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Wicklow Harbour Dredging and Arklow Disposal
Risk Assessment for Annex IV Species

WICKLOW
ENDLESS OPPORTUNITIES

Client	**Wicklow County Council**
Document Ref.	23145-REP-004-04
Project Title	Wicklow Harbour Dredging and Arklow Disposal RAAIVS
Date	16/02/2024

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Document Reference:	23145-REP-004-04

Client:	Wicklow County Council
Ultimate Client:	Wicklow County Council
Confidentiality	Non Confidential

REVISION HISTORY

Rev	Date	Reason for Issue	Originator	Checker	Reviewer	Approver
00	30/08/2023	Draft for Internal Review	[redacted]			
01	25/09/2023	Draft updated following Client Review				
02	30/10/2023	Draft updated following Client Review				
03	01/02/2024	Final updated following Client Review				
04	16/02/2024	Final Issue				

DISCLAIMER

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List of Abbreviations

API	American Petroleum Institute
BHD	Backhoe Dredger
CPOD	Cetacean Passive Acoustic Network
DAHG	Department of Arts, Heritage and the Gaeltacht
DCCAE	Department of Communications, Climate Action and Environment
DHLGH	Department of Housing, Local Government and Heritage
EC	European Commission
EEZ	Exclusive Economic Zone
EPS	European Protected Species
EU	European Union
IMO	International Maritime Organization
ISO	International Organization for Standardization
JNCC	Joint Nature Conservation Committee
MARPOL	The International Convention for the Prevention of Pollution from Ships
Minister	Minister for Housing, Local Government and Heritage
MAP	Maritime Area Planning Act 2021
NM	Nautical Mile
NPWS	National Parks and Wildlife Service
PTS	Permanent Threshold Shift
PV	Plough Vessel
SPL	Sound Pressure Level
TTS	Temporary Threshold Shift
TSHD	Trailing Suction Hopper Dredger
UK	United Kingdom
VC	Vibrocore
WGS	World Geodetic System

Glossary of Terms

Auditory Masking (marine mammals)	Surrounding or additional sounds which impacts/reduces marine mammals' ability to detect or recognise other relevant sounds
Dredging	The clearance of a harbour, river, or other, bed by the removal of mud, sand, sediment etc with dredging equipment
Exclusive Economic Zone	Marine area from the territorial seas boundary seaward to a distance of 200 miles or otherwise as agreed under international statute.
Foreshore	The foreshore of Ireland is classed as the land and seabed between the high water of ordinary or medium tides (shown HWM on Ordnance Survey maps) and the twelve-mile limit (12nm = 22.224km). The foreshore also covers the tidal reaches of rivers.
Foreshore Licence Area	Within this report: The area within the 12nm limit of the high-water mark of ordinary tides for which a Foreshore Licence Application is submitted to the Department of Housing, Local Government and Heritage for a licence under Section 3 of the Foreshore Act to undertake site investigation activities.
Habitats Directive	Adopted in 1992, the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. It forms the cornerstone of Europe's nature conservation policy with the Birds Directive and establishes the EU wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging developments.
Maritime Area Planning Act 2021	Legislation reforming consenting within Ireland's marine area, including introducing both an offshore specific consenting regime and extending the powers of the State to enable the State to operate a consenting regime across its entire EEZ and agreed continental shelf.
Maritime Usage Licence Area	Within this report: The areas within the outer limit of the State's continental shelf and high-water mark for which a Maritime Usage Licence Application is submitted to MARA for a licence under the Maritime Area Planning Act 2021 to undertake offshore activities.
MARPOL	MARPOL is the main international convention aimed at the prevention of pollution from ships caused by operational or accidental causes. It was adopted at the International Maritime Organization (IMO) in 1973. The Protocol of 1978 was adopted in response to a number of tanker accidents in 1976–1977.
Minister	In this report, Minister means the Minister for Housing, Local Government and Heritage
Pollution Event	A 'pollution incident' includes a leak, spill or escape of a substance, or circumstances in which this is likely to occur.
Receiving Environment	The receiving environment is the environment upon which a proposed activity might have effects.

Universal Transverse Mercator (UTM)	The UTM (Universal Transverse Mercator) coordinate system divides the world into sixty north-south zones, each 6 degrees of longitude wide. UTM zones are numbered consecutively beginning with Zone 1 and progress eastward to Zone 19. UTM 29N (EPSG:32629) is used to map the project area.

1 INTRODUCTION

Wicklow County Council proposes to undertake maintenance dredging works in Wicklow Harbour, which is subject to continued accretion of material. The dredged material will be deposited at a disposal site (Arklow Bank Disposal Site), approximately located 0.4 km offshore from Arklow, and approximately 20 km south west of Wicklow Harbour (Figure 1.1).

