Hartley Anderson Limited

Marine Environmental Science and Consultancy

Risk Assessment of Annex IV Species

Ballycotton Harbour Dredging Foreshore Licence Application

Report to
Department of Housing, Local Government and Heritage

March 2022

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SECTION 1 - INTRODUCTION

1.1 Background

Arup with Hartley Anderson Limited have been commissioned by the Department of Housing, Local Government and Heritage (DHLGH) to conduct an Article 12[1] Risk Assessment of an application by Cork County Council (CCC) for a Foreshore Licence to cover the proposed dredging of Ballycotton Harbour to restore it to navigable depths, and the dumping at sea of uncontaminated dredged material at the previously used dumping site to the south of Power Head, 16km southwest of Ballycotton. Any contaminated dredged material will be disposed of at a licensed landfill facility.

An application (S0032-01[2]) for a Dumping at Sea Licence (required under the Dumping at Sea Act 1996 as amended) for the proposed works is currently with the EPA for consideration.

1.2 Relevant consultation responses

The licence application was open for public consultation between 26th July 2021 to 24th August 2021. Responses from the prescribed bodies relevant to this risk assessment of Annex IV species are provided in Table 1.1.

[1] Article 12 of the Habitats Directive addresses the protection of species listed in Annex IV(a). The article applies throughout the natural range of the species within the EU and aims to address their direct threats, rather than those of their habitats.
[2] https://epawebapp.epa.ie/terminalfour/DaS/DaS-view.jsp?regno=S0032-01

Table 1.1: Responses from prescribed bodies to the consultation

Statutory Body	Applicant's Response
Marine Institute Chemical analysis of sediments to be loaded was carried out and presented with the application. The results of sediment analysis indicated approximately 1,500 tonnes* are contaminated and it is proposed that these sediments will be separately removed to land and disposed in a suitably licenced facility. The remaining material, (which is considered clean and suitable for disposal at sea) will be dredged and loaded for disposal at a site South of Power Head, 16km southwest of Ballycotton. It should be noted that the assessment guidelines for Dumping at Sea are not used for bringing the sediment on land. The sediment to be brought up on land will need to be assessed using the Waste Assessment Criteria. It is the understanding of the Marine Institute that the EPA issues waste licences for this activity. The Marine Institute noted that the risk to conservation features associated with the proposed activity was communicated in the NIS report. The Marine Institute considered that the interactions identified are appropriate and assuming the mitigation measures proposed are implemented in full, the likely interactions are not considered significant to conservation features. The Marine Institute agrees with the conclusions communicated in the NIS. **Interaction with Fisheries and Aquaculture operations:** The Marine Institute noted that the closest licenced aquaculture sites to the proposed development are in Cork Harbour (approx. 16km line of sight) or Ballymacoda Bay (approx. 11 km line of sight). The closest shellfish growing water is Ballymacoda Bay at approx. 11km. On the basis of the information provided in the application and supporting documents the Marine Institute concluded that the proposed development is unlikely to impact on any licenced aquaculture activities or shellfish growing waters.	The Applicant had no objection to the conditions proposed by the Marine Institute.

Statutory Body	Applicant's Response
Interactions with fisheries interests are likely in the harbour. The Marine Institute recommended full engagement with users of the pier and suggests it is carried out on an ongoing basis until the works are completed. On this basis, and considering the information above, the Marine Institute concluded that impacts on aquaculture and sea fishing from the proposed activity are not considered likely. *Arup notes that the quantity to be separately removed to land and disposed in a suitably licenced facility is 1500m^3.	
Inland Fisheries Ireland Inland Fisheries Ireland noted that the proposed works are not within known proximity of sensitive fisheries location or fish spawning grounds. The nearest significant river, in terms of potential use by anadromous fish species to the proposed dredge site is the Munster Blackwater, approximately 18km (hydrologically) from Ballycotton harbour. This river is designated for *Salmo salar* (Salmon), *Petromyzon marinus* (Sea lamprey), *Lampetra fluviatilis* (River Lamprey) and *Alosa fallax* (Twaite Shad) as habitat for Annex II migratory fish species. The proposed works have the potential to affect these species as they migrate along the coast by way of suspended sediment, pollution via drift of contaminated sediment or by accidental oil/fuel spills during works. Inland Fisheries Ireland pointed out that the mitigation measures and guidance of NPWS in regard to marine mammals are not transferrable to fish species. The fish remain invisible to any shore- or boat-based observer. Mitigation measures should aim to reduce the sound generated, in intensity and duration for the fish species present. The use of soft-start and ramp-up procedures for any sound-generating surveys undertaken – both on a day-to-day basis and on re-start after any stoppages within any day should be undertaken. This measure should be a condition of the foreshore licence. The estimated zone of influence (ZOI) extending from the dredging works is approximately 3km and is a relatively small distance that migratory species may avoid if suspended sediment levels are inhospitable during works.	The Applicant had no objection to the conditions proposed by Inland Fisheries Ireland.

