MWP

SUPPORTING INFORMATION FOR DEROGATION LICENCE

Marine Site Investigation Surveys at Dognose, Corkbeg, Whitegate, Co. Cork

Port of Cork Company

April 2026

Contents

1. Introduction 1
1.1 Purpose of the Report 1
1.2 Statement of Authority 1
2. Project Description 2
2.1 Site Location 2
2.2 Description of the Proposed Marine Site Investigation Works 3
2.3 Schedule of Works 4
2.3.1 Geophysical Surveys 4
2.3.1.1 Sub bottom profiler (SBP) Single Channel Seismic Reflection 4
2.3.1.2 Underwater multichannel analysis of surface waves (UMASW) and Seismic Refraction Surveys 5
2.3.2 Geotechnical Surveys 6
2.3.2.1 Borehole Sampling 6
2.3.2.2 Cone Penetration Test (CPT) 7
2.3.3 Environmental Surveys 8
2.3.3.1 Sub-tidal Benthic and Video Surveys 8
2.3.3.2 Intertidal Benthic Survey 9
2.3.3.3 Marine Mammal Surveys 10
2.3.4 Vessels 10
2.4 Indicative Outline Programme of Works 10
3. Risk Assessment for Annex IV Marine Species 12
3.1 Legislative Context 12
3.2 Relevant Annex IV Species 12
3.3 Other Annex IV Species 16
3.4 Non-Annex IV Species of Conservation Interest 18
3.4.1 Pinnipeds 18
3.5 Methodology 19
3.5.1 Test 1: Reasons for Seeking Derogation 19
3.5.2 Test 2: No Satisfactory Alternative 19
3.5.2.1 Alternatives 20
3.5.2.2 Do Nothing Scenario 22
3.5.3 Test 3: Favourable Conservation Status 26

4. Impact Assessment 29
4.1 Literature Review 29
4.1.1 Geophysical Survey Impacts 29
4.1.2 Side scan sonar, sub-bottom profiling 30
4.1.3 Cone Penetration Tests (CPTs) 31
4.1.4 Increased turbidity 31
4.1.5 Indirect impacts on prey 32
4.2 Risk Assessment 32
4.2.1 Acoustic disturbance 32
4.2.1.1 Effects on Marine Mammals 32
4.2.1.2 Otter and Marine Turtles 33
4.2.1.3 Bats 33
4.2.2 Physical Disturbance 33
4.2.3 Collision Risk 33
4.2.4 Indirect impacts on preferred prey 33
4.2.5 Potential disturbance to life cycle 33
4.2.6 Cumulative Effects 33
5. Mitigation Measures 34
5.1.1 Disturbance 34
5.1.2 Collision, injury and mortality 34
5.1.3 Disruption of normal behaviour 34
5.1.4 Residual Impacts 35
6. Conclusion 35
7. References 36

Tables

Table 2-1: Indicative Outline Programme of Works 11
Table 3-1: Comparative Analysis 23
Table 3-2: Selected Geophysical Survey Sources and their Modelled Specifications 27
Table 3-3: Typical Sound Characteristics of a range of Sub-Bottom Profilers 27
Table 3-4: Cetacean sightings recorded in Cork Harbour and Adjacent Waters 2012-2021 28
Table 4-1: Selected Geophysical survey sources and their modelled specifications 30
Table 4-2: Typical sound characteristics of a range of sub-bottom profilers 31

Figures

Figure 2-1: Location of Proposed Marine SIs 2
Figure 2-2: Site Layout Map with Indicative Sample Locations 4
Figure 2-3: Pinger Sub-Bottom 5
Figure 2-4: Boomer Sub-Bottom 5
Figure 2-5: Example of Sparker Sub-Bottom Profiler 5
Figure 2-6: General Principle of Marine Seismic Refraction Survey 6
Figure 2-7: Example of a Jack-Up Barge 7
Figure 2-8: Single Van Veen Grab 9
Figure 2-9: Hamon Grab Sampler 10
Figure 3-1: Sightings of Dolphins in Cork Harbour and adjacent waters 14
Figure 3-2: Sightings of Harbour Porpoise and Basking Shark in Cork Harbour and adjacent waters 14
Figure 3-3: Sightings of Baleen Whales in Cork Harbour and adjacent waters 16
Figure 3-4: Map of Leatherback turtle sightings records around Cork Harbour 17
Figure 3-5: Map of Otter distribution around Cork Harbour (left) and around Cork (right) 17
Figure 3-6: Map of common pipistrelle bat distribution around Cork Harbour 18

Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Status
23686	6004	A	October 2025	WM	HD	KF	ISSUE
23686	6004	B	December 2025	WM	HD	KF	ISSUE
23686	6004	C	April 2026	WM	HD	KF	ISSUE

MWP, Engineering and Environmental Consultants
Address: Park House, Bessboro Road, Blackrock, Cork, T12 X251, Ireland

www.mwp.ie

QUALITY I.S. EN ISO 9001:2015 NSAI Certified
HEALTH & SAFETY I.S. ISO 45001:2018 NSAI Certified
ENVIRONMENT I.S. EN ISO 14001:2015 NSAI Certified
BUILDING INFORMATION MODELLING ISO 19650-2:2018 NSAI Certified
ENGINEERS IRELAND CPD ACCREDITED EMPLOYER

Disclaimer: *This Report, and the information contained in this Report, is Private and Confidential and is intended solely for the use of the individual or entity to which it is addressed (the "Recipient"). The Report is provided strictly on the basis of the terms and conditions contained within the Appointment between MWP and the Recipient. If you are not the Recipient you must not disclose, distribute, copy, print or rely on this Report (unless in accordance with a submission to the planning authority). MWP have prepared this Report for the Recipient using all the reasonable skill and care to be expected of an Engineering and Environmental Consultancy and MWP do not accept any responsibility or liability whatsoever for the use of this Report by any party for any purpose other than that for which the Report has been prepared and provided to the Recipient.*

1. Introduction

The Port of Cork Company (PoCC) (the Applicant) is submitting a Marine Usage Licence (MUL) application for Marine Site Investigation (SI) Surveys (hereafter referred to as the 'proposed works') at Dognose Bank, Corkbeg, Whitegate, Co. Cork (hereafter referred to as 'proposed works site') to the Maritime Area Regulatory Authority (MARA).

MARA is responsible for the licencing of any works to be carried out in Ireland's marine areas. The aim is to ensure that all potential impacts from such works are identified and mitigated and/or prevented where possible. To this end, it is found a derogation licence from the NPWS is required to allow for the effective and safe undertaking of the SIs to protect Annex IV species located in the area of the proposed works. This is being applied for under Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I No. 477 of 2011), as amended.

1.1 Purpose of the Report

This report has been prepared by Malachy Walash and Partners Ltd. (MWP) for the Applicant. The report is to provide supporting information to aid in the granting of a derogation licence to allow the SIs to be carried out at the site, located at Corkbeg, Whitegate, Co. Cork in Cork Harbour.

The application is being made under Regulation 54 (2)(c), which states:

> *'In the interest of public health and public safety, or for other imperative reasons overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment'.*

This application has been carried out in adherence to the Applications for Regulation 54 Derogations for Annex IV Species Guidance for Applicants prepared by the Department of Housing, Local Government and Heritage published in July 2025.

1.2 Statement of Authority

The application has been prepared by William Murphy MSc., BA (Hons), HDip, a Grade II Environmental Consultant at MWP. William has 4 years' experience in environmental consulting, and in this time contributed to various marine projects, including Offshore Windfarms, Aquaculture sites, Site Investigations and infrastructure projects. This includes a suite of environmental reports including EIA Screenings, Statutory Information Supporting Appropriate Assessment, and a variety of MARA applications for marine projects. This experience makes William an appropriately qualified, trained and competent professional, having environmental experience gained through a variety projects.

This report was reviewed by Hazel Dalton (BSc., BBus.). Hazel is a Principal Ecologist with over ten years' experience with MWP since graduating with a first-class Honours Degree in 'Wildlife Biology' from Munster Technological University (MTU) in 2015. Hazel is experienced in ecological surveying and impact assessment for Appropriate Assessment (AA) and EIAR. She has authored and contributed to numerous screening reports for AA, Natura Impact Statements (NIS) and Ecological Impact Assessment (EcIA) reports. Hazel is an experienced field ecologist with a diverse ecological survey profile including habitats and flora, mammals, bats, birds and terrestrial invertebrates. She has held/holds National Parks and Wildlife Service (NPWS) Licences for small mammal trapping,

tape lure/endoscope bird surveys, Kerry slug surveys, disturbance of bat roosts and photographing wild animals (badger and otter) at their resting/breeding places.

2. Project Description

2.1 Site Location

The marine SI works proposed by the Applicant will be undertaken at Dognose Bank, Corkbeg, Whitegate, Co. Cork. The area of the MUL is circa. 98.20 hectares (ha) and is located approximately 1.6km west of Whitegate village. Figure 2-1 shows the location of the proposed SIs. The proposed marine SI works site is an offshore area to the south-east of Cork Harbour near the mouth of the harbour, along the eastern headland. This area is approximately 16km southeast of Cork City and 3.0km to 3.5km north of Roches Point. Water depth within the proposed marine SI works site is up to 18m deep. The land around the proposed marine SI works site is mainly agricultural and industrial land. The Irving Oil Whitegate Oil Refinery and Bord Gáis Energy Whitegate Power Station is also located on the headland, approximately 0.15km east of the proposed marine SI works site. It is a busy stretch of water, used by port traffic to access the Cork City docks, Tivoli docks, Ringaskiddy, Cobh and Whitegate oil refinery as well as other smaller harbours and marinas within greater Cork Harbour. Corkbeg Island, a small island, tied to the shore by a short, manmade causeway, and entirely taken up by the storage tanks of the Whitegate Oil Refinery is located directly to the east of the MUL area. A jetty extends northwest wards from Corkbeg Island into the harbour where large oil tankers berth.

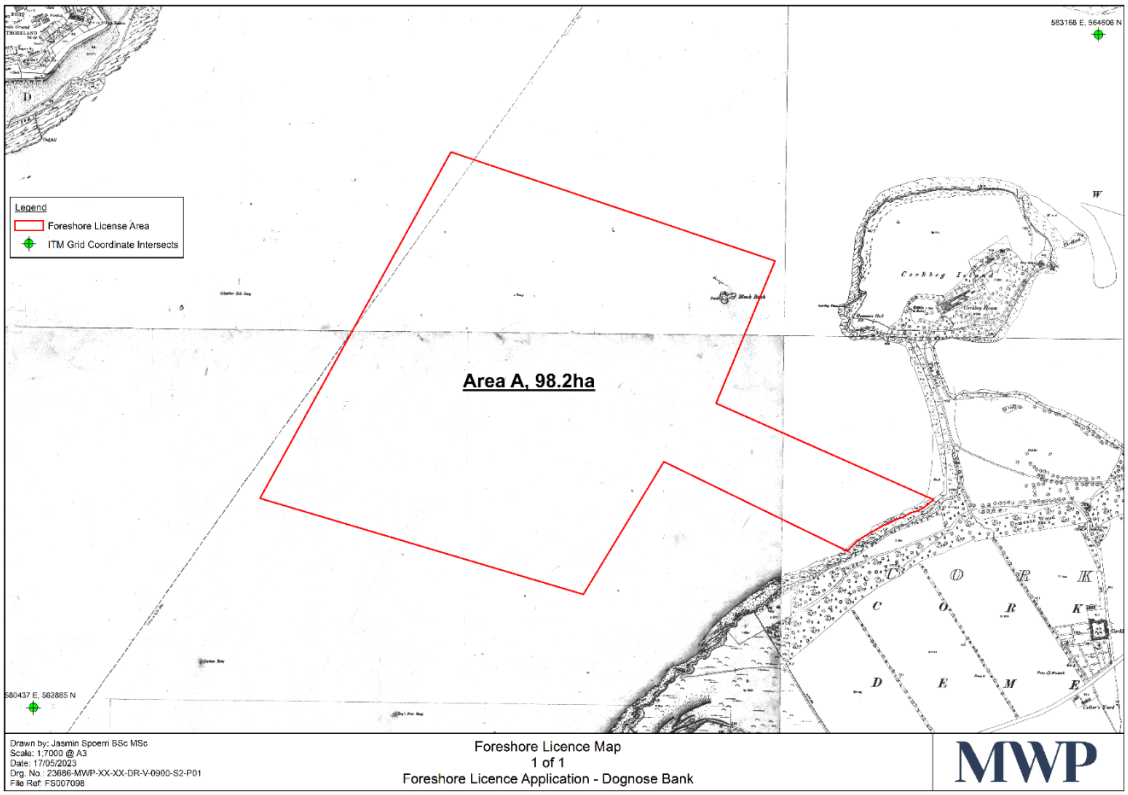

Figure 2-1: Location of Proposed Marine SIs

2.2 Description of the Proposed Marine Site Investigation Works

As discussed above this Report concerns the proposed marine SI works that are required to inform potential future development in this area as outlined in the Port of Cork Masterplan.