Wicklow County Council have commissioned Gavin and Doherty Geosolutions to prepare this report in support of applications for licences required to undertake the dredging and disposal at sea activities. All historical documentation regarding the establishment and use of the Arklow Bank Disposal Site have been reviewed, including environmental monitoring reports, to inform the assessment of the suitability of the Arklow Bank disposal site for disposal of material dredged from Wicklow Harbour.

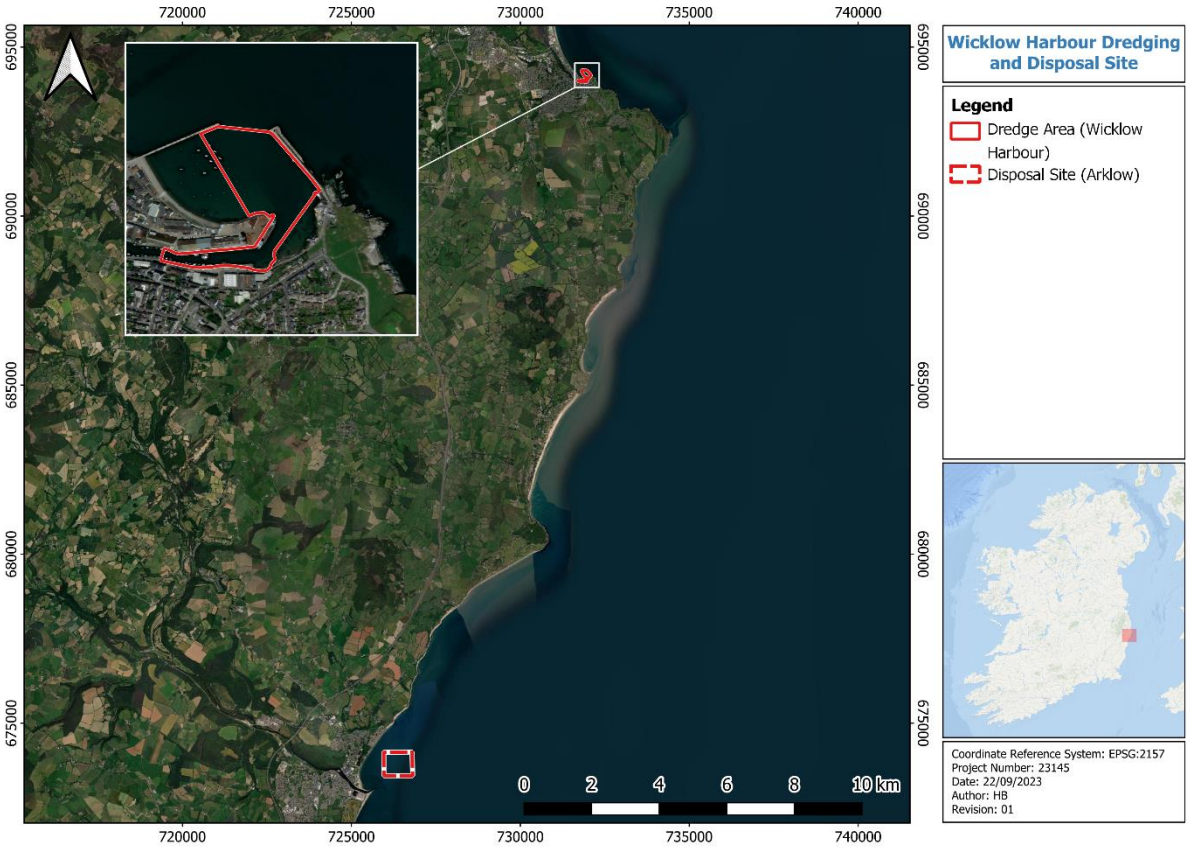

Figure 1.1 Wicklow Harbour Dredging Area (Dredge Area - Red Outline; Dredge Disposal Area – Red Dashed Outline).

The dredge area comprises an irregular-shaped polygon which has an area of 0.056 km^{2}within Wicklow Harbour, and a rectangular-shaped disposal site approximately 20 km southwest of Wicklow harbour which has an area of 0.587 km^2 (Figure 1.1). Where the dredge area adjoins or abuts the land the High-Water Mark as defined on the OSI 25 Inch Mapping is the boundary of the licence area. The disposal area does not adjoin or abut the land.

1.1 AIM OF THE REPORT

This report aims to provide the necessary information to the competent authorities to inform a risk assessment for Annex IV species under Article 12 of the Habitats Directive (92/43/EEC) to assist them in making an informed decision on the likely impact of this project on Annex IV species.