Statutory Body	Applicant's Response
Inland Fisheries Ireland noted that the Marine Institute was consulted in relation to environmental testing of proposed dredge material within the harbour and provided sediment site-specific sampling and disposal recommendations for the contaminated and non-contaminated sediment, which should limit any impact from contaminated dredged material to the environment. The application has a detailed methods statement with mitigation measures outlined for various risks highlighted. To avoid the possibility of accidental spillage of oil/fuel associated with machinery or inshore shallow water vessels, a series of mitigation measures are to be implemented, as described in the Natura Impact Statement. These mitigation measures should be a condition of the Foreshore licence. Inland Fisheries Ireland concluded that, given the localised nature of the project, including the ZOI and notwithstanding the past history of the dumping site, southwest of Ballycotton, the proposed works are not considered deleterious to migratory fish species in the long term. The local IFI office in Macroom should be informed in advance of works starting.	
National Parks and Wildlife Service The National Parks and Wildlife Service noted that the proposed dredging application for Ballycotton Harbour had been evaluated by a Natura Impact Statement (NIS) and other documents. The conclusion of the Natura Impact Statement document is that the proposed works are unlikely to pose a significant likely risk to nature conservation interests in the vicinity. It is noted that potential interaction with marine mammals can be ameliorated by the application of "Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters". National Parks and Wildlife Service concurred with this conclusion and requested that mitigation outlined in Section 7.1 of the NIS document is implemented in full.	The Applicant had no objection to the conditions proposed by the National Parks and Wildlife Service.

1.3 Legislative context

The *Foreshore Act 1933* (as amended), requires that a lease or licence must be obtained from the Minister for Housing, Local Government and Heritage for the carrying out of works or placing structures or material on, or for the occupation of or removal of material from, State-owned foreshore.

The 1992 EU Habitats Directive (Council Directive 92/43/EC) and Birds Directive (2009/147/EC) are transposed into Irish law by Part XAB of the *Planning and Development Act 2000* (as amended) and the *European Communities (Birds and Natural Habitats) Regulations 2011* (as amended).

In addition to the requirement to consider potential effects of a plan or project on European Sites under Article 6(3) of the Habitats Directive, the Directive requires consideration of the potential effects on species listed under Annex IV of the Directive (termed Annex IV species). Under Article 12, Annex IV species are afforded strict protection throughout their range, both inside and outside of designated protected areas.

SECTION 2 - DESCRIPTION OF PROPOSED WORKS

2.1 Proposed works

The works which will comprise a single dredging programme, are summarised below.

- Dredge the area outlined in orange in Figure 2.1 to bedrock or -3.5m below Chart Datum whichever is shallowest.
- Dredge remainder of the harbour outlined in purple to bedrock or -2.5m below Chart Datum whichever is shallowest.
- Disposal of suitable dredged materials at the previously used dumping site to the south of Power Head, 16km southwest of Ballycotton (Figure 2.2).
- Dispose of contaminated dredged material outlined in cyan to a licensed landfill facility.

2.2 Sediment analyses

Cork County Council's agent consulted with the Marine Institute' environmental chemist regarding their plans to submit both Foreshore licence and Dumping at Sea Permit applications. The Marine Institute provided a site-specific sampling and analyses plan for the analysis of the material to be dredged. Sediment sampling was undertaken in two rounds, in October 2020 and January 2021. Five samples were taken in the first round and 10 in the second round. The sediment samples were analysed by Socotec, an accredited laboratory based in Burton-upon-Trent in the UK.