This section provides a high-level overview of the proposed SIs. The survey works will most likely be carried out following award of the MUL and derogation, and subject to weather conditions and vessel availability. The exact mobilisation dates for the SI activities will not be known until a MUL and derogation licence has been secured and the process of procuring the contractor is complete. Most survey activities will only occur over a period of weeks. The time spent at each individual location will be a maximum of 2-3 days for other site investigation activities such as boreholes, Cone Penetrometer Tests (CPTs), grab sampling etc.

The following surveys works are planned:

- Geophysical survey: consist of sub bottom profiler single channel seismic reflection, underwater multichannel analysis of surface waves (UMASW) and seismic refraction surveys. The surveys are non-invasive and the interpretation of the geophysical survey forms the basis of the scope of work for geotechnical surveys.
- Geotechnical survey: the purpose of the geotechnical survey is to evaluate the nature and mechanical properties of the superficial seabed sediments along the survey corridor. Approximately 20 boreholes (cable percussive with rotary follow-on) and 20 CPTs will be required in total, along with associated sampling and laboratory testing.
- Environmental surveys including sub-tidal benthic and sub-tidal video surveys. Benthic habitats have a year-round survey period. The epifauna survey period is between April and the end of September. If required algal species survey has a survey period of May – August.
    - Sub-tidal Benthic Survey: used to sample for marine habitats and fauna. Van-Veen grab taken for benthic faunal analysis aid in the classification of submerged habitats.
    - Sub-tidal Video survey: provides footage to aid in the classification of submerged habitats. This is a non-invasive survey for habitats and fauna.
- Intertidal Benthic Survey: a series of cores will be taken in the soft sediment intertidal sections of the survey area.
- Marine mammal surveys: Marine mammals are typically surveyed from the shoreline via vantage point surveys. Surveyor uses a telescope and binoculars to scan the study area. This survey will be supplemented by an underwater acoustic survey. Survey for marine mammals may occur year-round taking account of species-specific movements.

Indicative locations of boreholes and CPTs are provided in Figure 2-2. It has been assumed that the geotechnical and geophysical surveys will be conducted across the whole of the MUL area.

The NPWS has produced guidance, *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* for the operation of geophysical seismic surveys in relation to marine mammals (NPWS, 2014). This methodology is standard practice for conducting geophysical seismic surveys. This guidance has been included as part of the operational methodology in the tender specification document for the marine SI works.

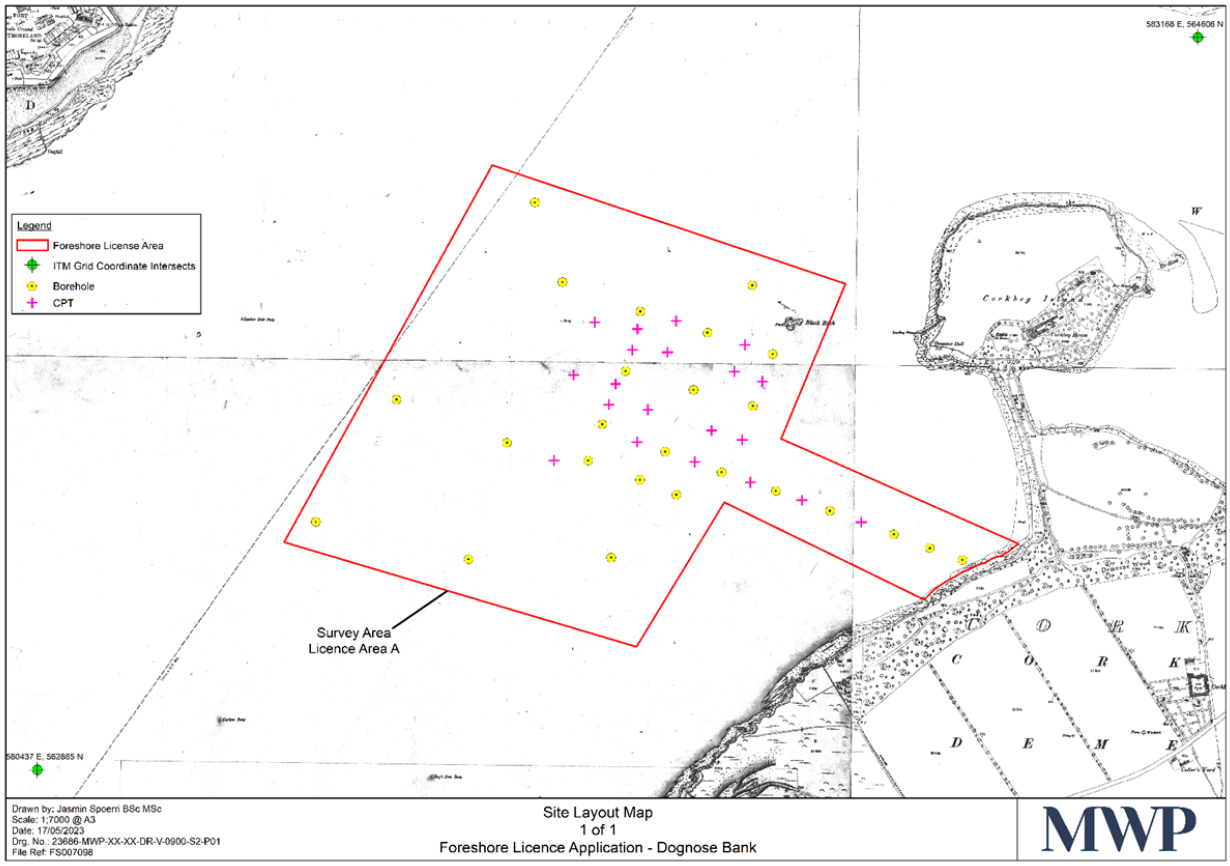

Figure 2-2: Site Layout Map with Indicative Sample Locations

2.3 Schedule of Works

2.3.1 Geophysical Surveys

This consists of sub bottom profiler single channel seismic reflection, underwater multichannel analysis of surface waves (UMASW) and seismic refraction surveys. These non-invasive surveys are likely to take **3 weeks** to complete, and the interpretation of the geophysical survey will form the basis of the scope of work for geotechnical surveys.

2.3.1.1 Sub bottom profiler (SBP) Single Channel Seismic Reflection

Shallow Sub-Bottom Profiling (SBP) aims to create a 2-D image of the subsurface up to potential depths of approximately 10-50 m below seabed, depending on the geological conditions encountered and the choice of system used. Different types of SBP are available including chirp, boomer (**Figure 2-3**), pinger (**Figure 2-4**), sparker (**Figure 2-5**) and parametric chirp systems.

The SBP system will be used to determine the stratigraphy across the survey area and quantify the variability in the lateral and vertical extents to a depth of at least 50m below seabed if necessary.

The exact equipment used will be confirmed following the appointment of a survey contractor. The Seatronics Edgetech 3300 may be taken as an indicative example of a hull-mounted pinger system and would have an expected operating frequency range of approximately 2-16 kHz with sound pressure levels of 200dB re1µPa at 1

metre range. The Applied Acoustics may be taken as an indicative example of a boomer source and would have an expected operating frequency of approximately 2.5 kHz with sound pressure levels in the range of 208- 215dB re1µPa at 1 metre range. The Geo-Source 200 or the Applied Acoustics Squid 500 may be taken as an indicative example of a towed sparker system, with sound pressure levels in the range of 204-216dB.

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

Figure 2-4: Boomer Sub-Bottom

Figure 2-3: Pinger Sub-Bottom

Figure 2-5: Example of Sparker Sub-Bottom Profiler

2.3.1.2 Underwater multichannel analysis of surface waves (UMASW) and Seismic Refraction Surveys

The geophysical investigations where possible will involve seismic refraction. The multichannel analysis of surface waves (MASW) is a seismic method used to evaluate the shear-wave velocities of the subsurface materials through the analysis of the dispersion properties of surface waves. Marine seismic refraction is similar but works at a deeper level where profiles are produced defining the interface between the differential layers by the P-Wave velocities.

Both survey techniques will be performed around the MUL area to provide information on subsurface sediment layers and thickness. A series of geophones will be laid out across the intertidal area and an impact (typically from a sledgehammer or similar impact method) onto a metal plater will be used to send an acoustic energy wave into the sediments, which travel vertically and laterally and refracts/reflects from the “harder or variable density” layers below the beach surface. The outgoing and returning impulse will be recorded on a portable logger co-

located along the same survey line (seismic refraction line) of interest. Figure 2-6 represents the general principle of marine seismic refraction survey.

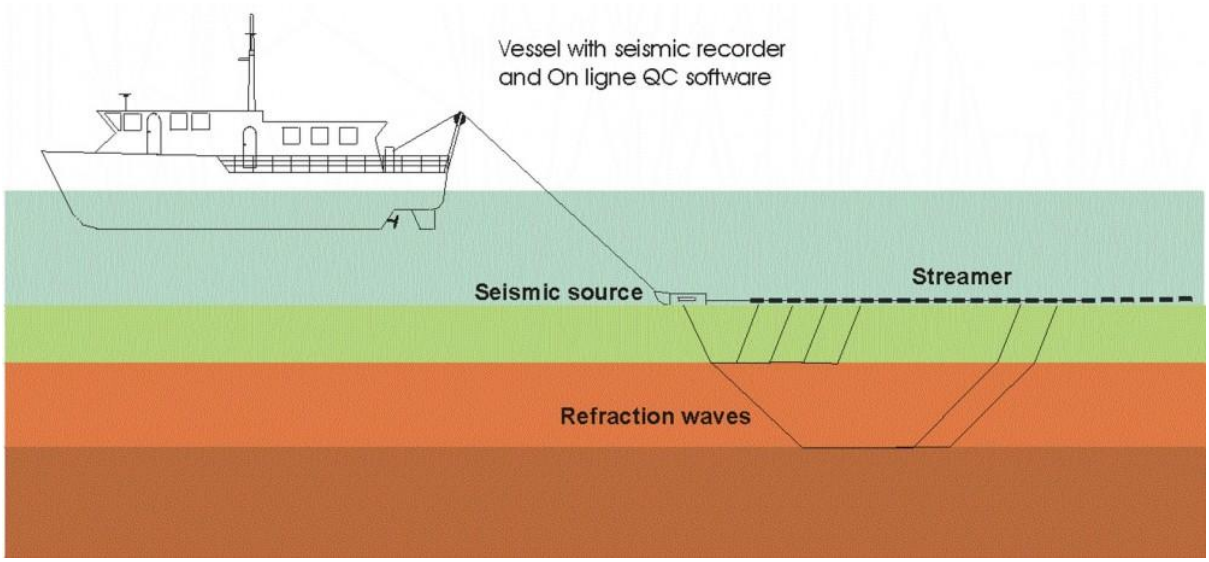

Figure 2-6: General Principle of Marine Seismic Refraction Survey

2.3.2 Geotechnical Surveys

The purpose of the geotechnical survey is to evaluate the nature and mechanical properties of the superficial seabed sediments along the survey corridor. Approximately 20 boreholes (cable percussive with rotary follow-on) and 20 CPTs will be required in total, along with associated sampling and laboratory testing. The exact location of the geotechnical sampling, within the survey corridor will be determined following interpretation of the geophysical. Indicative locations are outlined in Figure 2-2. The intrusive investigation works are likely to take 12 weeks to complete.

2.3.2.1 Borehole Sampling

The borehole sampling will be located in various water depths and will be performed by a geotechnical drilling rig mobilised on board a jack-up barge (Figure 2-7). This scope of work shall comprise of sampling boreholes and CPT boreholes that may be co-located. This shall provide *in situ* soil properties and recover soil samples or rock cores for the full depth range of interest.

During drilling, borehole wall integrity will be maintained using drilling mud mixed with sea water. This drilling fluid is typically comprised of biodegradable miscible guar gum. During fieldworks, the retrieved samples and cores shall be logged, and the CPT data processed and interpreted, to produce borehole and CPT logs that includes interpreted stratigraphy.

Figure 2-7: Example of a Jack-Up Barge

2.3.2.2 Cone Penetration Test (CPT)

Seabed CPTs involve mobilising a self-contained and automated CPT test unit housed within a seabed frame. This frame is typically kept on the deck of a dynamically positioned vessel and may be deployed using a dedicated Launch and Recovery System (LARS) - such as an A-frame. The vessel will hold station over the target position and deploy the CPT unit. The CPT is connected to the vessel via an umbilical, which acts as a lift wire and data transfer umbilical. Depending on the CPT unit, the CPT rods may need to be built up overboard prior to deployment through the water column. Once on seafloor, the cone is pushed into the seabed until it reaches refusal. Refusal is defined as the point where one of the following criteria are met: target penetration depth is reached, maximum system thrust is reached, excessive load on the tip or the sleeve, or excessive cone inclination occurs, or a combination of these. The objective of the survey will typically define the size and configuration of the CPT unit. A lightweight CPT unit with maximum penetration depth of 10m, may weigh about 5 tonnes. The test typically takes 2 to 5 minutes, depending on the target penetration depth, however total time taken to be deployed and recovered may be in order of one to two hours. If at each location the technical requirements of the project are met, the CPT unit is lifted back on to the vessel and the vessel moves on to the next location.