1.2 STRUCTURE OF THE REPORT

This report is structured into the following chapters to include information relating to the proposed dredging and disposal activities, the Annex IV Species that can potentially occur in the proposed activity area, the potential impacts to Annex IV species and measures to ensure Annex IV species are protected. Specifically, the chapters describe or comprise the following elements:

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

1.3 RECEIVING ENVIRONMENT

The receiving environment of the dredging activities encompasses Wicklow Harbour in Wicklow Town, the capital town of Co. Wicklow. Wicklow Harbour includes Wicklow Port, which is managed by the Wicklow County Council (WCC) and is situated at the mouth of the Leitrim River. Wicklow Port is a fishing and cargo port with hard stand areas, warehouses and associated machinery.

The receiving environment of the disposal site encompasses Arklow Bay off the coastline of Arklow town, Co. Wicklow.

1.4 MAINTENANCE DREDGING

Wicklow County Council needs to regularly dredge the navigation channel, turning basin and berthing pockets in order to maintain the depths needed for the safe navigation of vessels to and from Wicklow Port. The desired navigational levels to be maintained include 3.6m below Chart Datum (CD) at Packet Quay, East Pier, and Southern Quay. The levels to be maintained at North Quay are 3.0 m below DC and 2.0 m below CD at Leitrim River.

WCC is therefore proposing an Eight Year Maintenance Dredging programme between 2025 and 2032. Sediment chemistry sampling and analysis, along with eco-toxicological testing, was undertaken in 2021 (following Marine Institute advice) to check the suitability of the dredged material to be deposited/disposed of at sea. Sampling with a Van Veen grab revealed silty sand, with fine sands in

the harbour. The chemical analysis of the samples revealed the sediment is Class 1; where the contaminant concentrations are less than Level 1, uncontaminated and no biological effects are likely (Cronin *et al*., 2006; Marine Institute, 2019). The samples are therefore considered acceptable for disposal at sea.

A site located approximately 20 km to the southwest of Wicklow Harbour and approximately located 0.4 km offshore from Arklow, has been identified for disposal at sea of the dredged material. The Dumping at Sea Permit S0002-01 was granted by the EPA in April 2011 for the use of this site for disposal of material dredged from Arklow Harbour. For this project, WCC has proposed to use the same disposal location for the dredged material, which will be composed of mainly silt and sand, with small amounts of gravel present.

1.5 DREDGING METHODS

The following dredging methods will be used to ensure the correct depths are reached/maintained:

Trailing Suction Hopper Dredger (TSHD):

This is used for the outer areas and includes the approach channel, packet quay, North Quay and the majority of the East Pier.

This type of dredger is self-propelled using pumps to gather material. The dredger has drag arms that are used to reach the seabed. Once at designated area the dredger uses the trailer and drag head to slowly collect the material. The material is collected and stored in the hopper where the heavier material settles, is transported, and released at a permitted dumping site/area for dumping. The material generally collected by the trailing hopper suction dredger includes sand, silt, clay and gravel but cannot be used for heavier material such as rock, unless specially adapted (IADC, 2023).

Backhoe Dredger:

The method is primarily used in the inner areas of the harbour and includes the Southern Quay, Leitrim River and North Quay. Additional minor areas in the remainder of the port may also use this method (i.e. where TSHD access is restricted).

Generally, these dredgers are stationary and have a single hydraulic bucket located at the end of an arm (McQueen et al., 2018). The Backhoe is mounted on a barge or specialised and rotatable pontoon which then moves the material back towards the backhoe dredger for the collection of material (McQueen et al., 2018; IADC, 2023).

Backhoe dredgers can be used for a variety of areas and are suitable for dredging materials such as sand, clay, stone/cobbles, and heavier/stronger material including fractured and unfractured rock (IADC, 2023).

Plough vessel

A plough vessel generally uses, if available, a bulldozer type plough to relocate material, although a standard open box plough can suffice on occasion. Sediment movement is achieved by towing the plough behind a powered vessel, usually a small workboat or tug. If used correctly, the plough is

suspended at a controlled height from an A-frame mounted over the stern of the towing vessel. Height, or depth of submergence, is controlled by a deck mounted hoist winch. The cutting blade at the leading edge of the plough slices the surface sediment and pushes the material to deeper/target areas. The plough is then raised above the general seabed level and the towing vessel returns to the area from which sediment is to be moved and repeats the cycle.