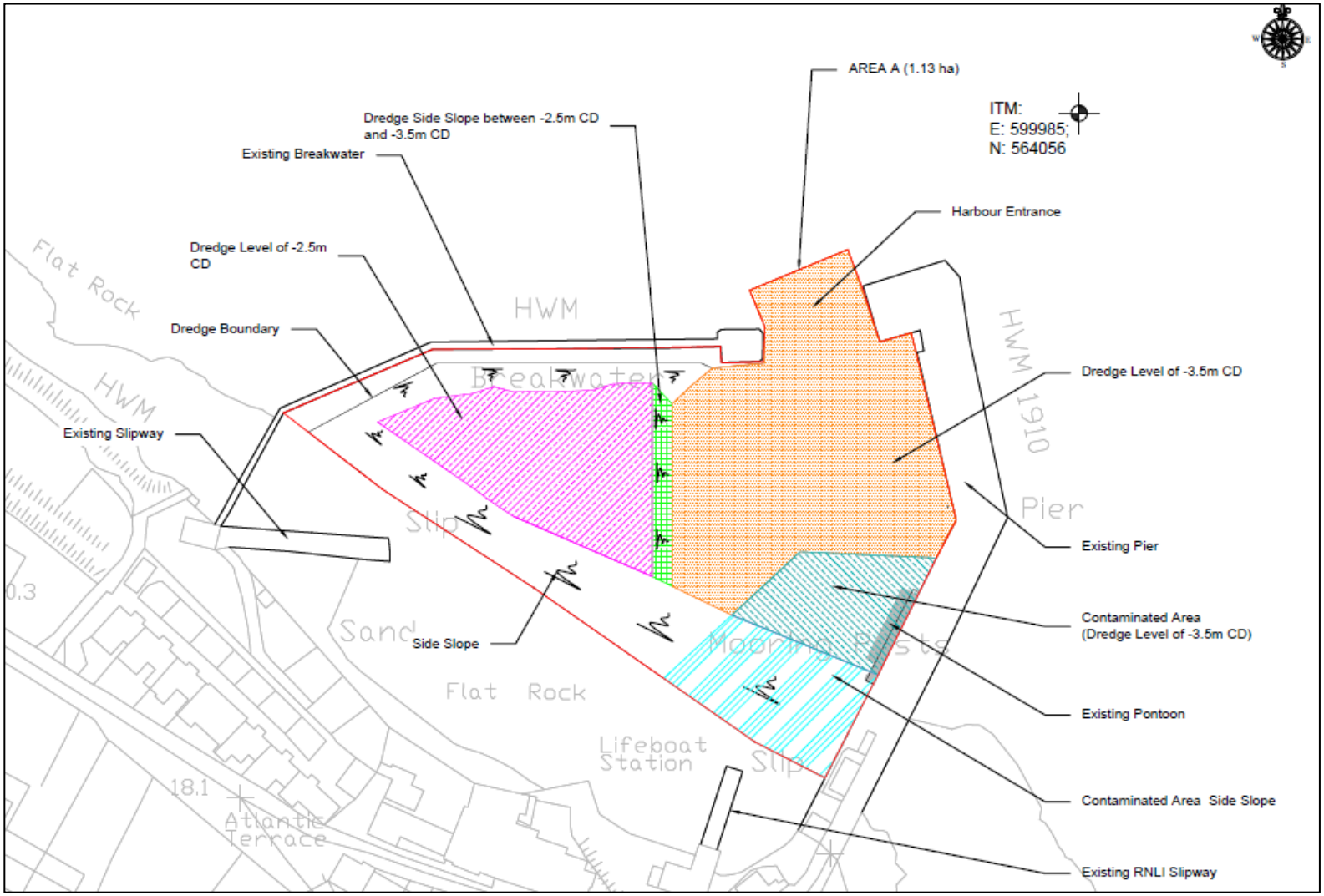
The five samples from the first round were analysed for a very wide range of parameters including 10 heavy metals, organochlorines, total extractable hydrocarbon, tributyl tin (TBT) and dibutyl tin (DBT), and 16 polycyclic hydrocarbons (PAH). Following consultation with the Marine Institute, the second round of sampling was undertaken, and the samples were analysed for copper, lead, TBT/DBT and PAH. The sampling and analyses plan and analyses results are provided in appendices to the Cork County Council Ballycotton Harbour Dredging Foreshore Application Report, Byrne Looby Partners (2021).

The results of the analyses were compared with the Marine Institute guidelines (Cronin *et al*. 2006). The guidelines established threshold levels for upper and lower levels of sediment contamination and define three classes of material as follows:

Class 1	Contaminant concentrations less than level 1 and level 2; Uncontaminated: no biological effects likely.
Class 2:	- Contaminant concentrations between Level 1 and Level 2. - Marginally contaminated. - Further sampling & analysis necessary to delineate problem area, if possible.
Class 3	- Heavily contaminated - Very likely to cause biological effects / toxicity to marine organisms. - Alternative management options to be considered.

