all vessels undertaking survey works will adhere to (International Convention for the Prevention of Pollution from Ships) MARPOL requirements, which provide an international standard for the safe management and operation of ships for pollution prevention. This will involve adoption of routine measures and standard best practice in terms of waste management, auditing, pollution prevention measures and implementation of a dropped object protocol. Oil and fuel shall be stored securely in bunded containers. Chemicals will be stored securely, and good housekeeping practices will be adhered to always. With this best practice approach, there will be **Negligible** impact from the Proposed Activities for litter and pollution to impact marine mammals.

All vessels will be complaint with the MARPOL and the MPCP, which contain the necessary steps to initiate an external response for any oil-related discharges, or in the case of a maritime accident / collision that results in an oil spill. Published guidelines and best working practices will be adhered to, to ensure that the likelihood of accidental spills is extremely low, and therefore the risk is assessed as **Negligible**. For instance, bunded bowsers for near shore investigation works on the jack-up barge would be used to refuel plant and equipment on deck and spill kits would be employed to ensure no leakage occurs into the underlying waterway. In the unlikely event of a spill, the volumes of potential contaminants released would likely be negligible and would be rapidly gathered and disposed appropriately.

7.5.1 Conclusion

The potential effect of pollution events is assessed to be **Negligible**, and the risk Annex IV and other protected species is assessed to be unlikely; therefore, no specific mitigation is required.

7.6 Impact Interactions

With the exception of increased anthropogenic noise resulting from the geophysical survey, the Proposed Activities will only affect receptors over such small areas at a low level (i.e. negligible or minor) that even should multiple activities occur simultaneously, the effect on Annex IV marine receptors will remain **Negligible**. While the anthropogenic noise resulting from the geophysical survey affects marine mammals over a wider area, the mitigation proposed will ensure that it does not give rise to any interactions with the other surveys to cause more than negligible effects on Annex IV marine receptors. Accordingly, the Proposed Activities do not give rise to any increased impact as a result of impact interactions.

7.7 Summary of risk assessment

Annex IV and other protected species have been recorded within the Irish Sea year-round with harbour porpoise, common dolphin, bottlenose dolphin, minke whale, grey and harbour seal the species most commonly recorded within the ZoI. The assessment has followed a precautionary approach when assessing impacts of geophysical and geotechnical surveys on these most commonly recorded species and has concluded that **the Proposed Activities are unlikely to present a risk to Annex IV and / or other protected species.**

There is no risk of lethal effects or physical injury to Annex IV species. Lethal effects and physical injury are considered to be damage to body tissue, such as internal haemorrhage or tissue rupture, or generation of gas or fat emboli similar to decompression sickness which may lead to death.

Assessment of the potential for impacts from geophysical survey concluded that the effect of instantaneous and cumulative TTS and PTS (auditory injury) in hearing to the relevant cetaceans, pinnipeds, marine turtles, and otters from these activities was **Minor**. The assessment of behavioural responses was considered, at worst depending on species assessed, as **Minor**; however, any behavioural responses from the geophysical survey is likely to be localised, short-term, intermittent and reversible. Where it could be estimated for the cetacean species, the percentage of the reference populations which has the potential to be disturbed, using a very precautionary ZoI of 12-km was 4.18% for harbour porpoise, 0.07% for common dolphin, 7% for bottlenose dolphin (considering most recent SCANS IV data) and 0.56% for minke whale (Table 7-5). For seal species, the percentage of the reference populations which has the potential to be disturbed, using a very precautionary ZoI of 12-km was 3.84% for grey seals and 1.60% for harbour seals. Therefore, the impact of sound produced by operation of equipment used during the geophysical survey work is unlikely to be detrimental to the maintenance of the populations of the species concerned at a FCS in their natural range. In conclusion, through the implementation of mitigation measures, the potential for PTS or TTS to arise from geophysical survey work is considered **Negligible** for the relevant species and no adverse effects is predicted due to the Proposed Activities **nor is a derogation licence required for the geophysical surveys assessed as part of the Proposed Activities.**

Assessment of the potential for impacts from geotechnical survey concluded that the impact of instantaneous and cumulative TTS and PTS (auditory injury) in hearing and behavioural responses to harbour porpoise, minke whale, grey and harbour seal from these activities was **Negligible**. The displacement of Annex IV species or other protected species as a result of noise from geotechnical surveys is unlikely to be detrimental to the maintenance of the populations of the species concerned at a FCS level in their natural range. **In conclusion, mitigation measures are not required, nor is a derogation licence required for the geotechnical surveys assessed as part of the Proposed Activities.**

Assessment of the potential risk of collision with vessels, changes in water quality, and pollution events concluded that the effects were **Negligible** and risk of impact on Annex IV and other protected species was unlikely. **In conclusion, mitigation measures are not required, nor is a derogation licence required for these assessed impacts.**

8 MITIGATION MEASURES

8.1 Geophysical surveys

Despite the assessment concluding that mitigation measures are not required for some of the Proposed Activities, the project will follow best practice guidelines for the geophysical surveys:

- Mitigation will be implemented for all audible sources where there is potential for instantaneous TTS or PTS onset (USBL, SBP, UHRS and check shot logging);
- In situations where effective visual monitoring is not possible prior to sound producing activities, passive acoustic monitoring (PAM) will be undertaken in order to allow work to proceed. PAM is a well-established technique used worldwide for real-time monitoring of the presence of marine mammals during mitigation work. The use of PAM was integrated into the Joint Nature Conservation Committee (JNCC) guidelines in 1995 and has been a standard tool for marine mammal mitigation since 2002 (JNCC, 2023). Recent documentation by the Irish Whale and Dolphin Group (IWDG) "IWDG Policy on Offshore Windfarm Development" published in 2020 proposes that PAM should be adopted into standard mitigation protocols for Irish waters.
- A full post-survey report will be provided to the National Parks and Wildlife Service (NPWS). This report will contain details of all pre-start surveys conducted, marine mammal detections and any action taken, and how and when the sound-emitting equipment was used.
- Due to the low level of potential risk (comparatively low energies involved, the high directionality of the sound source and the proximity to the sound source to the seabed compared to true seismic surveys), the monitored zone for use of relevant geophysical survey and positioning equipment (UHRS, seismic bore-hole) will be 500 m (rather than 1,000 m); and
- Due to the low level of potential risk (comparatively low energies involved; the high directionality of the sound source and the proximity to the sound source to the seabed compared to true seismic surveys), the period over which ramp up procedures (for the UHRS) will be conducted over 20 minutes (rather than 40 minutes). This will reduce the total duration of noise emissions into the marine environment during the Proposed Activities.

The assessment of effects to Annex IV species and other protected species from the geophysical surveys presented in this report has been assessed as **Minor** in relation to instantaneous and cumulative TTS and PTS (auditory injury), and **Negligible** or **Minor** for behavioural responses. CWP is committed to a precautionary but proportionate approach to managing such risks. Consequently, mitigation will be applied following the DAHG (2014) guidance, which outlines mitigation measures applicable to all seismic surveys, including boomers, SSS and chirp system.

To adhere to the DAHG (2014) guidance, it is proposed that the mitigation measures, including use of MMO's to monitor the 500 m marine mammal mitigation zone (MMMZ), are followed during the use of multibeam eco-sounders, boomers, SSS and / or chirp system.

In addition, mitigation measures will also be applied to MBES, SSS, and SBP – pinger / chirp equipment when used for nearshore works within a bay, inlet or estuary, or within 1,500 m of the entrance of an enclosed bay, inlet or estuary as per DAHG (2014) guidance.

Once mitigation is applied the impact on Annex IV species and other protected species as a result of TTS and / or PTS, or disturbance as a result of geophysical surveys will be **Negligible.**

8.2 Geotechnical and grab sampling surveys

The DAHG (2014) guidance does outline mitigation measures which are applicable to some geotechnical surveys, such as drilling operations, but that these are subject to a risk assessment on a case-by-case basis. In this case, for the Proposed Activities, the risk assessment concluded that all aspects of the geotechnical surveys or environmental survey work were **Negligible**. Therefore, as noted in Section 7.2.2.3, it is concluded that no specific mitigation is required for geotechnical survey activities associated with these Proposed Activities. Despite this, as a responsible developer, CWP will commit to use of a marine mammal observer on its vessels.

8.3 Other impacts

In order to ensure no adverse effects on marine mammals resulting from littering or pollution associated with the Proposed Activities, all vessels undertaking survey works will adhere to MARPOL requirements, which provide an international standard for the safe management and operation of ships for pollution prevention. This will involve adoption of routine measures and standard best practice in terms of waste management, auditing, pollution prevention measures, and implementation of a dropped object protocol. Oil and fuel shall be stored securely in bunded containers. Chemicals will be stored securely, and good housekeeping practices will be adhered to always.

All other risks to Annex IV species and other protected species assessed in this report have been assessed as **Negligible**.

It is therefore concluded that no further specific mitigation is required in relation to vessel presence, changes in water quality or pollution events.

CONCLUSION

This assessment of the potential impacts on marine Annex IV species and other protected species from Proposed Activities relating to the CWP **are unlikely to present a risk nor require a derogation licence** and concluded that:

- There is **no potential** for lethal effects or physical injury;
- The potential for PTS and TTS is considered **Negligible** after mitigation (i.e. MMO of MMMZ as highlighted in Section 8);
- The potential for behavioural response is considered to **Negligible**;
- The potential for collision risk is considered **Negligible**; and
- The potential for impacts relating to pollution events is considered **Negligible**.

Overall, a precautionary assessment of the impacts and risk to Annex IV species and other protected species from the CWP area concluded that there were no adverse effects to Annex IV species or other protected species, or their FCS because of any of the Proposed Activities. The assessment of effects to Annex IV species and other protected species from the geophysical surveys has been assessed as **Minor** in relation to effect of instantaneous and cumulative TTS and PTS (auditory injury), and **Minor** at worst (depending on species assessed) for behavioural responses. CPW will adopt a precautionary approach, and mitigation will be applied for relevant geophysical activities following the DAHG (2014) guidance, to further reduce any risk to these species to **Negligible**.

It is recommended that best practice mitigation measures detailed in DAHG (2014) are applied to the relevant geophysical surveys (multibeam eco-sounders, boomers, side-scan sonar and chirp system, only; see Section 7.1) during the Proposed Activities. In addition, best practice mitigation measures will also be applied to all MBES, SSS, and SBP - pinger/chirp equipment during survey works conducted within a bay, inlet or estuary, or within 1,500 m of the entrance of an enclosed bay, inlet or estuary in accordance with DAHG (2014) guidance.

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