Water Injection Dredging (WID):

Water Injection Dredging (WID) is an environmentally friendly method of removing sediment build up and maintaining navigation channel depths for ports and rivers (VanOord, 2023). The WID method is used in areas where the sediment is composed of fine sand, silts and clay. Water is injected into the subsoils which allows the sediment to be moved by density currents.

Disposal Activities:

For disposal, dredgers usually have doors in the hull to empty the dredged material by splitting the doors in two halves and opening on hydraulic hinges, where the dredged material is discharged through bottom doors at the selected location (IADC, 2023).

2 LEGISLATION AND REGULATION

2.1 EUROPEAN PROTECTED SPECIES (EPS)

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

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

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

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

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

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

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

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

permit). The Wildlife Act applies to waters within Ireland's Territorial Sea, i.e., out to the 12 nm limit from the baseline[1].

Please note, for the purposes of this assessment, grey and harbour seals are not included as they are not Annex IV species. Effects of the proposed activities on Natura 2000 sites where grey and/or harbour seals (and/or harbour porpoise and/or bottlenose dolphins) are designated features are considered in the SISAA document which accompanies this report.

2.2 GUIDANCE

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

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

This DAHG (2014) guidance recommends that listed coastal and marine activities, including dredging activities, undergo a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species to address any area-specific sensitivities, both in temporal and spatial extent, and to inform the consenting process. This document also sets out a generalised framework for the consideration of risk from particular sound-producing activities in the waters of Ireland's Exclusive Economic Zone (EEZ) and offers guidance for planning and risk management, where necessary. Additionally, 'The protection of marine European Protected Species from injury and disturbance: Guidance for the marine area in England and Wales and the UK offshore marine area', published in 2010 by the JNCC, Natural England and the Countryside Council for Wales (now Natural Resources Wales) (JNCC *et al.*, 2010), has been referenced in completing this assessment to complement the NPWS (2014) guidelines.

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

3 ANNEX IV SPECIES IN THE VICINITY OF THE AREA

Ireland has recorded 25 species of cetacean, all of which are recognised as protected species under the EU Habitats Directive and the Irish Wildlife Act 1976, as amended. Of these 25 species, nine - Common dolphin, Bottlenose dolphin, Harbour porpoise, Fin whale, Minke whale, Humpback whale, Killer whale, and Risso's dolphin - have been recorded off the east coast and may be present in the proposed survey area at least on a seasonal basis (O'Brien *et al*., 2009; Wall *et al*., 2013, Ireland's Marine Atlas, 2021). Leatherback turtles have been observed off the coast of Wicklow in recent years and with their range also reaching as far as the Dublin area on Ireland's east coast (NPWS, 2019). Otter may also interact with limited coastal areas of the landfalls should they be present in any rivers within range of landfall areas.

Table 3-1 presents a short synopsis of the Annex IV species that may be found within or near the proposed Marine Usage Licence Area.

Table 3-1 Annex IV species that may be found within or near the Marine Usage Licence Area according to DAHG (2009) and Ireland's Marine Atlas (2021)

Species	Species Information
Harbour Porpoise (*Phocoena phocoena)*	Generally found in the northern latitudes of the Pacific and Atlantic oceans, mainly in the continental margins. They are the most widespread of any species in Ireland, observed in all inshore waters around the entire coastline and almost all records were within 10 km of the coast (Berrow *et al*., 2010). The harbour porpoise is the smallest cetacean found in Irish waters and generally appears shy, avoiding other species and rarely interacting with boats, which can make observing it difficult in anything other than calm waters. Harbour porpoises are particularly abundant between Howth Head and Dalkey off Co. Dublin, where boat-based surveys conducted by IWDG produced the highest counts anywhere in Ireland (IWDG, 2022a; NPWS, 2022; 2019). More sightings were recorded in the summer months in Irish and Celtic waters (Rogan et al., 2018). Harbour porpoises rarely occur over deep water but have been observed over relatively shallow (<200m) offshore banks (DAGH, 2009).
Common dolphin (*Delphinus delphis*)	Deemed the second most frequently reported species of cetacean after the harbour porpoise, and the most abundant of all cetacean species recorded in Ireland (Berrow *et al.*, 2010). Common dolphins occur in all Irish waters including offshore waters and the Irish Sea, but highest concentrations appear to occur off the south and west coasts (DAGH, 2009). There appears to be an eastward movement of this species along the south coast during autumn and winter, with sightings peaking off County Kerry towards late summer, off County Cork between September and January and off County Waterford between November and February (Berrow *et al.*, 2010).
Bottlenose dolphin (*Tursiops truncatus*)	A large, robust, and gregarious dolphin found in tropical and temperate waters worldwide (Wall *et al*., 2013). In Ireland, bottlenose dolphin shows both a coastal and offshore distribution with most sighting records off the western seaboard and in the Celtic Sea, although it is also found in the Irish Sea and in