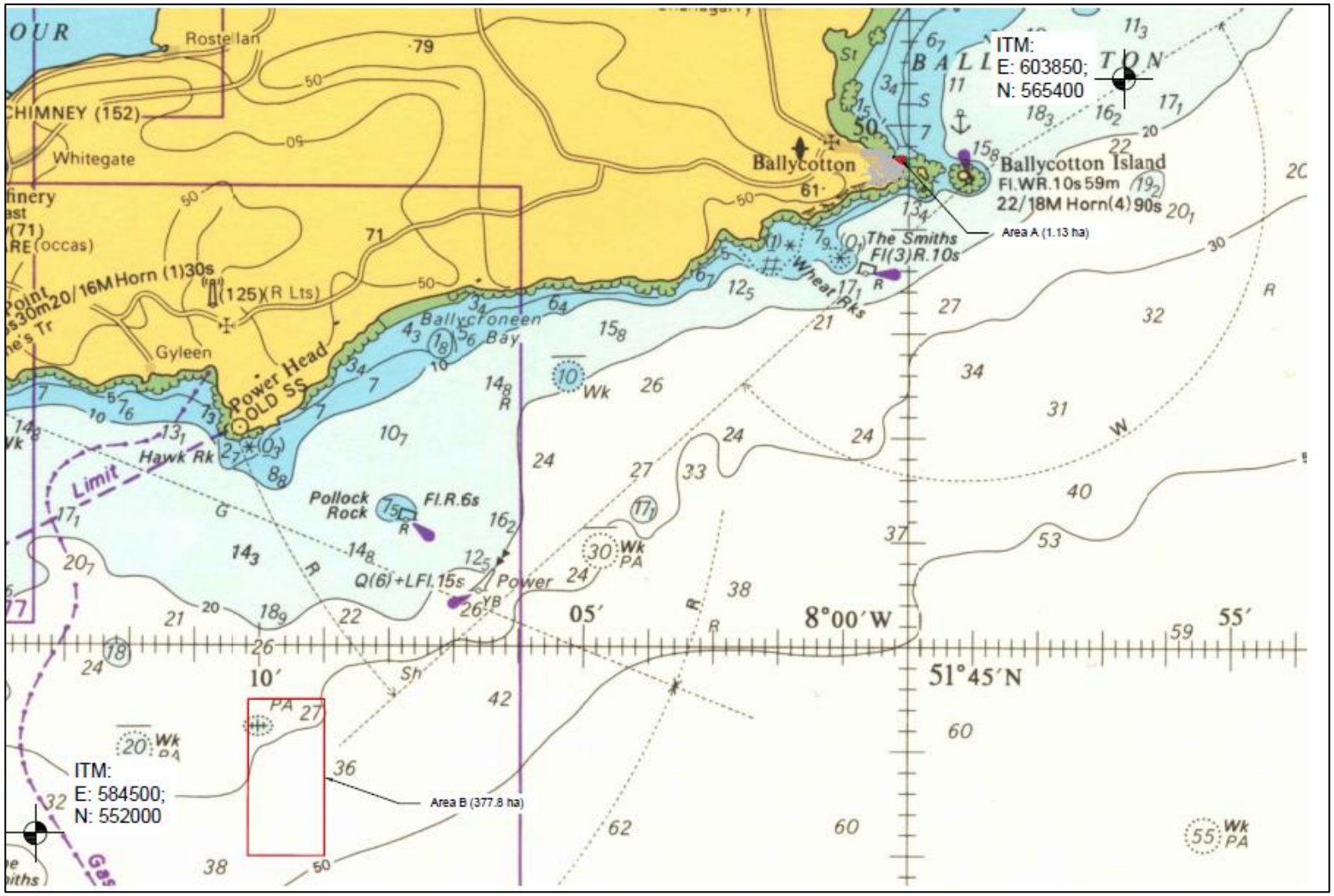
The analyses results indicated low levels of contamination in several of the samples. Class 2 levels of lead were found between the pontoon and the head of the pier. The contamination level did not preclude the option of disposing the dredged material at sea. Class 2 and 3 levels of TBT/DBT were found adjacent to the RNLI slipway. This material is not suitable for disposal at sea. This area is indicated in cyan in Figure 2.1.

Figure 2.1: Proposed Foreshore licence area (in red) for dredging



Source: Byrne Looby Partners, Foreshore Consent Application Ref. FS007037

Figure 2.2: Proposed Foreshore Licence area (in red) for dredge disposal



Source: Byrne Looby Partners, Foreshore Consent Application Ref. FS007037

2.3 Dredging methodology

A pre-condition survey of the site will be carried out by the contractor to determine the suitability of the plant proposed. It is proposed that the following equipment will be mobilised to the site for the dredging elements of the works:

- Long-reach back-hoe excavator
- Dredge barge
- 1,000m^3 hopper barge
- Tugboat
- Articulated dump trucks
- Safety boat
- Road sweeper

A site compound will be set up on site. Appropriate fencing will be erected around the perimeter of the compound. The size of the site compound will be minimised to limit obstructions to the normal operation of the port. The compound will incorporate a site office, canteen, welfare facilities and storage.

All existing swing moorings will be removed from the seabed before commencing dredging works. All swing moorings will be stored off site in a location agreed with Cork County Council while dredging works take place. Swing moorings will be reinstalled on completion of dredging works. The pontoon and gangway shall be removed by the dredging contractor, stored and reinstated on completion of the works.

A bathymetric survey will be carried out to determine the exact seabed levels prior to dredging. A dredge barge will be towed to the harbour by a tugboat.

For the contaminated material, indicated in cyan in Figure 2.1, a long-reach excavator, mounted on the dredge barge, will use a dig control system to determine the dredge level achieved. The excavated material will be placed in a hopper barge. This material will then be transferred to tipper trucks, which will transport it to a suitably licensed facility for disposal.

For uncontaminated material, the excavated material will be placed in a hopper barge and towed to the disposal site, south of Power Head (Figure 2.2), for disposal at sea. Storage of the material will not take place on the quay. It is likely that dredging activities will take place 24hrs per day, 7 days per week to achieve the maximum production rates within tidal envelopes.

It is not anticipated that there will be any requirement to dredge rock from the harbour. Table 2.1 indicates the estimated volumes of dredge materials.

Table 2.1: Estimated dredge volumes

Material to be dredged	Volume (m^3)	Mass (tonnes)
Silt, Sands & Gravels	19,500	35,743
Assume bulk density is 1,300kg/m^3		

It is estimated that 18,000m^3 of gravel, sand and silt will be disposed of at sea. The remaining 1,500m^3 of contaminated sediment will require disposal at a suitably licensed site.

2.4 Expected schedule

It is anticipated that overburden (gravel, sand and silt) will have a maximum dredging rate of 500m³ per 24 hours. It is estimated that the haulage contractor would dispose of overburden material over 12 hours per day. The expected programme is indicated in Table 2.2 with an expected duration for the project of two months.