2.3.3 Environmental Surveys

2.3.3.1 Sub-tidal Benthic and Video Surveys

Benthic habitats have a year-round survey period availability. The epifauna survey period is between April to September. If algal species are deemed necessary, they survey period for these is May to August. Once tendering is complete and a contractor appointed, the duration of these surveys will be established by the contractor.

- Sub-tidal Benthic Survey: used to sample the marine habitats and fauna. Van-Veen grab taken for benthic faunal analysis aid in the classification of submerged habitats; and,
- Sub-tidal Video Survey: provides footage to aid in the classification of submerged habitats. This is a non-invasive survey for habitats and fauna.

In any case where benthic sampling is not possible, sufficient video and stills will be taken from the sample location to identify existing habitats (to include Annex I habitats) and the habitat boundaries. This survey provides camera footage to aid in the classification of submerged habitats and is a non-invasive survey for habitats and fauna.

The SeaSpyder Telemetry system is a typical underwater camera system and is designed for operation in water depths up to 1000m utilising standard coaxial sonar umbilicals. This system is one of the most commonly used camera systems for underwater video inspections. The system as standard offers simultaneous uninterrupted recording of low latency live video footage along with high resolution stills photography, along with interfacing to a wide range of sensors and dataloggers. The stills camera is fitted with a high quality 18 mega pixel digital SLR Camera offering full control of all photographic parameters including manual focus, shutter speed and aperture. The stills camera is housed within a robust 1000m rated aluminium enclosure along with an internal IP video camera. All data is transferred directly to the surface unit for live interpretation, this includes video, stills photos, serial sensor data and ethernet data such as an imaging sonar.

Grab samplers are used to recover samples from approximately the top 0.2 - 0.5m of seafloor. These samples may be used to classify the seabed, or for biological analyses. These samples are generally deployed overboard using a crane from a vessel.

There are various grab sampler types to include but not limited to Van Veen, Hamon and Day Grab samplers. Generally, some variants may come either as single or double, and in a variety of different sizes.

Grab samplers generally comprises of steel buckets that are deployed open and which trigger shut when the sampler is in contact with the seafloor. As the buckets close, sediment and biological material are retained inside the sampler. The grab sampler is then recovered to deck and place on a trestle or table. The retained material is then visually inspected for acceptance and then transferred to adequate container or on to a designated mat for further offshore processing and logging.

Single Van Veen Grab (Figure 5-1) is ideal for the collection of sediment samples for biological and environmental sampling. In a range of sizes (0.025m^2, 0.1m^2, 0.2m^2, 0.3m^2) each model has a marine grade stainless steel bucket with hinged access flaps on the top allowing sub sampling of the collected sediment before it is emptied from the grab. The bucket is operated with a pair of stainless-steel lever arms that increase the tension to secure the sample securely in the grab as it is retrieved to the surface. Additional lead weights can be added to the back of the bucket to improve stability in strong currents and to the lever arms to increase the equipment's ability to perform in harder conditions.

Figure 2-8: Single Van Veen Grab

Generally, any grab sampling will be carried out by deploying sampling gear from the vessel, as per standard operation procedure for deck works involving this kind of equipment taking into account the technical specification of the grab in use. Various grabs will be available for the benthic survey provision to ensure adequate sampling equipment for various sediment types. From the grab samples a small amount of sediment can be retained for Particle Size Analysis and Loss on Ignition Analysis.

Van Veen/other suitable methods will be used for soft sediments for quantitative benthic infauna analysis and for physio–chemical analysis. Colonial and epifaunal species will be recorded qualitatively. Sediment samples for physio–chemical analysis will be acquired for later laboratory analysis.

2.3.3.2 Intertidal Benthic Survey

A series of cores will be taken in the soft sediment intertidal sections of the survey area. At each site typically:

1) a single stove-pipe core (19cm Ø) is taken for macrofaunal analysis;

2) A single sediment scrape is taken from the sediment surface for Particle Size Analysis (PSA) and Loss on Ignition (LOI), and;

3) A photographic record is taken. Notes of sediment type and obvious epibenthos will be recorded.

Survey period for these intertidal surveys is April to September. The duration of these surveys will be confirmed once a contractor is appointed after the tendering process.

Mini and Standard Hamon Grabs (0.1m^2 and 0.2 m^2 respectively are particularly used for the collection of samples generally from coarse (sand and gravel) sediment substrates and used for benthic macrofauna and particle size measurement. The grab is relatively simple to operate in almost any water depth.

A 0.1m² sample area is a standard practice used in many benthic sampling applications. The Hamon Grab (Figure 2-9) is a box shaped sampling scoop mounted in a triangular frame. Upon contact with the seabed, tensioned wires are released, which causes the sampling bucket to pivot through 90º pushing seabed sediment into the bucket. On completion of its travel the open end of the bucket comes against a rubber sealed steel plate which stops the sediment escaping during recovery. 0.1m² Hamon Grab refers to 0.1m² area of seabed sampled. The depth of scoop penetration is up to 20cm. On recovery the grab is landed onto a rectangular base from where access can be gained

to the inside of the bucket via an inspection window. Whilst in the stand the grab sample can then be easily emptied into a sampling container located under the bucket.

Figure 2-9: Hamon Grab Sampler

2.3.3.3 Marine Mammal Surveys

Marine mammals are typically surveyed from the shoreline via vantage point surveys. The surveyor uses a telescope and binoculars to scan the study area. This survey will be supplemented by an underwater acoustic survey. Surveys for marine mammals may occur year-round taking account of species-specific movements. An Annex IV Species Risk Assessment for the proposed SI works has been undertaken by Dr Simon Berrow of the Irish Whale and Dolphin Group (IWDG). Mitigation is recommended through provision of a Marine Mammal Observer (MMO) during geophysical and geotechnical activities to comply with NPWS (2014) guidelines. The duration of these surveys will be the same as the duration of the geotechnical and geophysical surveys. Mitigation, once implemented, will result in no significant negative impacts on marine mammals.

2.3.4 Vessels

Dedicated survey vessels will be used which are appropriate to the water depth of the survey area; a vessel with a shallow draft will be utilised for the shallow water survey area. The exact equipment to be used will be confirmed following a tender process to procure the survey contractor.

A jack-up platform will likely be used to acquire geotechnical boreholes in the application area. Exact details of the vessel/platform to be used will not be confirmed until the ground investigation contractor can be confirmed. Positioning at the site will require the use of a tug vessel.

2.4 Indicative Outline Programme of Works

The intention is to begin survey activities as soon as feasible following grant of license and contractor appointment, with a staged programme of investigations, capitalising on suitable weather windows over this time period. The exact mobilisation dates will not be known until the MUL and Derogation licence has been obtained and the process of procuring a contractor is complete. It is estimated that the proposed works will take approximately 19 weeks to complete in the field. See Table 2-1 for an indicative Outline Programme of Works.

Table 2-1: Indicative Outline Programme of Works

Survey	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19
Geophysical																			
Geotechnical: Boreholes and CPTs																			
Environmental: Sub-tidal Benthic and Sub-tidal Video																			
Intertidal Benthic																			
Marine Mammals																			

3. Risk Assessment for Annex IV Marine Species

3.1 Legislative Context

Irish cetaceans (whales, dolphins and porpoises), pinnipeds, otter and Leatherback Turtle are all protected under national legislation and under a number of international directives and agreements which Ireland is signatory to. All cetaceans, as well as grey and harbour seals, are protected under the Wildlife Act (1976) and amendments (2000, 2005, 2010 and 2012). Under the Act and its amendments, it is an offence to hunt, injure or wilfully interfere with, disturb or destroy the resting or breeding place of a protected species (except under license or permit). The Act applies out to the 12 NM limit of Irish territorial waters.

All cetaceans, otter and Leatherback Turtle are protected under Annex IV of the EC Habitats Directive (92/43/EEC). The Directive lists Annex IV species of community interest 'in need of strict protection'. Pinnipeds are not listed on Annex IV but are listed on Annex II, which also includes the harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), leatherback turtle (*Dermochelys coriacea*) and otter (*Lutra lutra*) which are of community interest and whose conservation requires the designation of special areas of conservation.

Ireland is also signatory to conservation agreements such as the Bonn Convention on Migratory Species (1983), the OSPAR Convention for the Protection of the Marine Environment of the northeast Atlantic (1992) and the Berne Convention on Conservation of European Wildlife and Natural Habitats (1979).

Under the EU Marine Strategy Framework Directive with respect to maintaining good environmental status (GES), "*human activities should occur at levels that do not adversely affect the harbour porpoise community at the site" and "proposed activities or operations should not introduce man-made energy at levels that could result in a significant negative impact on individuals and/or the community of harbour porpoise within the site". This refers to the "aquatic habitats used by the species in addition to important natural behaviours during the species annual cycle*".

In 2007, the National Parks and Wildlife Service (NPWS) of the Department of Arts, Heritage and the Gaeltacht produced a 'Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters (NPWS, 2007). These were subsequently reviewed and amended to produce 'Guidance to Manage the Risk to Marine Mammals from Man-Made Sound Sources in Irish Waters' (NPWS, 2014). The guidelines recommend that listed coastal and marine activities be subject to 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.

Once the listed activity has been subject to a risk assessment, the regulator may decide to refuse consent, to grant consent with no requirement for mitigation, or to grant consent subject to specified mitigation measures.

3.2 Relevant Annex IV Species

Bottlenose dolphin (*Tursiops truncatus*)

Bottlenose dolphins occur off the Cork coast (**Figure 3-1**) but at relatively lower frequency than along the west coast (Berrow et al. 2010). Animals encountered inshore are likely to derive from a coastal population which range around the entire Irish coastline and to adjacent UK and mainland Europe coasts (O'Brien et al. 2009; Robinson et al. 2012).

Many historic bottlenose dolphin sightings in the vicinity of Cork Harbour relate to a small pod of 6-7 bottlenose dolphins which were resident at the mouth of Harbour (Ryan et al. 2010). Although bottlenose dolphins are

frequently recorded, no sightings of this "resident" group have been reported since May 2013. Sightings of small groups of non-resident dolphins occur throughout the year but data from land-based effort watches indicate a peak in late autumn / early winter which may coincide with the presence of pelagic schooling fish in the area. Bottlenose dolphins are typically encountered in group sizes of 5 but up to 30 animals. Larger group sizes have been recorded but predominantly in offshore areas. Inshore animals will readily approach vessels but are less likely to engage in extended periods of bow riding than common dolphins.

Common dolphin (*Dephinus delphis*)

Common dolphins occur frequently and at high densities off the Cork coast (Wall et al. 2013). They are frequently encountered in the area for most of the year (**Figure 3-1**) including in the inner harbour near the city, though these individuals frequently live strand and die. Abundance typically falls to a minimum during April and May but peaks in the vicinity of Cork Harbour during autumn and winter, coinciding with the presence of pelagic schooling fish in the area (Wall et al. 2013). Common dolphins are regularly recorded at the spoil grounds (**Figure 3-1**). They are gregarious and commonly occur in group sizes of tens of animals. During the autumn and winter, group sizes numbering many tens or even hundreds of animals are not uncommon off the Cork coast. They readily approach vessels and may bow ride for extended periods.

Risso's dolphin (*Grampus griseus*)

Risso's dolphins are sighted occasionally at the entrance to Cork Harbour and adjacent waters (**Figure 3-1**). Risso's dolphins are not abundant in Irish waters but tend to be patchily distributed (Wall et al. 2013).

Harbour porpoise (*Phocoena phocoena*)

Harbour porpoise is the most widespread and abundant cetacean in inshore Irish waters, with highest abundances in the Irish Sea (Berrow et al. 2010). Harbour porpoise was one the most frequently recorded cetacean species during maintenance dredging operations for the Port of Cork over the September-October period (Russell and Levesque, 2014; O'Dwyer, 2017). Sightings were outside of Cork Harbour, during transit to and at the disposal site. Harbour porpoise are widespread and have been sighted within Cork Harbour and on the spoil ground (**Figure 3-2**). Harbour porpoise are typically encountered as individuals or in small groups of 2-3 animals throughout the year, but with a peak in group size during the autumn off the Cork coast. They normally will avoid medium and large vessels.