Species	Species Information
	waters along the edge of the continental shelf (DAGH, 2009). Resident or semi-resident populations are known from the Shannon Estuary, Tralee Bay, the Mayo coast and Cork Harbour. Results from a study by Mirimin *et al*. (2011) comparing bottlenose dolphin biopsies indicate that there is a degree of isolation of the Shannon Estuary population from animals encountered elsewhere around the coast, and that a larger pelagic population exists that is also genetically distinct from the Irish coastal populations.
Risso's dolphin (*Grampus griseus*)	In Ireland during the summer months Risso's dolphin favours inshore waters and offshore islands, especially The Saltee Islands off County Wexford, the County Cork coast and the Blasket Islands off County Kerry in contrast to deep-water habitats elsewhere in the world (IWDG, 2023b). According to Berrow *et al.* (2010), most sightings occur between May and July suggesting a late spring inshore movement. Although Risso's dolphins have been reported off all coasts in Ireland, their distribution is more clustered with regular sightings inshore off the northwest and southeast coasts, with most records of Risso's dolphins in the UK and Ireland being within 11 km of the coast (DAGH, 2009). Risso's dolphin were reported regularly in the Irish sea, with counties Wicklow and Wexford accounting for 41% of all inshore Risso's dolphin sightings (Berrow *et al*. 2010). Higher sightings of the Risso's dolphin were recorded in the Irish Sea during the summer months (Rogan et al., 2018).
Killer whale (*Orcinus orca*)	Killer whales are the largest delphinid growing up to 9.5m. They are easily identified with striking coloration and large dorsal fins, particularly in the adult males. They are the most widely distributed cetacean in the world (Shirihai & Jarrett, 2006), and have been recorded off all Irish coasts in all seasons, with markedly fewer sightings in the Irish Sea (Wall *et al*., 2013), but mainly in shallow continental shelf waters (DAGH, 2009). Photo identification has linked killer whales sighted off Ireland with the "West Coast Community" resident off Scotland (Berrow *et al*., 2010).
Minke whale (*Balaenoptera acutorostrata*)	The minke whale is the most common and widely distributed of the baleen whales in Ireland and the most likely to be encountered in shallower coastal and continental shelf waters. It occurs off all coasts, including the Irish Sea, but most records are from southern and southwestern coastal waters between April and July (IWDG, 2023c). The species has also been observed over offshore banks (DAGH, 2009). The smallest of the baleen whales, their length averages 8.5 metres. Usually encountered singly or in small groups, sightings are most frequent off the Irish coast in spring and autumn (Wall *et al*., 2013).
Fin whale (*Balaenoptera physalus*)	Growing up to 24m, Fin whales are the second-largest animal in the world after the blue whale (*Balaenoptera musculus*) and the largest baleen whale likely to be present close to shore off Ireland. The Fin whale has a worldwide distribution in mainly temperate and polar sea (Shirihai & Jarrett, 2006). In Irish waters, fin whales are recorded in all seasons, but the current population remains unknown (NPWS, 2019). Nearshore sightings cluster to the south and southwest of the country with peaks in the number of animals in the autumn and early winter (DAGH, 2009), but they are also well-represented off the shelf edge in deeper waters (Wall *et al*., 2013).
Humpback whale (*Megaptera novaeangliae*)	The Humpback whale is a global species found in all the major ocean basins. In Ireland, Humpback whales have been recorded in small numbers close inshore