Table 2.2: Proposed works programme

Activity	Duration
Mobilisation	2 weeks
Removal of existing moorings	1 week
Dredging	8 weeks
Mooring reinstallation	2 weeks
De-mobilisation	1 week

SECTION 3 - RELEVANT ANNEX IV SPECIES

Under Article 12 of the Habitats Directive, Annex IV species are afforded strict protection throughout their range, both inside and outside of designated protected areas. Those Annex IV species (cetaceans and marine turtles) that could potentially occur in the area of the proposed works are described below. Much of the information provided comes from the Marine Mammal Risk Assessment of the proposed works prepared by IWDG Consulting (Appendix I of the AA Screening and NIS report).

3.1 Cetacean species

A review of cetacean (whale, dolphin and porpoise records) submitted to the IWDG during the period 1 January 2000 to 31 December 2020 indicated that during this period, 281 validated cetacean records were available. Most records were of bottlenose dolphins (106 or 37.7% of all records) followed by common dolphin with 45 records (16%), which were the most abundant species. Another six species including harbour porpoise, fin, humpback, minke and killer whale and Risso's dolphin were also recorded, reflecting the high species diversity and productivity of this area (Table 3.1).

Table 3.1: Cetacean sightings recorded off Ballycotton Harbour from 2000-2020

Species	Number of sightings	Number of individuals	% of total sightings
Bottlenose dolphin	106	738	37.7
Common dolphin	45	2943	16
Fin whale	33	91	11.7
Minke whale	16	45	5.7
Harbour Porpoise	15	79	5.3
Killer whale	7	14	2.5
Humpback whale	5	111	1.8
Risso's dolphin	2	20	0.8
Dolphin species	18	210	6.4
Large whale	11	23	3.9
Dolphin possibly harbour porpoise	8	91	2.8
Whale species	7	14	2.5
Sei/Fin/Blue	3	7	1.1
Cetacean species	3	34	1.1
Patterned dolphin species	1	3	0.4
Medium whale	1	1	0.4
Total	**281**	**4324**	**100**

Bottlenose dolphin *(Tursiops truncatus)*

Bottlenose dolphins are frequently recorded off Ballycotton Harbour, Co Cork and adjacent to the disposal site. Bottlenose dolphins are widespread and relatively abundant off the Irish coast with most sightings along the western seaboard (Berrow *et al*. 2010).

Recent genetic evidence (Mirimin *et al.* 2011) suggests the existence of three discrete populations of bottlenose dolphins in Ireland: the Shannon Estuary, an inshore population and

an offshore population that ranges from the Bay of Biscay and the Azores (Louis *et al*. 2014). The inshore population is highly mobile and photo-identification has shown individuals recorded off Co. Cork to be part of this population (O'Brien *et al.* 2009). Although the semi-resident dolphins in Cork Harbour (Ryan *et al.* 2010) were attributed to the "Shannon" genetic population (Mirimin *et al*. 2011), it is likely that the dolphins off Ballycotton are part of the inshore population. Bottlenose dolphins have mainly been recorded during spring and summer months. Bottlenose dolphins are listed on Annex II of the EU Habitats Directive but the nearest SAC for this species is the Shannon estuary.

Common dolphin *(Delphinus delphis)*

Common dolphins are distributed around the entire Irish coast but highest concentrations are off the southwest and west coasts (Berrow *et al.* 2010). However, in the winter large numbers of common dolphins enter the Celtic sea to feed on schools of pelagic fish such as herring and sprat. Common dolphin were sighted throughout the area of interest but almost exclusively during the winter period. They have been reported adjacent to the disposal site.

Harbour porpoise *(Phocoena phocoena)*

Harbour porpoise are the most widespread and abundant cetacean in inshore Irish waters, with highest abundances in the Irish Sea (Berrow *et al.* 2010). Harbour porpoise were sighted in small numbers throughout the area of interest but with most sightings off Cork Harbour to the west of the disposal site. There were few sightings near Ballycotton Harbour. Sightings occurred at the proposed dredge site and adjacent to the disposal site and throughout the year though there were more sightings in winter.

Harbour porpoise are known to particularly associate with areas of strong tidal currents and can be regularly seen foraging off Hook Head. Sightings of harbour porpoise have occurred in all months with a peak in numbers during the winter.

Killer whale *(Orcinus orca)*

Killer whales are widespread in Ireland and recorded off all coasts (Berrow *et al.* 2010) but unpredictably. There have been 7 sightings of a total of 14 individuals over the past 20 years in the area of interest but with the proximity to Cork Harbour these are likely to include the three that took up residency in 2001 (Ryan & Wilson 2003).

Risso's dolphin *(Grampus griseus)*

Risso's dolphins are also patchily distributed around the Irish coast but seem to favour islands, especially off west Kerry, Galway and the Saltee Islands (Berrow *et al*. 2010). There were two sightings of a total of 20 individuals, both west of the disposal site in the mouth of Cork Harbour.

Fin whale *(Balaenoptera physalus)*

Fin whales were the most frequently recorded baleen whale, accounting for 11.7% of all sightings. They were recorded offshore along the entire area of interest and adjacent to the disposal site and almost exclusively during the winter from October to February.

Fin whales are regularly recorded off the south coast of Ireland especially during winter (Berrow *et al*. 2010). Whooley *et al*. (2011) showed using photo-identification that it was frequently the same individual fin whales returning each year to the south coast and they stayed in coastal waters for many months feeding on pelagic schooling fish such as herring

and sprat. The timing of their easterly movement through the winter seemed to coincide with herring moving inshore to spawn.