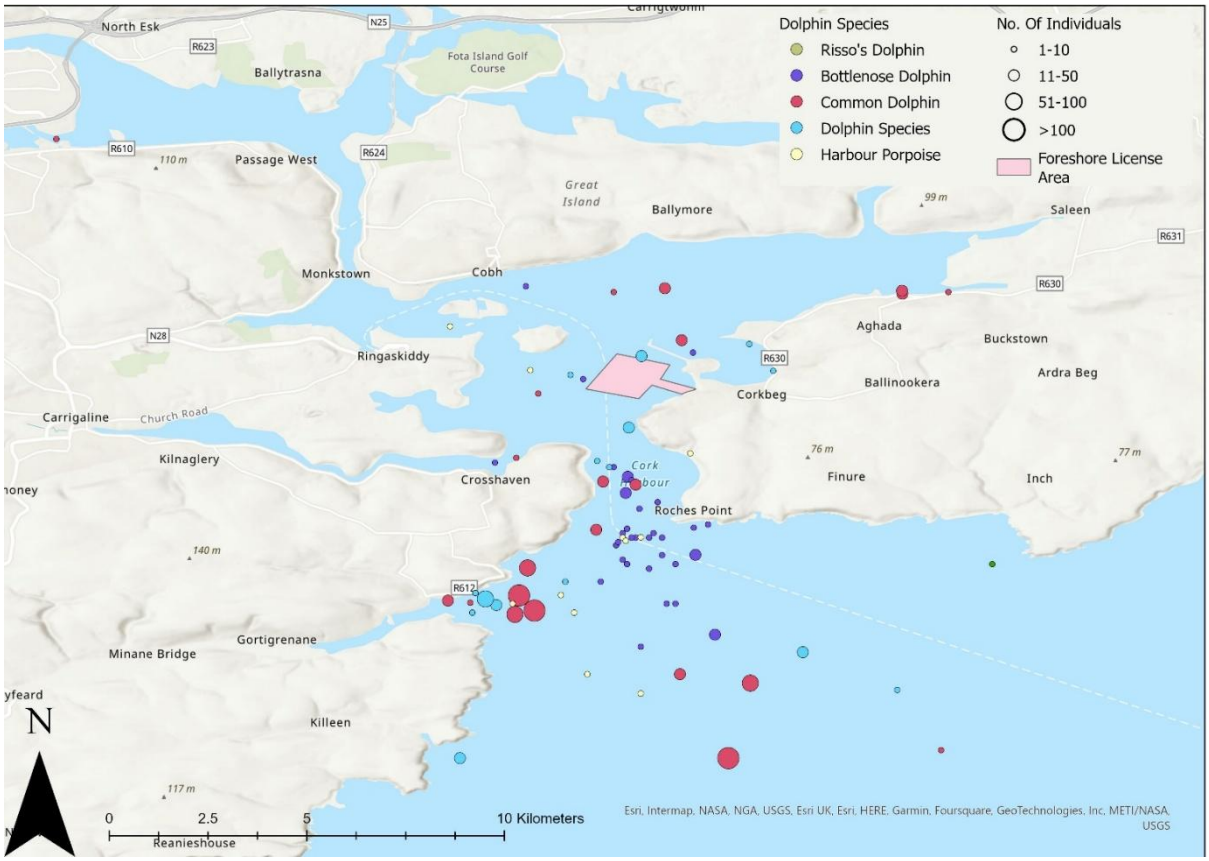

Figure 3-1: Sightings of Dolphins in Cork Harbour and adjacent waters

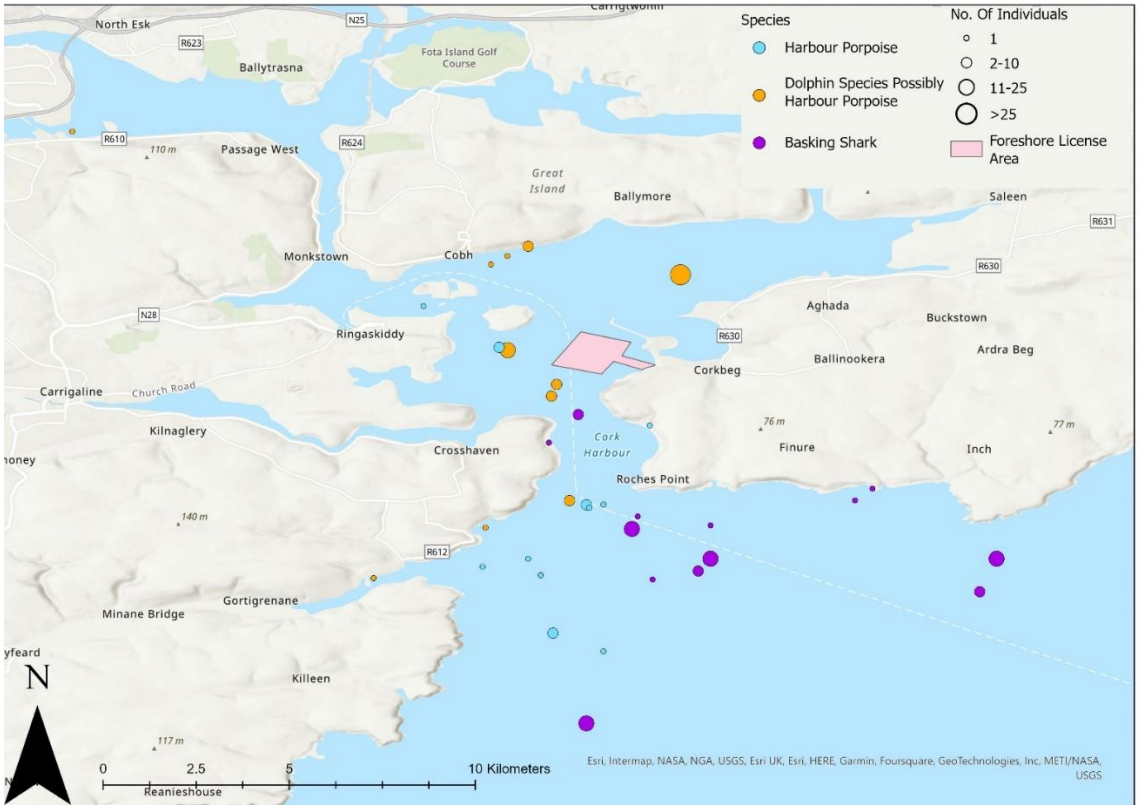

Figure 3-2: Sightings of Harbour Porpoise and Basking Shark in Cork Harbour and adjacent waters

Minke whale (*Balaenoptera acutorostrata*)

Minke whales occur frequently off the Cork coast and at the entrance to Cork Harbour, including on the spoil ground (Figure 3-3). They occur from late spring to early winter but are largely absent during winter and early spring (Berrow et al. 2010). Minke whale abundance in the vicinity of Cork Harbour peak in late summer and autumn and coincide with the presence of pelagic schooling fish in the area (Wall et al. 2013). Minke whales were recorded off Roches Point during dredging operations for the Port of Cork in 2014 and 2017 (Russell and Levesque, 2014; O'Dwyer 2017). Minke whales are typically encountered as individuals. In the late summer and autumn, loose feeding aggregations of two to five animals may be encountered. They do not typically approach large vessels but can be quite inquisitive and may approach slow moving or static vessels.

Fin whale (*Balaenoptera physalus*)

Fin whales regularly occur off the Cork coast (Whooley et al. 2011) and have been recorded at the entrance to Cork Harbour (Figure 3-3). They occur from June to January but are largely absent from February to May (Berrow et al. 2010). Fin whale abundance in the vicinity of Cork Harbour coincides with the presence of pelagic schooling fish (Wall et al. 2013). Fin whales were observed during dredging operations in 2014 (Russell and Levesque, 2014). Photo-identification studies indicate a significant degree of site fidelity by fin whales using these foraging grounds (Whooley et al. 2011). Fin whales are typically encountered as individuals or in small groups of 2-3 animals but during autumn and early winter loose feeding aggregations of up to 10 - 12 animals may be encountered. They do not typically approach large vessels.

Humpback whale (*Megaptera novaengliae*)

Humpback whales occur regularly but in smaller numbers than fin whales off the Cork coast. They are recorded from June to January but are largely absent from February to May. Humpback whales occur in the vicinity of Cork Harbour peak in autumn and early winter (Figure 3-3), which coincides with the presence of pelagic schooling fish in the area (Wall et al., 2013). Photo-identification studies indicate a significant degree of site fidelity by humpback whales using these foraging grounds (Ryan et al. 2015). Humpback whales are typically encountered as individuals or in pairs off the Cork coast. They do not readily approach large vessels but can be quite inquisitive and may approach slow moving or static vessels.

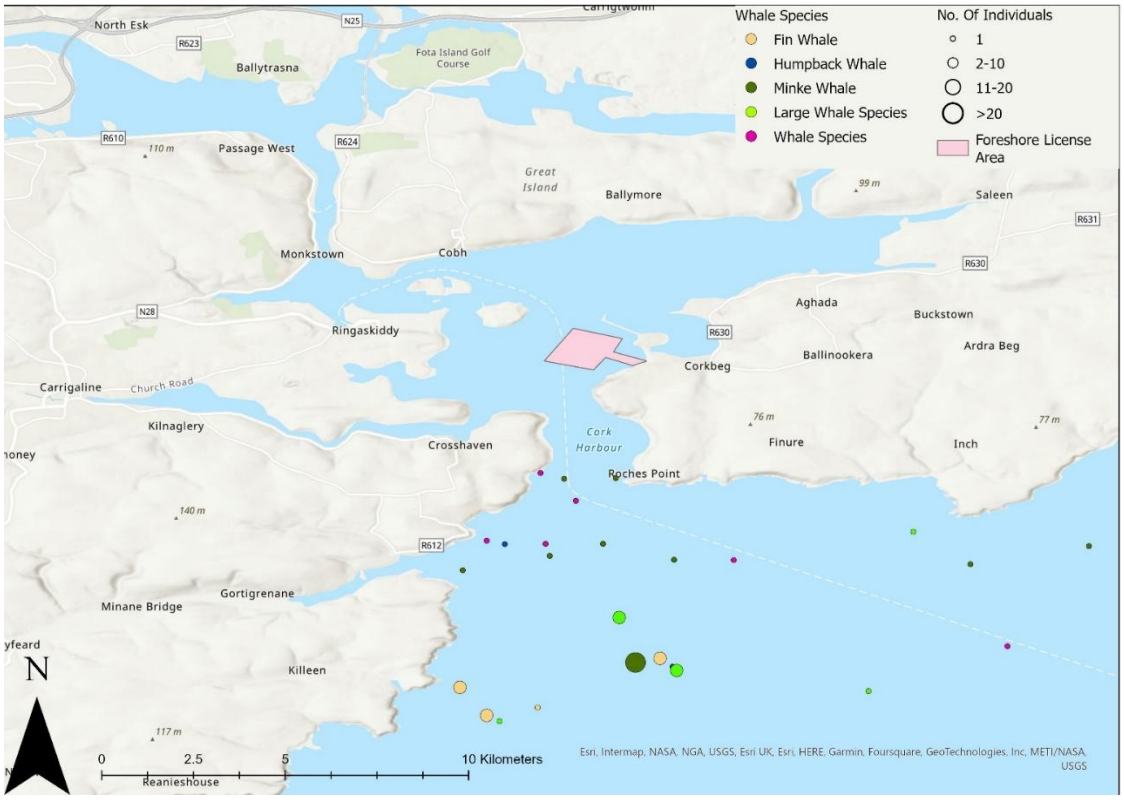

Figure 3-3: Sightings of Baleen Whales in Cork Harbour and adjacent waters

3.3 Other Annex IV Species

Other Annex IV species of interest include marine turtles, otter and rare seal species. Data from the National Biodiversity Data Centre was also accessed to help inform this assessment.

Leatherback Turtles (*Dermochelys coriacea*)

Leatherback turtles are the largest extant sea turtle and have many unique anatomical and physiological adaptations. These include the absence of a hard shell, possession of an extensive layer of peripheral blubber (Doyle, 2007) and a rete-like arrangement of blood vessels at the proximal end of each fore flipper (counter-current heat exchangers) (Doyle, 2007). Leatherback turtles have been frequently recorded off Cork Harbour, with records throughout the year but most between July and September (Figure 3-4; King and Berrow, 2009). Loggerhead turtle (*Caretta caretta*) has also been recorded off Cork Harbour but only very rarely (King and Berrow, 2009).

Otter (*Lutra lutra*)

Otters are widespread around Cork Harbour. Smiddy (1993) surveyed the east side of Cork Harbour and suggested it provided good habitat for otters. Reid et al. (2013) categorised Co Cork as having intermediate densities (0.10/0.15 females per km²) compared to other parts of Ireland. Otters were present in all 10km² blocks around Cork Harbour between 2007-2011 (Reid et al. 2013).