Species	Species Information
	mainly off the south and southwest coasts, although all coasts are represented, including the Irish Sea. However, records offshore are relatively scarce (NPWS, 2019; DAGH, 2009). Sightings of the iconic humpback have increased recently in Irish waters, with the Irish photo-ID catalogue of unique humpback whale sightings comprising 120 individuals (IWDG, 2022d).
Leatherback turtle (*Dermochelys coriacea*)	The leatherback turtle (*Dermochelys coriacea*) is the most widely distributed living reptile species, being found in all oceans except the Southern Ocean. Within the North Atlantic its range extends from the tropics to the high latitudes of Newfoundland right across to Europe's north-easterly fringe. It is a widely roaming species, with individuals making extensive pan-oceanic movements. Breeding is confined to warm tropical regions because of thermal constraints on egg incubation, but the species has many unique anatomical and physiological adaptations that permit it, unlike other marine turtles, to forage seasonally into cooler temperate waters. Consequently, leatherback populations have a very dynamic range. During the summer months their range is at its greatest extent with individuals located throughout the North Atlantic, whereas during the winter months their range is restricted to areas where the sea surface temperature is >15°C. (NPWS, 2019) Recent studies have shown that after nesting in the tropics the majority of North Atlantic leatherbacks head north towards cooler temperate waters. Some of these individuals head north towards the north-east Atlantic and Irish waters where they forage on jellyfish for the summer months before turning south again in the autumn as water temperatures decline (NPWS, 2019). They are generally spotted off the south and southwest coasts of Ireland during the summer months, with live sightings peaking in August (NPWS, 2019; OSPAR, 2009; King and Berrow, 2009; Doyle *et al*., 2007). However, they have also been spotted in recent years off the coast of Wicklow (King and Berrow, 2009).
Eurasian otter (*Lutra lutra*)	The otter is a semi-aquatic mammal, which occurs in a wide variety of aquatic habitats such as rivers, streams, lakes, estuaries and on the coast. Coastal dwelling populations use shallow, inshore marine areas for feeding but they also require access to fresh water for bathing and terrestrial areas for resting and breeding, therefore their foraging range in the marine environment is limited to coastal areas. In Ireland, the territory of female otters is 6.5 ± 1.0 km in coastal environments (de Jongh *et al*. 2010) and males may have a larger extent; it has been suggested that the otter's range is approximately 12 km along the coast and 80 m seaward from the coast (NWPS, 2015; NPWS, *Lutra lutra* (1355) Conservation Status Assessment Report). Under water, hearing sensitivity is significantly reduced when compared to sea lions and other pinniped species, demonstrating that otter hearing is primarily adapted to receive airborne sounds (Ghoul *et al*., 2014).

Although not considered specifically in this assessment due to their lower likelihood of occurrence, any assessment of, or mitigation measures put in place for, the species assessed here are considered to be appropriate/relevant for other less commonly occurring Annex IV species (e.g., other cetaceans and basking shark *Cetorhinus maximus*).

4 POTENTIAL IMPACTS

The following are the potential impacts that have been identified given the nature of the dredging and disposal activities proposed under this application:

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

4.1 DISTURBANCE FROM VIBRATION AND UNDERWATER NOISE ASSOCIATED WITH SURVEYS

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

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

In order to evaluate the potential of the proposed activities to cause harm to Annex IV species, an assessment has been conducted using the approach described in Southall *et al*. (2007), in line with the current guidance from DAHG (2014).

Southall *et al*. (2007) separate marine mammals into groups based on their functional hearing, namely low-frequency cetaceans, mid-frequency cetaceans, high-frequency cetaceans, pinnipeds in water and pinnipeds in air. For each of these groups sound pressure levels that would result in injury (TTS or PTS) are proposed for individuals exposed to single, multiple and non-pulsed sources.

Note updated noise exposure criteria are proposed by the US National Marine Fisheries Service (NMFS, 2016; NMFS, 2018) and Southall *et al*. (2019). The NMFS (2018) / Southall *et al*. (2019) weightings and criteria are similar to the Southall *et al*. (2007) criteria, although the hearing groups are more differentiated. Specifically, the distinction between High Frequency and Very High Frequency cetacean groups (as opposed to between mid- and high-frequency) reflects the regions of best hearing sensitivities within these groups, often including frequencies approaching or exceeding 100 kHz and a potential distinction between very low (VLF) and LF cetaceans among mysticetes and a potential

segregation of mid-frequency (MF) and HF cetaceans in addition to the distinction of HF and VHF cetaceans are suggested.

In effect this results in a re-labelling of Mid-Frequency (MF) cetaceans and High-Frequency (HF) Cetaceans to High-Frequency cetaceans and Very High-Frequency cetaceans respectively. The relevant PTS values within the updated groups were identical between NOAA (2018) and Southall (2019) with no substantive change in that respect.

As the updated exposure criteria do not materially change the injury criteria thresholds and current national guidance (DAHG, (2014) refers to Southall *et al*. (2007), the Southall *et al*. (2007) criteria are used in this report.

The injury criteria Sound Pressure Levels for each of the groups listed from Southall *et al*. (2007) are provided in Table 4-1 below and Southall *et al*. (2019) Sound Pressure Levels for reference in Table 4-2.

Table 4-1 Sound Pressure Level (SPL) injury criteria proposed by Southall et al. 2007.