Minke whale *(Balaenoptera acutorostrata)*

Minke whales are widespread and abundant in inshore Irish waters from May to October (Berrow *et al*. 2000). The summer distribution tends to be concentrated around southwest Ireland. They were recorded within the entire area of interest including adjacent Ballycotton Harbour and within the disposal site. They were reported mainly between April and August.

Humpback whale *(Megatera novaengliae)*

Humpback whales are regularly recorded off the south coast of Ireland especially during winter (Ryan *et al.* 2015). The same individual humpback whales are recorded each year and spend many months feeding on pelagic schooling fish such as herring and sprat. Sightings of humpback whales were made throughout the area of interest and adjacent to the disposal site and were nearly all of single individuals sighted during January and February.

3.2 Other Annex IV species

Marine turtles

There are seven species of marine turtle, of which five species have been recorded in the seas around Ireland and the UK: leatherback turtle (*Dermochelys coriacea*), loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*). The leatherback turtle is the largest of the marine turtles and is the only species of turtle to have developed adaptions to cold water (Goff & Stenson 1988).

A significant majority of turtle sightings recorded in Irish waters are of the leatherback turtle (King & Berrow 2009), which migrate into the Celtic and Irish Seas in response to the distribution of the gelatinous zooplankton which make up their favoured diet (Doyle *et al.* 2008, Fossette *et al.* 2010). Tagging studies show that they migrate across the Atlantic from the eastern American coast and the Caribbean (Hays *et al*. 2004, Doyle *et al*. 2008). Sightings in the wider region are concentrated off the south and west of Ireland, the southwest of England and the west coast of Wales but also in the Irish Sea. Most sightings occur in the summer, peaking in August (Penrose & Gander 2016, Botterell *et al*. 2020). The decadal trend of records in the UK and Ireland for leatherback turtles generally increased, peaking in the 1990s from which it has since decreased. Data from the National Biodiversity Data Centre[3] reflects these patterns with the predominance of sightings in the south and west of Ireland. Aerial surveys for the ObSERVE project from 2015-2016 recorded a handful of leatherback turtle sightings at the southern limits of Irish offshore waters in summer; none were observed in the area of the proposed works (Rogan *et al*. 2018).

Otters

The area at the proposed dredge site does not provide suitable habitat for otter. Freshwater and coastal habitats are used by otters, but otters utilising the marine environment require access to freshwater habitats to drink and bathe (Reid *et al.* 2013). The nearest watercourse to the proposed dredge site is the Sunville stream, 2km to the north. The Powers Head dump site is too far from the coast to support otter habitat.

[3] https://maps.biodiversityireland.ie/Species/128443

SECTION 4 - RISK ASSESSMENT

4.1 Potential impacts associated with proposed works

4.1.1 Disturbance

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 by the vessel during dredging and transiting to and from the dump site, the noise generated by dredging and that generated during dumping.

Received levels of dredging noise by marine mammals can exceed ambient levels to considerable distances depending on the type of dredger used (Richardson *et al*. 1995). Noise levels emanating from a backhoe dredger operating around the Shetland Islands, UK, were recorded by Nedwell *et al*. (2008). Using a scaling of 10 log (R/1 m), the back-calculated source level was 163 dB re 1 mPa at 1 metre (bandwidth ¼ 20 Hz–100 kHz). In contrast, Reine *et al*. (2012) calculated source levels of 179 dB re 1mPa at 1 metre (bandwidth ¼ 3 Hz – 20 kHz), but the used scaling was different [15 log (R/1 m)], so results are difficult to compare. Evans (2000) suggested dredging activities produce sounds varying from 172-185 dB re 1 µPa at 1 metre over the broadband range 45 Hz to 7 kHz but there have been no studies examining the reaction of odontocetes to this activity. Audiograms for bottlenose dolphins show peak sensitivity between 50-60 kHz and no sensitivity below 2 kHz and above around 130 kHz (Richardson *et al*. 1995). Because of rapid attenuation of low frequencies in shallow water dredge noise normally is undetectable underwater at ranges beyond 20-25km (Richardson *et al*. 1995). The effects of low frequency (4-8 kHz) noise level and duration in causing threshold shifts in bottlenose dolphins were predicted by Mooney *et al*. (2009), who found that if the Sound Exposure Level was kept constant significant shifts were induced by longer duration exposures but not for shorter exposures.

NPWS (2014) identify increased sound pressure levels above ambient do occur due to dredging which could be detected up to 10km from shore. These levels are thought to potentially cause masking or behavioural effects but are not thought to cause injury to a marine mammal. There is no guidance on the effects of noise generated by dumping of dredge material on marine mammals.