Coastal dwelling otters require access to a freshwater source as they must regularly cleanse their fur of salt as this can affect its insulating properties and therefore their territorial range will be influenced by access to freshwater. In Ireland, the territory of female otters is 6.5 ± 1.0km in coastal environments (de Jongh et al., 2010) and for males it may be a larger extent, where for both females and males a total width of coastal water body

would be 80m (NPWS, *Lutra lutra* (1355) Conservation Status Assessment Report). Underwater hearing sensitivity is significantly reduced compared to pinniped species, demonstrating that otter hearing is primarily adapted to receive airborne sounds (Ghoul et al. 2014). Otter distribution around Cork Harbour and county is shown in **Figure 3-5.**

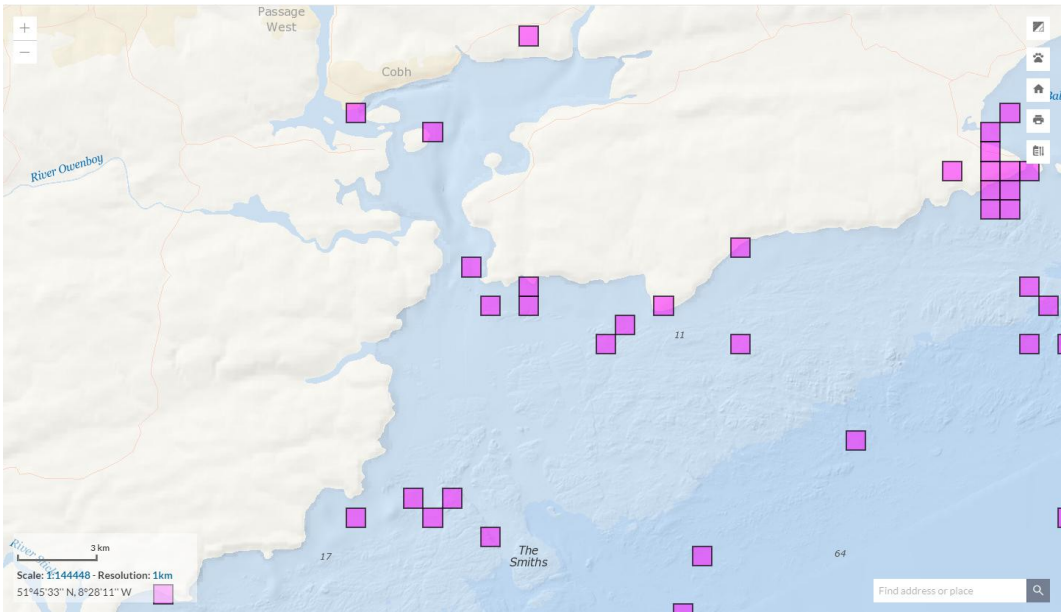

Figure 3-4: Map of Leatherback turtle sightings records around Cork Harbour

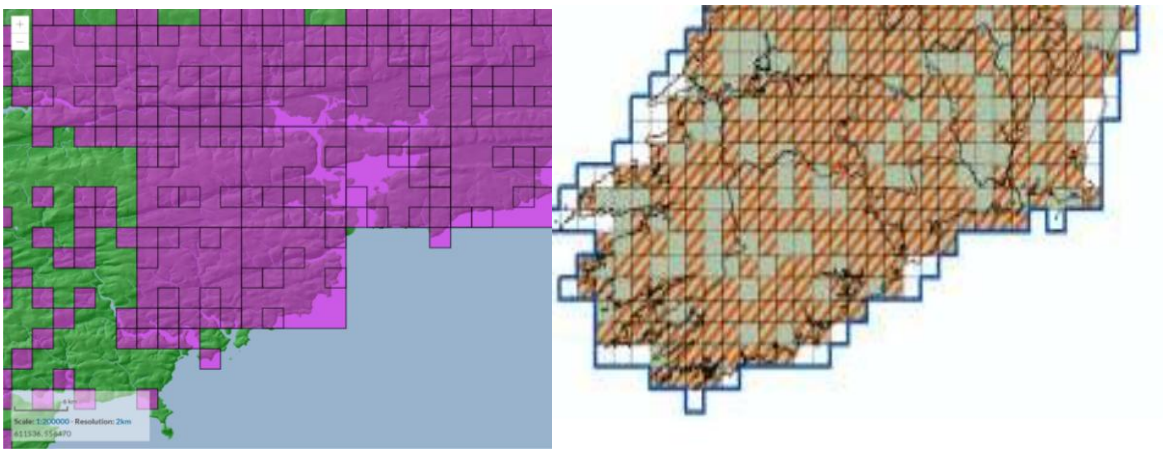

Figure 3-5: Map of Otter distribution around Cork Harbour (left) and around Cork (right)

Bats

Bats are also protected under the EU Habitats Directive (92/43/EEC). The lesser horseshoe bat which is found in the Republic of Ireland is the only bat species listed in Annex II of the EU Habitats Directive, while all bat species are listed in Annex IV of the Directive. The Annex IV Species Risk Assessment has also considered the potential for any impacts from the proposed activities at the site on any of the ten species of bat that are confirmed as resident in Ireland (Kelleher and Marnell, 2006).

A review of existing bat records within a 10km radius of the study site (**Figure 3-6**) showed that six Irish bat species have been recorded locally. The most frequently recorded was the common pipistrelle bat (*Pipistrellus pipistrellus sensu lato*) according to data supplied by the National Biodiversity Data Centre.

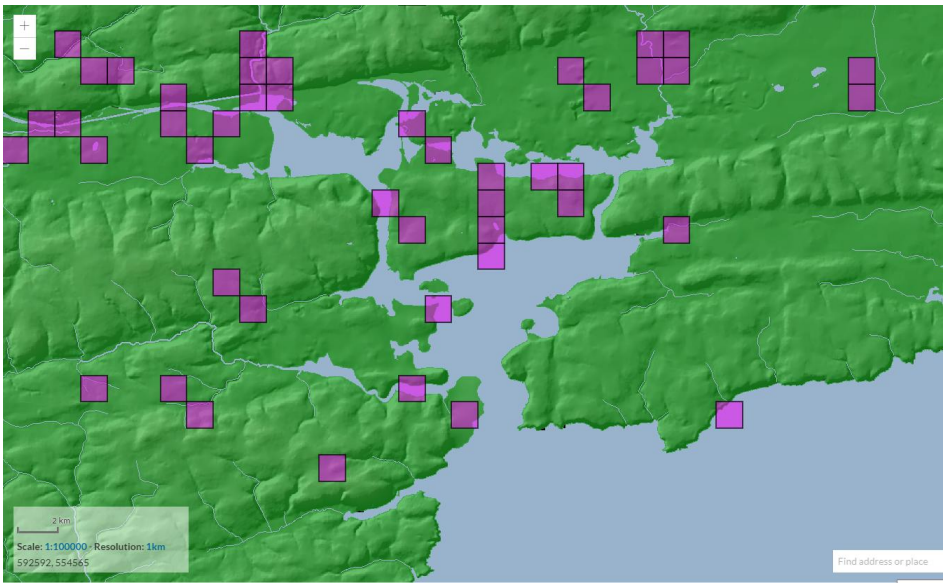

Figure 3-6: Map of common pipistrelle bat distribution around Cork Harbour

3.4 Non-Annex IV Species of Conservation Interest

Basking shark (*Cetorhinus maximus*)

Basking sharks were observed along the coast and off the Old Head of Kinsale, including at the mouth of the harbour (**Figure 3-2**). Basking sharks are seasonally abundant on the surface during early spring and summer but may occur in continental shelf Irish waters throughout the year.

3.4.1 Pinnipeds

Grey and harbour seals are distributed around the entire Irish coast with grey seals being more abundant along the western seaboard (Cronin et al., 2004; O'Cadhla et al., 2007; O'Cadhla and Strong, 2007).

Grey Seal (*Halichoerus grypus*)

There are no recorded grey seal breeding sites in Cork Harbour (O'Cadhla et al., 2007; Morris and Duck, 2019), however grey seals have been noted hauled out in Cork Harbour. Grey seals range long distances while foraging (Cronin et al., 2016) and may be expected to be encountered regularly within the harbour. They were the most frequently recorded marine mammal during dredging operations in 2014 and 2017 with between 57 and 70% of all sightings being of grey seals, usually single individuals (Russell and Levesque, 2014; O'Dwyer, 2017).

Harbour or Common Seal (*Phoca vitulina*)

There were no harbour seal haul-out sites or breeding sites recorded within Cork Harbour during National Parks and Wildlife Service (NPWS) surveys (Cronin et al., 2004; Morris and Duck, 2019). A small number of harbour seals (six) were recorded hauled out at Kinsale Harbour, to the west (Cronin et al., 2004). Harbour seals are much less frequently recorded within Cork Harbour but have been recorded along the shipping channel. Harbour seals pup

in June-July and the moulting period occurs after breeding, starting in June and ending in November, with a peak in mid-September (Cronin et al., 2014).

3.5 Methodology

This risk assessment for Annex IV species has been prepared with adherence to the following guidance:

- European Commission (2021) Guidance document on the strict protection of species of community interest under the Habitats Directive. C. (2021) 7301 final. Brussels.
- NPWS (2021) Guidance on the Strict Protection of Certain Animal and Plant Species under the Habitats Directive in Ireland. National Parks and Wildlife Service Guidance Series, No. 2. Department of Housing, Local Government and Heritage.
- NPWS (2025) Applications for Regulation 54 Derogations for Annex IV Species: Guidance for Applicants. Department of Housing, Local Government and Heritage.

This risk assessment for marine mammals Annex IV species follows the methodology structure outlined in the NPWS guidance from 2025.

3.5.1 Test 1: Reasons for Seeking Derogation

Reasons set out in Regulations 54 (2) (a)-(e) are as follows:

(a) In the interests of protecting wild flora and fauna and conserving natural habitats;
(b) To prevent serious damage, in particular to crops, livestock, forests, fisheries and water and other types of property;
(c) In the interests of public health and public safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment;
(d) For the purpose of research and education, of re-populating and reintroducing these species and for the breeding operations necessary for these purposes, including artificial propagation of plants, or;
(e) To allow, under strictly supervised conditions, on a selective basis and to a limited extent, the taking or keeping of certain specimens of the species to the extent specified therein, which are referred to in the First Schedule. If it cannot be clearly demonstrated that one or more of the reasons set out above apply, a derogation licence cannot be granted by the Minister.

The Port of Cork Masterplan 2050 aims to facilitate a 'river to seaport' objective, where port operations will be moved downstream and consolidate all harbour activities in the lower section of Cork Harbour by 2050. The Port of Cork is also the only port in Ireland with planning permission in place to help facilitate the development of Offshore Renewable Energy (ORE) sector in Ireland. This is in line with Ireland's National Marine Planning Framework, which supports the development of ORE in Ireland to reduce dependencies on fossil fuels and reduce greenhouse gas emissions. It also aligns with the South Coast Designated Maritime Area Plan for ORE, published in 2024, which incorporates an area of the south coast from Carnsore Point in Wexford to Seven Heads in Cork. The proposed SIs will help establish a baseline for the environment and inform future planning decisions and suitability for infrastructure developments.

3.5.2 Test 2: No Satisfactory Alternative

The area of the proposed SIs is one of four areas put forward in Cork Harbour having potential to support the future green energy sector. For these areas to be fully assessed, SIs will have to be carried out to assess their

potential to support such infrastructure development. The area is already industrial, with Corkbeg Island facilitating the Whitegate refinery, which is the location of its oil storage tanks and a jetty.

The site at Dognose is considered to have potential to support the ORE sector by providing an area that supports the marshalling and assembly of offshore wind turbines before their installation. Given the scale of the components required, shipping them in is the best approach and the clear navigation channel that already exists in Cork Harbour would support this. The ESB Aghada Power station is also in close proximity to Dognose, circa 1km from the proposed SI site, and provides the opportunity for connection to the national grid when ORE projects are operational and need to connect to the national grid.

Dognose could also gain capacity to support future and transition cargoes in the form of LNG bunkering and a Floating Storage Regasification Unit (FSRU) with the addition, in the short to medium term, of a jetty and berth for a permanent vessel. The proposed location is near (1km) the main gas pipeline and the main Aghada combined cycle gas turbine power stations for the region, and so the site could also help Ireland to meet its energy security requirements. Once ORE and hydrogen industries are established, the area also has the potential to serve as a multipurpose terminal for other liquid bulks (e.g. green hydrogen, green ammonia, and E-Methanol), providing additional support to efforts to match national energy needs.

The proposed SIs are supportive of a variety of legislation and policy related to the growth and expansion of Ireland's renewable energy sector and our energy dependence. These include, and are not limited to, to following policies:

- Renewable Energy Directive (RED III)
- Energy Efficiency Directive (as amended)
- National Marine Planning Framework
- Climate Action and Lowe Carbon Development Plan 2015-2021
- National Energy and Climate Plan 2025
- Climate Action Plan 2025
- Offshore Renewable Energy Development Plan II
- National Development Plan
- Renewable Energy Support Scheme
- Cork City Climate Action Plan 2024-2029
- Cork County Climate Action Plan 2024-2029
- Cork City Development Plan 2022-2028
- Cork County Development Plan 2022-2028

3.5.2.1 Alternatives

The proposed SIs of geotechnical and geophysical surveys are essential to assessing the feasibility for the development of Dognose for ORE and LNG infrastructure. The proposed SIs are standard of this type of surveying and provide critical environmental information regarding the potential for development at the site. These surveys do produce underwater noise which have potential to impact Annex IV species. However, adherence to 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' and mitigation outlined in the Marine Mammal Risk Assessment submitted with this application will reduce the effect on marine mammals.

Alternative Locations

The site selected is one of four identified in the Port of Cork Masterplan for the development of ORE. The existing infrastructure in the near vicinity of the proposed SI area makes this site suitable for potential future

development. The proximity of the proposed site to existing ESB infrastructure, the ESB Aghada power station and the Bord Gais operated Whitegate power station, and the Whitegate Oil Refinery operated by Irving Oil.