Marine Mammal group	Injury Criteria	
	TTS	PTS
Low-Frequency Cetaceans (Baleen whales)	224dB re: 1µPa (peak)	230dB re: 1µPa (peak)
Mid-Frequency Cetaceans (including Bottlenose dolphins)	224dB re: 1µPa (peak)	230dB re: 1µPa (peak)
High Frequency Cetaceans (including harbour porpoise)	224dB re: 1µPa (peak)	230dB re: 1µPa (peak)
Sea otter (in water) (proxy for Eurasian otter)	212dB re: 1µPa (peak)	218 dB re: 1µPa (peak)

Table 4-2 Sound Pressure Level (SPL) injury criteria proposed by Southall et al. (2019), for individual marine mammals exposed to discrete noise events.

Marine Mammal group	Injury Criteria	
	TTS	PTS
Low-Frequency Cetaceans (LF) (Baleen whales)	213dB re: 1µPa (peak)	219dB re: 1µPa (peak)
Mid-Frequency Cetaceans (HF) (including Bottlenose dolphins)	224dB re: 1µPa (peak)	230dB re: 1µPa (peak)
High Frequency Cetaceans (including harbour porpoise)	196dB re: 1µPa (peak)	202dB re: 1µPa (peak)

Auditory band widths from Southall *et al*. (2007) (as cited in the DAHG (2014) guidance) and Southall *et al*. (2019, provided for reference) for marine mammals which may be present in the vicinity of the Marine Usage Licence Area are shown in Table 4-3. Leatherback turtle auditory band widths from Piniak *et al.*, 2012, which are in the very low frequency range with a range of 50 - 1200 Hz and maximum sensitivity between 100-400 Hz in water, are also provided.

Table 4-3 Underwater Auditory Band Width for Marine Mammal Species (Southall et al., 2007 & 2019) and Leatherback turtle (Piniak et al, 2012)

Frequency	Marine Mammal/Species	Estimated Auditory Band Width (kHz) Southall et al. (2007)	Estimated Auditory Band Width (kHz) Southall et al. (2019)	Estimated Auditory Band Width (kHz) (Piniak et al., 2012)
Low Frequency Cetaceans	Baleen whales (Minke whale, Humpback whale)	0.007 – 22	0.007 – 35	
Mid Frequency Cetaceans	Most toothed whales and dolphins (including Common & Risso's Dolphin)	0.15 - 160	0.15 – 160	
High Frequency Cetaceans	Certain toothed whales and porpoises (including Harbour porpoise)	0.2 - 180	0.275 – 160	
Low Frequency	Sea otter			0.125-38
Very Low Frequency turtles	Leatherback turtle			0.050 – 1.2

4.2 Injury Due to Collision (Survey Vessels/Sampling Equipment)

There is a risk of collision between marine mammals and dredging vessels. However, it is largely recognised that the key factors contributing to collision between marine mammals and vessels is speed (see Schoeman *et al.*, 2020 for review). Injuries to marine mammals from vessel strikes are species-dependent but are generally more severe at higher impact speeds, with ships travelling at 14 knots or faster being the most likely to cause lethal or serious injuries (Wang *et al.*, 2007).

4.3 Pollution Event

Proposed dredging and disposal activities will result in a temporary increase in vessels using the area, which would therefore theoretically increase the risk of accidents and resultant fuel spills.

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

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

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

5 RISK ASSESSMENT FOR THE PROTECTION OF ANNEX IV SPECIES UNDER ARTICLE 12 OF THE HABITATS DIRECTIVE

The purpose of this section is to examine the possible impacts of the proposed activities on those Annex IV species identified as having the potential to be present in the area, and address protective measures aimed at reducing any impact to these species.

5.1 IDENTIFICATION OF RELEVANT ANNEX IV SPECIES

The following Annex IV species have been identified as having the potential to be present in the area:

- Harbour porpoise
- Common dolphin
- Bottlenose dolphin
- Fin whale
- Minke whale
- Humpback whale
- Killer whale
- Risso's dolphin
- Leatherback turtle
- Otter

5.2 IMPACT ASSESSMENT

The species listed above may be impacted by disturbance from underwater noise associated with surveys and through injury due to collision with dredging vessels.

Considering the information presented in section 4.1, all proposed dredging and disposal activities either emit noise that is inaudible to Annex IV species or of lower Sound Pressure Level than is required to cause injury.

WODA (2013) provide technical guidance relating to underwater sound and dredging activities, which notes busy port settings have high levels of background noise. This, in addition to the noise produced from dredging activities, may result in masking effects, where surrounding additional sounds impact/interfere with marine mammals' ability to detect or recognise other sounds. The authors conclude long-term exposure to noise may lead to TTS, but PTS and injury are unlikely to occur (WODA, 2013).