McKeown (2016) made underwater noise measurements during the 2016 maintenance dredging campaign in Dublin Port. The PSD plots of the dredging operation show some lower frequency tonal components between 200 Hz and 2 kHz were attributed to the pump. The dredging operation had a higher frequency signal in comparison to the dumping operation. Sound levels for the dredging operations at ranges of 213 and 268 m were below the disturbance threshold for harbour porpoise of 140 dB re 1 µPa SPL (RMS) and 140 dB re 1µPa² s SEL. The sound level of 142.7 dB re 1 µPa SPL (RMS) for the dumping operation at a range of 90 m were 2.7 dB re 1 µPa SPL (RMS) above the disturbance threshold for harbour porpoise, suggesting porpoise may react <100m of the dredger during dumping. However, this level is still below the NOAA general behavioural threshold for marine mammals of 160 dB re 1 µPa SPL (RMS). Increased noise was restricted to <100m from the dredger during dredging (McKeown 2016).

Diederichs *et al*. (2010), through the use of acoustic monitoring with click detectors, showed that porpoises temporarily avoided an area where sand extraction took place off the Island of Sylt in Germany. The authors found that when the dredging vessel was closer than 600m to the monitoring location, it took three times longer before a porpoise was again detected

compared with times without sand extraction. However, all of these studies only considered dredging and not the dumping of dredged material. Tougaard *et al.* (2015) recently reviewed proposed noise exposure limits for harbour porpoises. TTS was previously induced at 164 dB at 4kHz with a single pulse or 164-175 if exposed for longer periods and a range of frequencies. Tougaard *et al*. (2015) suggested TTS could be elicited at SEL of 100-110 dB but this work was aimed at pulse sounds from pile driving and not continuous sound produced by dredging and shipping. It is clear that of all the odontocetes, harbour porpoise are likely to be most affected by anthropogenic noise due to their high foraging rates as they tend to prey on small fish (Wisniewska *et al.* 2016).

Pirotta *et al*. (2013) carried out a comprehensive study of the potential effects of dredging on bottlenose dolphins using static acoustic monitoring before, during and after maintenance and capital dredging of Aberdeen Harbour off NE Scotland, where 400,000m^3 of spoil was removed. The Moray Firth is home to a resident group of bottlenose dolphins and they demonstrated a clear avoidance response to dredging at a foraging area despite it being a highly urbanised site. Dolphins spent less time in the harbour as the intensity of dredging increased. Visual monitoring also showed a lower probability of observing dolphins occurred when dredging boats were present. Group size was not affected suggesting that all individuals in a group were affected equally and were likely to leave the area (Pirotta *et al.* 2013). The mechanism leading to displacement was not clear. The response may have been due to the discontinuous and rarely occurring stimulus, not regularly experienced by dolphins, or due to masking and impacting on communication or foraging. The effect may have been indirect by affecting the dolphins prey within this prey patch.

Shipping produces low broadband and “tonal” narrowband sounds. The primary sources are propeller cavitation and singing and propulsion of other machinery (Richardson *et al.* 1995). For large and medium vessels tones dominate up to around 50Hz and broadband components may extend to 100Hz.

Reported responses of marine mammals to the presence and movement of vessels include avoidance, interrupted foraging behaviour, changes in swimming speed, direction and surfacing patterns, and alteration of the intensity and frequency of calls (review in Erbe *et al*. 2019). Chronic exposure has also been linked to an increase in stress-related hormones (Rolland *et al.* 2012). Harbour porpoises, white-sided dolphins and minke whales have been shown to respond to survey vessels by moving away from them, while white-beaked dolphins have shown attraction (Palka & Hammond 2001). A study on captive harbour porpoises in a semi-natural net-pen complex in a Danish canal, recorded their behaviour while simultaneously measuring underwater noise of vessels passing the enclosure; reaction to noise was defined to occur when a highly stereotyped ‘porpoising’ behaviour was observed. Porpoising occurred in response to almost 30% of vessel passages; the most likely behavioural trigger were medium- to high- frequency components (0.25–63kHz octave bands) of vessel noise, while low- frequency components of vessel noise and additional pulses from echo-sounders could not explain the results (Dyndo *et al*. 2015). A tagging study of a small number of free-ranging porpoises in Danish coastal waters estimated that porpoises encountered vessel noise 17-89% of the time (from evaluation of the wideband sound and movement tag recordings). Occasional high-noise levels (coinciding with a fast ferry) were associated with vigorous fluking, bottom diving, interrupted foraging and even cessation of echolocation, leading to significantly fewer prey capture attempts at received levels greater than 96dB re 1 mPa (16 kHz third-octave, Wisniewska *et al.* 2018).

More evidence is available on bottlenose dolphins, especially for coastal populations. Shore-based monitoring of the effects of boat activity on the behaviour of bottlenose dolphins off the US South Carolina coast, indicated that slow moving, large vessels, like ships or ferries, appeared to cause little to no obvious response in bottlenose dolphin groups (Mattson *et al*.

2005). Pirotta *et al*. (2015) used passive acoustic techniques to quantify how boat disturbance affected bottlenose dolphin foraging activity in the inner Moray Firth. The presence of moving motorised boats appeared to affect bottlenose dolphin buzzing activity (foraging vocalisations), with boat passages corresponding to a reduction by almost half in the probability of recording a buzz. The boat effect was limited to the time where a boat was physically present in the sampled area and visual observations indicated that the effect increased for increasing numbers of boats in the area. Dolphins appeared to temporarily interrupt their activity when disturbed, staying in the area and quickly resuming foraging as the boat moved away.