Dognose could also gain capacity to support future and transition cargoes in the form of LNG bunkering and a Floating Storage Regasification Unit (FSRU) with the addition, in the short to medium term, of a jetty and berth for a permanent vessel. The proposed location is near (1km) the main gas pipeline and the main CCGT power stations for the region, and so the site could also help Ireland to meet its energy security requirements.

Once the ORE and hydrogen industries are established, Dognose Bay has the potential to serve as a multipurpose terminal for other liquid bulks (e.g. green hydrogen, green ammonia, and E-Methanol), providing additional support to efforts to match national energy needs.

Further up the Cork harbour, closer to the city was also assessed for potential for development regarding ORE and renewable energy. The space needed for the manoeuvrability of vessels is restricted closer to the city, and the size of the vessels would have an impact on the navigation of the channel by other vessels. The area is also predominately urban as opposed to industrial, with a higher residential population that would be impacted by the presence of an ORE and renewable energy infrastructure. There is also no currently operational existing energy infrastructure in the vicinity that could support such development when compared with the location at Dognose.

Having taken into consideration factors of operational and existing infrastructure, their proximity to the Dognose site, and vessel manoeuvrability, this is considered the least overall impactful location to assess for future developments regarding ORE.

Alternative Surveys

Alternatives to the proposed surveys investigated a number of different approaches that were deemed unsuitable. For non-intrusive surveys, a Remote Operated Vehicle (ROV) may be used to gather survey data such as side scan sonar and sub-bottom profiling, but the equipment used will still generate acoustic noise. Also, a separate vessel will still need to be deployed to collected geophysical data in the form of boreholes. This prolongs the survey period and the exposure of species to related survey noise.

For the boreholes, no alternative will provide as accurate data as the CPTs will. The alternatives are usually complementary to boreholes, such as shadow drilling, T-Bar and ball penetration tests, and do not provide as detailed data or go to the depths that CPTs can. Desktop studies were undertaken throughout the application process to help establish a baseline and determine the sites suitability for development, but thorough SIs are needed to build a comprehensive baseline and adequately assess the area for future ORE infrastructure and development.

Regarding the timing of surveys and proximity to functional areas such as breeding, foraging and migration, marine mammals occur at the site but there is no evidence the site is close to important foraging, nursery, resting or migration routes. No long-term displacement will occur. While a range of Annex IV species occur throughout the year and during for some species at important feeding times (e.g. autumn for fin whales), the marine activities will not lead to any significant disturbance. Small numbers of grey seals may occur in the vicinity of the site, but they are accommodated to human activities and are unlikely to be affected. There are no known pupping or moulting sites for seal within or adjacent to Cork Harbour. No long-term disturbance of Annex IV species in the area will occur, short term affects can be mitigated. Further detail can be found in the Annex IV Risk Assessment submitted with this application.

3.5.2.2 Do Nothing Scenario

The 'do nothing' scenario of not undertaking the SIs at the site to assess its feasibility to support development as outlined in the Port of Cork Masterplan is not possible as there is currently insufficient information available environmentally to allow the site to be adequately assessed for potential development. The information gathered during the SIs will help inform the design and whether the site can be developed to support future ORE infrastructure and LNG bunkering and aid in securing Ireland's energy independence and security.

Without the new data that will be gathered during the SIs, the feasibility of the site to support development as outlined in the Port of Cork Master Plan cannot be adequately assessed, which risks failure to achieve the objectives of the Masterplan and national targets set by the European Union and Irish Government.

It is considered that there are no satisfactory alternatives that would allow for the gathering of sufficient environmental data that would allow the feasibility assessment to be undertaken for the development of the Dognose Bank area in Cork Harbour.

A breakdown of alternatives and justification are presented in Table 3-1.

Table 3-1: Comparative Analysis

Options	Description	Preferred Option	Justification
Proposed location	The area of the proposed surveys is Dognose, which lies to the west of Corkbeg Island in the lower Cork Harbour. The area is heavily industrialised with the Bord Gais Whitegate power station, the Irving Oil Whitegate Oil Refinery and Aghada ESB Power station located nearby, with Ringaskiddy Port, and Depuy, Hovione, Thermos-Fisher and Johnson Pharmaceutical companies located across the channel.	Yes	The location at Dognose is the preferred site given the industrial nature of the area already, access available via the navigation channel in the Lower Cork Harbour and the proximity to the operational Whitegate Refinery, Bord Gais operated Whitegate Power Station, and ESB Aghada Power Station. The space in the area can accommodate bulk carriers and large vessels without impeding the navigation of other vessels.
Alternative location	There are four locations identified in the Port of Cork Masterplan as best suited for future development for ORE and green energy infrastructure.	No	Each of these areas will have to be investigated with SIs to confirm their suitability for future development related to ORE and renewable energy infrastructure. One of these alternative locations cannot be swapped for Dognose as Dognose was identified given its location in an industrial port area and proximity to existing energy infrastructure.
Location further up Cork Harbour	The option to develop an area further up the harbour closer to Cork City.	No	Up the harbour closer to the city has a narrower navigable channel compared to the proposed site and would be less manoeuvrable and have greater impact on vessel traffic if this area was used. The area is also predominantly urban and populated when compared with the proposed site. There is also no adequate existing infrastructure further up the harbour to support ORE and renewable energy infrastructure development compared with the proposed site.
Desktop Study	A review of publicly available data to establish a baseline environment.	No	A desktop study was preferred in selecting the site for potential to support ORE and renewable energy infrastructure development. More detailed information that will be gathered during the proposed surveys as the information from the desktop study does not on its own provide enough information to adequately assess the site.

Options	Description	Preferred Option	Justification
Use of ROV for non-intrusive surveys	An ROV could be deployed with side scan sonar ad sub-bottom profiler to gather data.	No	The equipment used on the ROV for non-intrusive surveys would still generate acoustic noise given the nature of the survey equipment. A vessel would still have to be deployed for intrusive surveys also, increasing the survey period length and species exposure to survey related noise.
Borehole alternatives	Complimentary survey techniques used to acquire data during geotechnical surveys such as shadow drilling, T-Bar and ball penetration tests. Remote sensing uses sensors to build a profile of the environment, including sea surface temperatures and coverage of large areas.	No	Shadow drilling, T-Bar and ball penetration tests are complimentary survey types to CPTs, not providing as accurate or detailed data that CPTs would provide. A vessel would still have to be deployed to carry out these tests. Remote sensing could provide general data on the area and seabed but can't provide the same detailed data that CPTs produce.
Survey timing to not disturb foraging, breeding, migration etc.	Change the timing and scheduling of surveys to above and disturbance to species and lessen impact on functional activities.	No	Marine mammals occur at the site but there is no evidence the site is close to important foraging, nursery, resting or migration routes. No long-term displacement will occur. While a range of Annex IV species occur throughout the year and during for some species at important feeding times, the marine activities will not lead to any significant disturbance. No long-term disturbance of Annex IV species in the area will occur, short term affects can be mitigated. Further information can be found in the section above and in the MMO report.
Scale of Surveys	Alter the scale of the surveys to reduce the area surveyed	No	The size of the proposed survey area is relevant for the proposed use of the area for ORE and renewable energy infrastructure. It is proportionate to the size of vessels that would utilise the infrastructure and allows for vessel manoeuvrability.
Do-Nothing Scenario	No surveys are undertaken and no future development.	No	No investigative surveys are undertaken to adequately assess the potential for development for supporting ORE and renewable energy infrastructure. This will continue the country's dependence on fossil fuels and may cause the missing of targets set by the

Options	Description	Preferred Option	Justification
			EU on renewable energy targets, and resulting fines associated with these missed targets.

3.5.3 Test 3: Favourable Conservation Status

Any proposed works granted under a derogation licence must not be detrimental to the Annex IV species populations. Their status must either be maintained or restored to Favourable Conservation Status. Therefore, the granting of a derogation licence must result in a neutral or positive effect for the species under assessment. The impact on Annex IV species is considered in detail in Section 4 of this report and in the Marine Mammal Risk Assessment submitted in support of this derogation application. Mitigation measures will be implemented throughout the survey period, and given the short-term duration of the surveys, 19 weeks, the SIs are considered not to have a negative impact on the conservation status of any of the Annex IV species.

MMO

Throughout the duration of the survey period, a Marine Mammal Observer (MMO) will be present on the vessel to monitor the area for the presence of any marine mammals that may appear during these surveys. A 30-minute watch will be undertaken before the start of each survey period to ensure no marine mammals are in the area during the surveys. If one is spotted during the start-up watch, it will be watched until it leaves the area and the 30-minute period will restart. If a marine mammal is spotted during operation, surveying will cease and a cool down period will be initiated for 30 minutes once the mammal is seen to leave the survey area. This is to ensure there will be no negative effect to the conservation status of the marine mammals. The geotechnical and geophysical surveys will only commence during daylight hours.

Acoustic Disturbance

Acoustic output during geotechnical site investigations prior to marine construction was investigated. Drilling (120 kW, 83 mm diameter drill bit, 1500 rpm, 16–17 m drill depth in sand and mudstone) and SPT (50 mm diameter test tube, 15 mm wall thickness, 100 kg hammer, 1 m drop height) by a jack-up rig in 7–13 m of water were recorded with a drifting hydrophone at 10–50 m range. Source levels ranged at around 142–145 dB re 1 lPa rms @ 1 m (30–2000 Hz) for drilling and 151–160 dB re 1 lPa2 s @ 1 m (20–24 000 Hz) for standard penetration testing. Sound produced by drilling at 145 dB re: 1 mPa@1m will not elicit a behavioural response, temporary threshold shift (TTS) or permanent threshold shift (PTS) in marine mammals within the survey area. Sound from penetration testing although higher did not exceed thresholds likely to cause a significant effect even at close range not lead to TTS. In addition, the sound produced is intermittent and generated for short durations, resulting in minimal exposure periods. Increased vessel activity including a jack-up barge will occur. Marine mammals are sensitive to geophysical surveys but tolerant of shipping noise, being repeatedly exposed to many vessels, small and large. Pinnipeds also exhibit much tolerance and often haul out on man-made structures where there is considerable human activity. Marine turtles, bats and otter are unlikely to occur at the site. Table 3-2 and 3-3 show the specifications of likewise equipment to be used. Acoustic disturbance to marine mammals is assessed in detail in the Annex IV Risk Assessment submitted with this application.

Table 3-2: Selected Geophysical Survey Sources and their Modelled Specifications

Type	Model	Frequency (kHz)	Beam width (−3 dB)	Beam orientation	Source level (rms dB re 1 μPa @ 1 m)	Rep. rate (/sec)	Pulse length (ms)
		Low-frequency (<10 kHz)					
Airgun array	Bolt 4 × 40 in³	0.005-2 (pulse)	n/a	n/a	229[b]	0.1	100
Sub-bottom profiler	EdgeTech DW-106	1–6 (chirp)	28°–36° circular	vertical	200	15	33
		Mid-frequency (10 to 100 kHz)					
Communications transceiver	Simrad HiPAP 500 USBL	23	10° circular	2° from horizontal[a]	206	1	1000
Fish finding sonar	Simrad SX90	26	7° circular	2° from horizontal[a]	215	1	72
Hydrographic echosounder	Simrad EA500	38	7° circular	vertical	232	0.5	0.1
		High-frequency (>100 kHz)					
Multibeam echosounder	Simrad EM2000	200	150° × 1.5° rectangular	vertical	218	10	0.2
Side-scan sonar	EdgeTech 4500DF	230	50° × 0.15° rectangular	30° from horizontal	229	10	20

[a]Sonars with steerable beams were oriented toward the horizontal.
[b]Maximum source level in horizontal plane.

Table 3-3: Typical Sound Characteristics of a range of Sub-Bottom Profilers

Model	High Frequency	Parametric or low Frequency	Source level primary	Source level parametric	
Atlas Parasound	18-33 kHz	0.5 to 6kHz	242/245dB	206/200 dB	Whale warning mode
Kongsberg SBP 120		2.5 to 7 kHz	220 dB		
Innomar SES-2000 Deep Parametric sub-bottom profilers	35 kHz	2, 3, 4, 5, 6, 7 kHz	244 dB		
Huntec boomer		0.5 to 8 kHz	205 dB		
Edgetech 512i		1 to 12 kHz	198 dB		
SIG '2 mille' mini-sparker		1 to 6 kHz	204 dB		
Arena Sub K-Chirp 3310		2 to 8 KHz	204 dB		
Applied Acoustics AA201 and AA301 boomer		1 to 6 kHz	212/215 dB		
Applied Acoustics Squid 500/2000 sparker		1 to 3.5 kHz	216/222 dB		
Applied Acoustics S-Boom		1 to 5 kHz	222dB approx.		