The sounds from dredging activities are generally lower frequencies (i.e. below 1 kHz, with the main source of the continuous sound coming from the propellers and pumps (McQueen et al., 2018). The type of material being dredged impacts the sound frequencies emitted from the dredging and dumping activities. The highest sound levels emitted from dredging activities is associated with the

dredging and depositing of sand, from a bucket closing or a hopper depositing the material. The Sound Pressure Level (SPL) from this type of activity can range from approximately 100 to 190 dB (McQueen et al., 2018). Water injection dredging is likely to produce less noise than mechanical dredging of material.

Note Sound Pressure Levels associated with the proposed activities are all **below** the injury criteria levels and the activities will not be undertaken long-term.

As such, Annex IV Species are unlikely to be disturbed by noise emitted by the proposed dredging and disposal activities.

The key factors contributing to collision between marine mammals and vessels are the presence of both in the same area and vessel speed (see Schoeman et al. (2020) for review). Injuries to marine mammals from vessel strikes are species-dependent but generally are more severe at higher impact speeds (Wang et al., 2007). Vessels involved in the dredging and disposal works are likely to be stationary or travelling slowly, c. 2 knots during dredging and less than 10 knots travelling to the disposal location, thus allowing any animal in the area time to avoid collision.

Cetaceans and seals in the area are exposed to vessels of all sizes on a regular basis due to other activities in the area including fishing and shipping. As a result, they are likely to maintain a distance from the vessel for the relatively short time required for dredging and disposal activities before returning to the area once the works have finished. The collision risk posed by the dredging and disposal activities is likely to be significantly lower that than posed by commercial shipping activity.

Significant effects on Annex IV species due to injury due to collision with the survey vessels used by the proposed activities are considered **unlikely**.

6 PROTECTION MEASURES TO PREVENT HARM TO ANNEX IV SPECIES

No likely significant effects are expected for any Annex IV species as a result of the proposed dredging and disposal activities, however vessel speed limits will be followed to minimise any disturbance to marine mammals. The project vessels will be moving at a maximum speed of 13 knots during transit to allow for marine mammal species to move away from the vessel should they be disturbed by the vessel presence or noise emissions. These movements are not considered to deviate from normal vessel traffic in the area and collision is very unlikely due to slow movement of the vessels.

7 CONCLUSION

The proposed activities will not have a significant effect on the species considered in this report.

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

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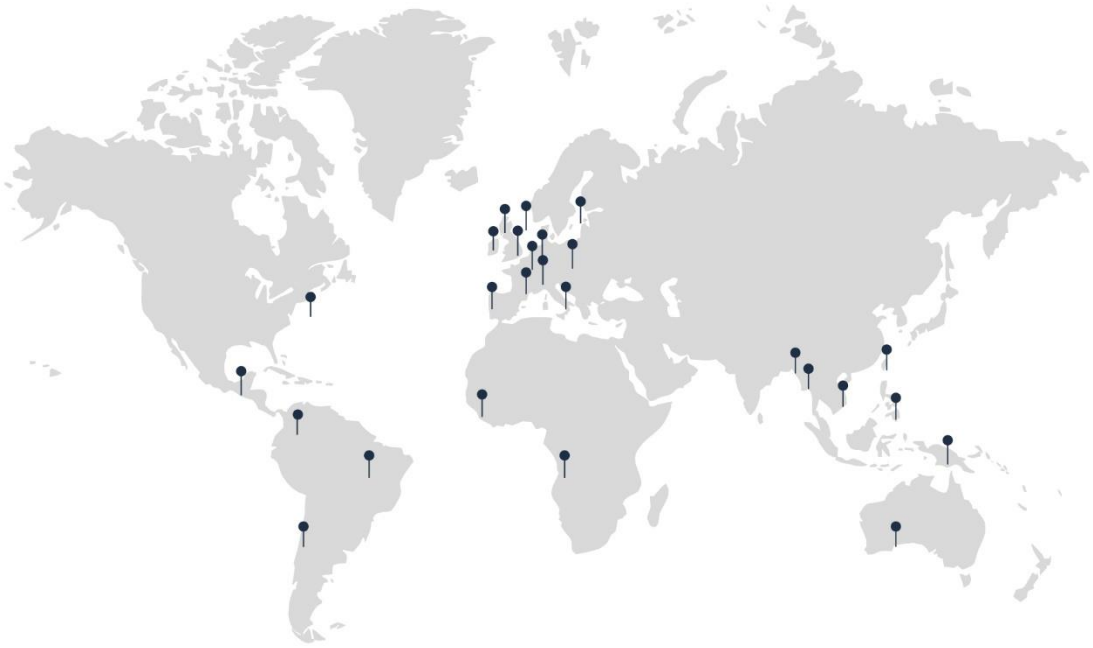
GLOBAL PROJECT REACH



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