The presence of a dredger and associated craft in the harbour will lead to a very slight increase in vessel traffic and associated noise. Back-hoe dredgers produce largely low frequency sounds, however, given the use of Ballycotton Harbour by vessels, creating ambient noise already experienced at this site, the presence of an additional vessel and associated noise, is extremely unlikely to be significant. The increased noise above ambient levels generated by the activity will be of relatively short duration (8 weeks) and unlikely to have a significant effect on marine mammals, particularly if mitigation measures are implemented (Section 4.2).

Available information on potential effects of underwater sound on marine turtles is very limited (Nelms *et al*. 2016). The hearing range of cheloniid species has been estimated at between 50-2,000Hz, with highest sensitivity below 400Hz (Popper *et al*. 2014). For leatherback turtles, measurements made on hatchlings suggested a similar low frequency sensitivity, with sound detection ranging between 50 and 1,200Hz when in water and between 50 and 1,600Hz in air (Dow Piniak *et al*. 2012). Underwater noise generated by dredging and the vessel movements may be detectable by leatherback turtles, although their low density and limited seasonal presence in the area dictates that very few individuals are likely to be exposed to noise levels beyond that of the background for the region.

Any otters in the area will have very limited exposure to underwater noise given they are predominantly terrestrial/freshwater animals which may utilise coastal waters to forage. The potential for significant effects is unlikely.

4.1.2 Physical disturbance and collision risk

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 towing vessel is slow moving and not able to turn quickly thus any animals (including marine turtles) in the area would have sufficient time to avoid any collisions and thus injury or mortality. The chance of actually releasing dredged material on top of an animal is extremely unlikely. The duration of the release of dredged material is very short (<1 minute) and the vessel slows down during spoil release.

4.1.3 Indirect effects on preferred prey

No adverse effects on fish species are expected from dredging and disposal operations.

4.1.4 In-combination effects

The use of the disposal site by Port of Cork could lead to cumulative effects if dredging at Ballycotton and in Cork Harbour occurred at the same time. The Port of Cork have recently applied for a Disposal at Sea licence to cover the period 2021 to 2029 for maintenance dredging. The proposed maintenance dredging campaigns may occur throughout the year excluding November and February. This is a change to previous dredging campaigns, which was restricted to the autumn period (September – October). Thus it is important that dredging

at Ballycotton does not coincide with dredging campaign in Cork Harbour with both using the same disposal site simultaneously.

4.2 Mitigation measures

NPWS (2014) provides guidance to manage the risk to marine mammals from man-made sound sources in Irish waters. This document provides guidance and mitigation measures to address key potential sources of anthropogenic sound that may impact negatively on marine mammals in Irish waters. The mitigation methods should follow the guidance prescribed by the NPWS. These are summarised below.

1. A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms (Appendix 6, NPWS 2014).
2. Unless information specific to the location and/or plan/project is otherwise available to inform the mitigation process (e.g., specific sound propagation and/or attenuation data) and a distance modification has been agreed with the Regulatory Authority, acoustic surveying using the above equipment shall not commence if marine mammals are detected within a 500m radial distance of the sound source intended for use, i.e., within the Monitored Zone.

Pre-Start Monitoring

3. Sound-producing activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.
4. An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.
5. In waters up to 200m deep, the MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO.
6. This prescribed Pre-Start Monitoring shall subsequently be followed by a Ramp-Up Procedure which should include continued monitoring by the MMO.

Ramp-up Procedure

7. In commencing an acoustic survey operation using the above equipment, the following Ramp up Procedure (i.e., “soft-start”) must be used, including during any testing of acoustic sources, where the output peak sound pressure level from any source exceeds 170 dB re: 1µPa @1m:
    (a) Where it is possible according to the operational parameters of the equipment concerned, the device’s acoustic energy output shall commence from a lower energy start-up (i.e., a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20 minutes.
    (b) This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period.
    (c) Where the acoustic output measures outlined in steps (a) and (b) are not possible according to the operational parameters of any such equipment, the

device shall be switched “on” and “off” in a consistent sequential manner over a period of 20 minutes prior to commencement of the full necessary output.

8. In all cases where a Ramp-Up Procedure is employed the delay between the end of ramp-up and the necessary full output must be minimised to prevent unnecessary high level sound introduction into the environment.
9. Once the Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source, i.e., within the Monitored Zone.

Breaks in sound output

10. If there is a break in sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down, survey line or station change) then all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) must be undertaken.
11. For higher output survey operations which have the potential to produce injurious levels of underwater sound (see sections 2.4, 3.2) as informed by the associated risk assessment, there is likely to be a regulatory requirement to adopt a shorter 5–10-minute break limit after which period all Pre-Start Monitoring and a subsequent Ramp up Procedure (where appropriate following Pre-Start Monitoring) shall recommence as for start-up.

Reporting

12. Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority as outlined in Appendix 6 of NPWS (2014).

4.3 Conclusion of Risk Assessment of Annex IV Species

With implementation of the above mitigation measures, it is very unlikely that there will be negative residual impacts from the proposed dredging works on Annex IV species in the area. It is also very unlikely that any animals will be injured or killed as a result of the proposed works.

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