Threats and Behaviour

There is a chance of collision with vessels, but this is considered unlikely given the industrial nature of the area. Marine mammals in the area are accustomed to marine traffic in the area and tend to avoid vessels. The small size and speed of the survey vessel will also reduce the risk of collision. Geophysical and geotechnical investigations activity is very local and of relatively short duration and any disturbance will be short term. The presence of an additional vessel and the associated noise produced, is very unlikely to have a significant impact on marine mammals behaviour and won't negatively impact favourable conservation status.

Population Densities

Bottlenose dolphins are the most frequently recorded marine mammal species adjacent to the site. Grey seals are frequently observed in, and at the mouth, of Cork Harbour. Common dolphin, minke and fin whales occur in the wider area. No moulting sites for grey or harbour seals occur in Cork Harbour. All marine mammals are part of a larger population and are very mobile. Section 3.4 of this document presents details on the variety of marine mammal species sighted in and around Cork Harbour, and Table 3-4 presents sighting used for the Annex IV Risk Assessment submitted with this application.

Table 3-4: Cetacean sightings recorded in Cork Harbour and Adjacent Waters 2012-2021

Species	No. Sightings	No. Individuals	% of Records
Bottlenose dolphin	32	224	26.2
Common dolphin	23	1743	18.9
Harbour Porpoise	12	22	9.8
Minke whale	9	31	7.4
Fin whale	4	14	3.3
Humpback whale	2	2	1.6
Risso's dolphin	1	8	0.8
Dolphin species possibly harbour porpoise	11	74	
Dolphin species	15	234	
Large whale species	5	10	
Whale sp.	6	8	
Cetacean species	2	2	
Total	**122**	**2372**	

Timing

As discussed during Test 2, the timing of surveys and proximity to functional areas such as breeding, foraging and migration, marine mammals occur at the site but there is no evidence the site is close to important foraging, nursery, resting or migration routes. No long-term displacement will occur. While a range of Annex IV species occur throughout the year and during for some species at important feeding times (e.g. autumn for fin whales), the marine activities will not lead to any significant disturbance.

4. Impact Assessment

The potential effects of geophysical and geotechnical surveys on Annex IV species were addressed by assessing the likelihood that these species would be exposed, or interact, with marine activities. Impacts assessed include likelihood of occurrence and disturbance, especially from noise emitted during surveys and drilling, and from additional marine vessels. Acoustic disturbance includes the ability of the individual to detect increased noise levels over ambient levels, masking, Temporary Threshold Shift (TTS) and Permanente Threshold Shift (PTS) and behavioural impacts, i.e. resulting in a behavioural change by individuals. The potential effects on turbidity and indirect impacts on preferred prey are also considered.

4.1 Literature Review

The NPWS 'Guidance to Manage the Risk to Marine Mammals from Man-Made Sound Sources in Irish waters – January 2014' recommends that listed 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. It is required that such an assessment must competently identify the risks according to the available evidence and consider (i) direct, (ii) indirect and (iii) cumulative effects of anthropogenic sound (NPWS, 2014).

4.1.1 Geophysical Survey Impacts

Geophysical and geotechnical equipment produce a wide range of frequencies and source levels. MacGillivray et al. (2014) used modelling explore the acoustic effects of marine survey sound sources on marine mammals. They reviewed the acoustic signatures of widely used equipment (Table 4-1).

Table 4-1: Selected Geophysical survey sources and their modelled specifications

Type	Model	Frequency (kHz)	Beam width (−3 dB)	Beam orientation	Source level (rms dB re 1 μPa @ 1 m)	Rep. rate (/sec)	Pulse length (ms)
		Low-frequency (<10 kHz)					
Airgun array	Bolt 4×40 in^3	0.005-2 (pulse)	n/a	n/a	229[b]	0.1	100
Sub-bottom profiler	EdgeTech DW-106	1–6 (chirp)	28°–36° circular	vertical	200	15	33
		Mid-frequency (10 to 100 kHz)					
Communications transceiver	Simrad HiPAP 500 USBL	23	10° circular	2° from horizontal[a]	206	1	1000
Fish finding sonar	Simrad SX90	26	7° circular	2° from horizontal[a]	215	1	72
Hydrographic echosounder	Simrad EA500	38	7° circular	vertical	232	0.5	0.1
		High-frequency (>100 kHz)					
Multibeam echosounder	Simrad EM2000	200	150° × 1.5° rectangular	vertical	218	10	0.2
Side-scan sonar	EdgeTech 4500DF	230	50° × 0.15° rectangular	30° from horizontal	229	10	20

[a]Sonars with steerable beams were oriented toward the horizontal.
[b]Maximum source level in horizontal plane.

Sub-bottom profilers produced frequencies of 1-6 kHz at a source level of 200 dB re 1µPa @1m, while multibeam and side-scan sonar much higher frequencies of 200-230kHz at 218-229 dB re 1µPa @1m. The model indicated that odontocetes were most likely to hear sounds from mid-frequency sources (fishery, communication, and hydrographic systems), mysticetes from low-frequency sources (sub-bottom profiler and airguns), and pinnipeds from both mid and low-frequency sources. High-frequency sources (side-scan and multibeam) generated the lowest estimated sensation levels for all marine mammal species groups.

4.1.2 Side scan sonar, sub-bottom profiling

Sub-bottom profilers are typically low to mid-frequency with high source levels and could impact of marine mammals (Table 4-2). Typical level magnitudes of Sub-Bottom Profilers used by IFREMER (2016) showed transmitted signals were quite homogeneous between constructors (Ixblue, Kongsberg, Knudsen). The peak levels of acoustic pressure were in the range 213 to 228 dB re 1µPa @1m. The FM signal features a long modulation typically of few tens of ms with a relatively constant level in the frequency band. The typical pulse length was 80 ms, and the usable frequency band was between 1.8 and 5.3 kHz. The SPL (Sound Pressure Level) received is equal to 213 dB re 1µPa@1m with a pulse length of 80 ms, is 202 dB re 1 µPa².s @ 1m (IFREMER, 2016).

Table 4-2: Typical sound characteristics of a range of sub-bottom profilers

Model	High Frequency	Parametric or low Frequency	Source level primary	Source level parametric	
Atlas Parasound	18-33 kHz	0.5 to 6kHz	242/245dB	206/200 dB	Whale warning mode
Kongsberg SBP 120		2.5 to 7 kHz	220 dB		
Innomar SES-2000 Deep Parametric sub-bottom profilers	35 kHz	2, 3, 4, 5, 6, 7 kHz	244 dB		
Huntec boomer		0.5 to 8 kHz	205 dB		
Edgetech 512i		1 to 12 kHz	198 dB		
SIG '2 mille' mini-sparker		1 to 6 kHz	204 dB		
Arena Sub K-Chirp 3310		2 to 8 KHz	204 dB		
Applied Acoustics AA201 and AA301 boomer		1 to 6 kHz	212/215 dB		
Applied Acoustics Squid 500/2000 sparker		1 to 3.5 kHz	216/222 dB		
Applied Acoustics S-Boom		1 to 5 kHz	222dB approx.		

Acoustic sources are prone to impact marine mammals when the values of SPL and SEL received by the marine mammals are above specific tolerance thresholds (depending on the signal type and frequency, and on marine mammal species). Southall et al. (2007) recommend a threshold of 215-230 dB re. 1µPa²×s. The results suggest that auditory damage is only likely if animals pass the transducer at close range and that the impact on marine mammals can be mitigated by implementing prior detection and shut down procedures.

4.1.3 Cone Penetration Tests (CPTs)

Site investigations will be a combination of cable percussion and rotary drilled boreholes, carried out using a drilling rig set-up on a jack up barge. Cone Penetrometer Test (CPT) is used to determine the geotechnical engineering properties of sediments. Boreholes will be drilled using cable percussion rig and a rotary coring rig.

4.1.4 Increased turbidity

Any increases in turbidity are unlikely to affect Annex IV species. Marine mammals often inhabit turbid environments, and many utilise sophisticated sonar systems to sense the environment around them (Au et al., 2000). Pinnipeds do not produce sonar for prey detection purposes, however, Newby et al. (1970) reported apparent blindness in three harbour seals on Gertrude Island, Puget Sound, Washington and found them to appear healthy suggesting their ability to forage was unaffected by blindness. McConnell et al. (1999) tracked grey seals in the North Sea and included one blind seal in their study. No significant difference in foraging behaviour was found indicating vision is not essential to pinnipeds' survival or ability to forage.

4.1.5 Indirect impacts on prey

Prey such as fish and crustaceans could be affected by low to mid-frequency sound sources if close on start-up.

4.2 Risk Assessment

The potential for disturbance to marine mammals is greatest when elevated levels of underwater noise are considered. Marine mammals, especially cetaceans, have well developed acoustic capabilities and are sensitive to sound at much higher frequencies than humans (Richardson et al., 1995). They are less sensitive to the lower frequencies but there is still great uncertainty over the effects of sound pressure levels on marine mammals and thus the assessment of its impact. Sources of noise include that generated during geophysical surveys and caused by drilling, and CPT and associated vessels during marine operations.

4.2.1 Acoustic disturbance

4.2.1.1 Effects on Marine Mammals

Erbe and McPherson (2017) measured the acoustic output during geotechnical site investigations prior to marine construction. Drilling (120 kW, 83 mm diameter drill bit, 1500 rpm, 16–17 m drill depth in sand and mudstone) and SPT (50 mm diameter test tube, 15 mm wall thickness, 100 kg hammer, 1 m drop height) by a jack-up rig in 7–13 m of water were recorded with a drifting hydrophone at 10–50 m range. Source levels ranged at around 142–145 dB re 1 lPa rms @ 1 m (30–2000 Hz) for drilling and 151–160 dB re 1 lPa2 s @ 1 m (20–24 000 Hz) for standard penetration testing.

Sound produced by drilling at 145 dB re: 1 mPa@1m will not elicit a behavioural response, temporary threshold shift (TTS) or permanent threshold shift (PTS) in marine mammals within the survey area according to the behavioural response criteria proposed by Southall et al. (2007). Sound from penetration testing although higher did not exceed thresholds likely to cause a significant effect even at close range not lead to TTS. In addition, the sound produced is intermittent and generated for short durations, resulting in minimal exposure periods.

Although there are few empirical studies on the effects of geophysical and geotechnical techniques on pinnipeds or odontocetes (Richardson et al., 1995). Elevated noise from sub-bottom profilers could affect seals which are sensitive to a lower frequency ranges than odontocetes (Todd et al., 2015).

Anderwald et al. (2013) found that grey seals showed some level of avoidance to high construction vessel traffic in Ireland, but this study was in a relatively pristine environment compared to the already heavily impacted Cork Harbour. Pinnipeds may exhibit much tolerance and often haul out on man-made structures where there is considerable human activity. This exposure may lead to some chronic exposure to man-made noise, with which they tolerate. Ecological or physiological requirements may leave some marine mammals with no choice but to remain in these areas and continue to become chronically exposed to the effects of noise. In areas with repeated exposure, mammals may become habituated with a decline in avoidance responses and thus become less sensitive to noise and disturbance (Richardson et al., 1995). Reactions, when measured, have only occurred when received sound levels are well above ambient levels.

Increased vessel activity including a jack-up barge will occur. Marine mammals are sensitive to geophysical surveys but tolerant of shipping noise, being repeatedly exposed to many vessels, small and large. Pinnipeds also exhibit much tolerance and often haul out on man-made structures where there is considerable human activity. Marine turtles, bats and otter are unlikely to occur at the site. Based on these findings it is concluded that the proposed works could have an impact on the Annex IV cetacean species without mitigation.

4.2.1.2 Otter and Marine Turtles

Otters are also quite sensitive to the low frequency range but less sensitive than marine mammals. They can therefore hear and are susceptible to the noise of shipping, geotechnical drilling, SBP and HESS. However, only those individuals within the water will be exposed and then only when very close to the activities. The area has low suitability for otter as it occurs offshore. Otters could potentially forage offshore but the site is considered to be of negligible value for otter. Based on these findings in relation to otter it is concluded that the proposed works will have no impact on the Annex IV species otter.

The likelihood of otters or marine turtles being in the area during geophysical or geotechnical surveys is extremely low. If they did occur, they could be impacted by the geophysical survey if they were very close to the sound source. The presence of small vessels and a jack-up barge and the associated noise produced, could lead to a very localised increase in vessel traffic and associated noise, but is very unlikely to have a significant negative impact on any Annex IV species.

4.2.1.3 Bats

The area has low suitability for bats as it occurs offshore. Bats could forage at or transit the site however no linear features which could function as significant commuting routes and/or feeding areas will be affected. Considering its offshore nature, the site is considered to be of negligible value for bats. Based on these findings in relation to bats as it is concluded that the proposed works will have no impact on the terrestrial Annex IV bat species.

4.2.2 Physical Disturbance

The risk of injury or mortality is considered extremely low as marine mammals are exposed to considerable vessel traffic on a daily basis and would be aware of their presence. The geophysical vessel is small and slow thus any animals in the area would have sufficient time to avoid any collisions and thus injury or mortality.

4.2.3 Collision Risk

Collisions are extremely unlikely due to the small size and slow speed of the survey vessel.

4.2.4 Indirect impacts on preferred prey

No adverse effects on fish species are expected from marine operations.

4.2.5 Potential disturbance to life cycle

The proposed marine operations will not cause any adverse effects on Annex IV species in the area as the affected area affected is small and disturbance local.

4.2.6 Cumulative Effects

Cumulative effects will be very limited as duration is short (19 weeks in total) and no other marine activities are planned in the immediate area to the best of our knowledge, leading to no cumulative effects.

5. Mitigation Measures

Potential mitigation measures during marine site investigations are limited. The most effective mitigation is through the use of a Marine Mammal Observer (MMO) who ensures that there are no marine mammals within a pre-agreed distance prior to the onset of marine site investigations. The MMO can also record any reaction to the geophysical and geotechnical investigations. However, this mitigation measure will only be effective during daylight hours and in favourable weather conditions.

The National Parks and Wildlife Service recommend a distance of 1000m for geophysical survey and 500m radial distance of the drilling sound sources in water depths of <200m (NPWS 2014) on commencement.

The mitigation measures recommended by the NPWS are for the presence of a trained and experienced Marine Observer (MMO) to ensure a "buffer zone" is clear of marine mammals prior to the start of noise inducing activities. The proposed mitigation measures (Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters) recommended by the Department of Arts, Heritage and the Gaeltacht in 2014 are designed to mitigate any possible effects.

The following mitigation measures are proposed to minimise the potential impacts on marine mammals and to allow animals move away from the area of dredging and HDD operations:

1. A dedicated, qualified and experienced MMO will conduct a 30-minute watch for marine mammals within 1000m (geophysical) and 500m (geotechnical) prior to start up. If an Annex IV species (cetacean, marine turtle or otter) or seal is sighted within the mitigation zone, start-up must be delayed until the animal/s is observed to move outside of the mitigation zone or 30-minutes has passed without the animal being sited in the mitigation zone.
2. Geophysical and geotechnical activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.
3. Once normal operations commence, there is no requirement to halt or discontinue the activity at nighttime, nor if weather or visibility conditions deteriorate nor if marine mammals occur within the mitigation zone.

5.1.1 Disturbance

The most effective way of mitigating the potential effects of acoustic disturbance is through the provision of an MMO ensuring no marine mammals are present within the agreed mitigation zone.

5.1.2 Collision, injury and mortality

There is an insignificant risk to Annex IV species in regard to injury, morality or collision.

5.1.3 Disruption of normal behaviour

Geophysical and geotechnical investigations activity is very local and of relatively short duration and any disturbance will be short-term. Sound exposure levels from geophysical and geotechnical investigations maybe above levels that are able to cause disturbance to a marine mammal, including masking or behavioural impacts. The presence of an additional vessel and the associated noise produced, is very unlikely to have a significant impact on marine mammals.

5.1.4 Residual Impacts

With the implementation of the above mitigation measures, it is very unlikely that there will be any negative residual impacts from the proposed SIs on Annex IV species in the area.

6. Conclusion

The SIs proposed will not deliberately capture or kill any Annex IV Species for their duration. There will be no eggs taken or removed from site and won't disturb any species during breeding seasons or migration, and won't disturb any resting sites for these species. The conservation status of these Annex IV species will not be negatively impacted by the undertaking of the SIs, and a qualified MMO will be used on site to further mitigate any potential impacts. There will be no permanent damage or loss of habitat for the species listed in Annex IV also.

It is deemed that, based on the information provided in this report and the supporting information in the Marine Mammal Risk Assessment submit with this application, the SI works that are subject of this derogation licence would not lead to any negative significant impacts on the species listed in Annex IV of the Habitats Directive.

7. References

- Anon (2017) DOCKET NO. CP17--000 RESOURCE REPORT NO. 9 APPENDIX S – HDD ENVIRONMENTAL SOUND LEVEL ASSESSMENT REPORT. ALASKA LNG PROJECT. DOC NO: USAI-PE-SRREG-00- 000009-000 DATE: APRIL 14, 2017 REVISION: 0
- Au, W. W. L., Popper, A. N., and Fay, R. R. 2000. Hearing by whales and dolphins. Springer Handbook of Auditory Research. Springer-Verlag, New York.
- Anderwald, P., Brandecker, A., Coleman, M., Collins, C., Denniston, H., Haberlin, M. D., Donovan, M., Pinfield, R., Visser, F. and Walshe, L. (2013) Displacement responses of a mysticete, an odontocete, and a phocid seal to construction related vessel traffic. Endangered Species Research, 21: 231–240.
- Berrow, S.D., Whooley, P., O'Connell, M. and Wall, D. (2010). Irish Cetacean Review (2000-2009). Irish Whale and Dolphin Group, Kilrush, Co. Clare. 60pp.
- Cronin, M., Duck, C., Ó Cadhla, O., Nairn, R., Strong, D. and O' Keeffe, C. (2004). Harbour seal population assessment in the Republic of Ireland: August 2003. Irish Wildlife Manuals, No. 11. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Cronin, M.A., Zuur, A.F., Rogan, E., McConnell, B.J. (2009) Using mobile phone telemetry to investigate the haul-out behaviour of harbour seals *Phoca vitulina vitulina*. Endang Species Res 10:255-267. https://doi.org/10.3354/esr00170
- Doyle, T.K. (2007) Leatherback Sea Turtles (*Dermochelys coriacea*) in Irish waters. Irish Wildlife Manuals, No. 32. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- Erbe, C. and McPherson, C. (2017) Underwater noise from geotechnical drilling and standard penetration testing", The Journal of the Acoustical Society of America 142, EL281-EL285 https://doi.org/10.1121/1.5003328
- Ghoul, A. and Reichmuth, C. (2014) Hearing in the sea otter (*Enhydra lutris*): auditory profiles for an amphibious marine carnivore. Journal of Comparative Physiology A volume 200, pages 967–981.
- Haebler, R. and Moeller, R.B. (1993) Pathobiology of Selected Marine Mammal Diseases. In Couch, J.A., and Fournie, J.W. (Eds.). (1993). PATHOBIOLOGY of MARINE and ESTUARINE ORGANISMS (1st ed.). CRC Press. https://doi.org/10.1201/9781003069058.
- IFREMER (2016) ACOUSTIC IMPACT ASSESSMENT OF SUBBOTTOM PROFILERS ON MARINE MAMMALS. Technical report. 2016.
- Irwin Carr (2021) Moneypoint Pile Instillation: marine noise emissions from drilling. Rp001/2021294. Moneypoint Pile Instillation, December 2021, 31pp.
- Kelleher, C. and Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Mathavarajah, S., Stoddart, A.L., Gagnon, G.A., Dellaire, G. (2021) Pandemic danger to the deep: The risk of marine mammals contracting SARS-CoV-2 from wastewater, Science of The Total Environment,760, 143346, ISSN 0048-9697,
- https://doi.org/10.1016/j.scitotenv.2020.143346.
- McConnell, B.J., Fedak, M.A., Lovell, P. and Hammond, P.S. (1999) Movements and foraging areas of grey seals in the North Sea. *Journal of Applied Ecology* 36, 573-590
- Morris, C.D. and Duck, C.D. (2019) A*erial thermal-imaging survey of seals in Ireland, 2017 to 2018.* Irish Wildlife Manuals, No. 111 National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland
- Newby T. C., Hart F. M., Arnold R. A. (1970) Weight and blindness of harbor seals. *Journal of Mammalogy, 1970, vol. 51 pg. 152.*
- Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. (2007) Responses of cetaceans to anthropogenic noise. *Mammal Review* 37(2), 81-115.
- NPWS (2007) Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters. National Parks and Wildlife Service, 7 Ely Place, Dublin 2.
- NPWS (2011a) Conservation Objectives Series: Saltee Islands SAC: SAC 000707. National Parks and Wildlife Service, 7 Ely Place, Dublin 2.
- NPWS (2011b) Conservation Objectives: Roaringwater Bay and Islands SAC 000101. National Parks and Wildlife Service, 7 Ely Place, Dublin 2.
- NPWS (2014) Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters – January 2014. National parks and Wildlife Service, 7 Ely Place, Dublin 2.

- O'Brien, J.M., Berrow, S.D., Ryan, C, McGrath, D., O'Connor, I., Pesante, P., Burrows, G., Massett, N., Klötzer, V. and Whooley, P. (2009) A note on long-distance matches of bottlenose dolphins (*Tursiops truncatus*) around the Irish coast using photo-identification. Journal of Cetacean Research and Management 11(1), 71-76.
- Ó Cadhla, O., Strong, D., O'Keeffe, C., Coleman, M., Cronin, M., Duck, C., Murray, T., Dower, P., Nairn, R., Murphy, P., Smiddy, P., Saich, C., Lyons, D. and Hiby, A.R. (2007). An assessment of the breeding population of grey seals in the Republic of Ireland, 2005. Irish Wildlife Manuals No. 34. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- O'Cadhla, O. and Strong, D. (2007) Grey seal moult population survey in the Republic of Ireland, 2007. CMRC.
- O'Dwyer, P. (2017) Marine Mammal Observers Report for Dredging and Dumping Activity, September to October 2017. Port of Cork. Dumping at Sea Permit: S0013-02. IWDG Consulting. 82pp.
- OSPAR (2008) *Draft Assessment of the Environmental Impact of Underwater N*oise. Biodiversity Series. OSPAR.
- Port of Cork (2023) Port of Cork Masterplan 2050. May 2023.
- Reid, N., Hayden, B., Lundy, M.G., Pietravalle, S., McDonald, R.A. and Montgomery, W.I. (2013) National Otter Survey of Ireland 2010/12. Irish Wildlife Manuals No. 76. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Richardson, W.J., Greene, C.R., Malme, C.I. and Thomson, D.H. (1995) *Marine Mammals and Noise*. Academic Press.
- Robinson, K.P., O'Brien, J.M., Cheney, B., Mandleberg, L., Eisfeld, S.M., Ryan, C., Whooley, P., Oudejans, M.G., O'Donovan, M., Berrow, S.D., Costa, M., Haberlin, D., Stevick, P.T. and Thompson, P.M. (2012) Discrete or not so discrete: Long distance movements by coastal bottlenose dolphins in UK and Irish waters. *Journal of Cetacean Research and Management 12: 365–371.*
- Russell, C. and Levesque, S. (2014) Port of Cork Maintenance Dredging Marine Mammal Observers Report for Dredging and Dumping Activity. September-October 2017. IWDG Consulting.
- Ryan, C., Whooley, P., Berrow, S.D., Barnes, C., Massett, N., Strietman, W. J., Broms, F., Stevick, P.T., Fernald Jr, T.W. and Schmidt, C. (2015) A longitudinal study of humpback whales in Irish waters. Schmidt, C. (2016) A longitudinal study of humpback whales in Irish waters. *Journal of the Marine Biological Association (UK),* Volume 96, (Special Issue 4), 877-883 DOI:10.1017/S0025315414002033.
- Ryan, C., Rogan, E., and Cross, T. (2010). The use of Cork Harbour by bottlenose dolphins (*Tursiops truncatus* (Montagu, 1821)). Irish Naturalists' Journal, 31(1), 1-9.
- Sini, M.I., Canning, S.J., Stockin, K.A. and Pierce, G.J. (2005) Bottlenose dolphins around Aberdeen harbour, north-east Scotland: a short study of habitat utilization and the potential effects of boat traffic. *Journal of the Marine Biological Association (UK),* 85, 1547-1554.
- Southall, B. L., Bowles, A. E., Ellison, W. T., Finneran, J. J., Gentry, R. L., Greene, C. R., Kastak, D., Ketten, D. R., Miller, J. H., Nachtigall, P. E. et al. (2007). Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals 33, 411- 521.
- Sutton, G., Jessopp, M., Folegot, T. and Clorenec, D. (2014) *Mapping the spatio-temporal distribution of underwater noise in Irish waters*. EPA STRIVE Programme 2007-2013 Report No. 121.
- Todd, V.L.G., Todd, I.B., Gardiner, J.C., Morrin, E.C.N., MacPherson, N.A., DiMarzio, N.A., and Thomsen, F. (2015) A review of impacts of marine dredging activities on marine mammals. ICES Journal of Marine Science 72(2), 328-340.
- Thompson, P.M. (2007) Developing water quality standards for coastal dolphins. Marine Pollution Bulletin, 54(2), 123-127,
- ISSN 0025-326X, https://doi.org/10.1016/j.marpolbul.2006.11.026.
- Wall, D., Murray, C., O'Brien, J., Kavanagh, L., Wilson, C., Glanville, B., Williams, D., Enlander, I., Ryan, C., O'Connor, I., McGrath, D., Whooley, P. and Berrow, S. (2013) *Atlas of the distribution and relative abundance of marine mammals in Irish offshore waters: 2005 – 2011*. Irish Whale and Dolphin Group. 58 pp. ISBN 0-9540552-7-6.
- Whooley, P., Berrow, S., and Barnes, C. (2011). Photo-identification of fin whales (*Balaenoptera physalus* L.) off the south coast of Ireland. *Marine Biodiversity Records*, 4, e8.