ANNEX IV RISK ASSESSMENT OF PROPOSED DREDGING AT SARSFIELD DOCK, LIMERICK CITY

Prepared by
Dr Simon Berrow

IWDG Consulting, Merchants Quay, Kilrush, Co Clare

1 | INTRODUCTION

The Irish Whale and Dolphin Group (IWDG) were contracted by the engineering and environmental consultants Malachy Walsh and Partners to carry out an Annex IV Risk Assessment of the proposed dredging operations at Sarsfield Dock in Limerick City and subsequent discharge of dredge material in the main channel of the River Shannon and Estuary. Annex IV species include all cetacean species, marine turtles, otter and bats.

The proposed works will involve the removal of approximately 6,355m^3 (12,075 tonnes) of material in year 1 and up to 2,118 m^3 (4,025 tonnes) in each subsequent year. The dredged and discharge site is within the Lower River Shannon Special Area of Conservation (SAC), which includes bottlenose dolphin and otter as qualifying interests. The proposed works will take place over a two-week period each year between October and February.

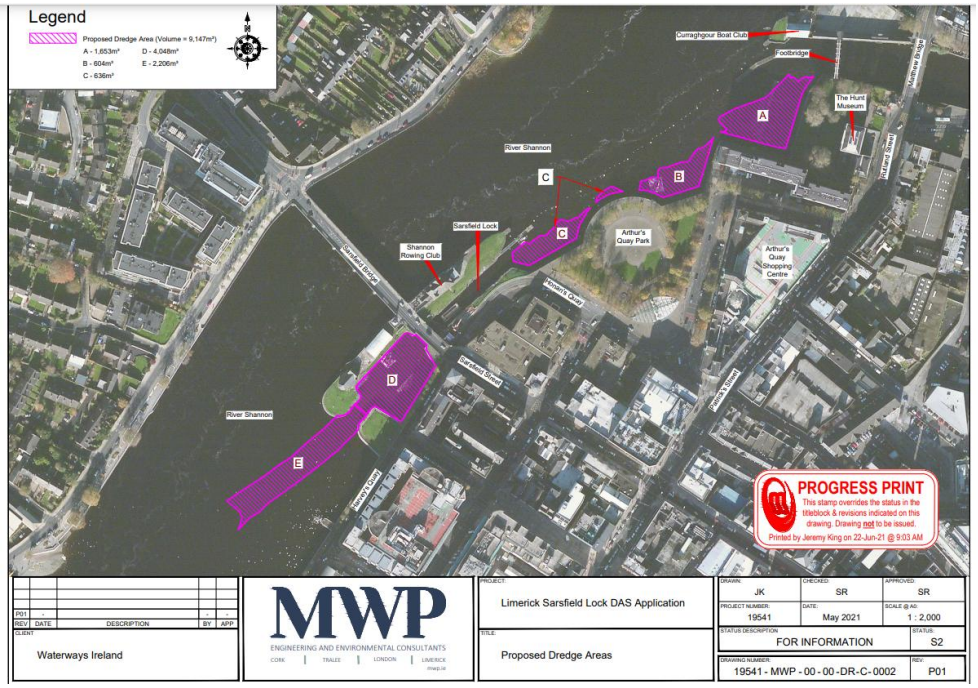

Figure 1. Proposed dredging areas in Limerick City

Proposed works

This Annex IV covers dredging and discharge activity over an 8-year period from winter 2029-2038. During this period an estimated 21,181 m^3 (40,249 tonnes) of dredged material will be disposed of in the Shannon River and Estuary. Most of this work (30%) will be carried out in year 1 (winter 2021_2022).

Year	Net (m^3)	Net (tonnes)
YEAR 1	6355	12075
YEAR 2	2118	4025
YEAR 3	2118	4025
YEAR 4	2118	4025
YEAR 5	2118	4025
YEAR 6	2118	4025
YEAR 7	2118	4025
YEAR 8	2118	4025
TOTAL	**21181**	**40249**

The dredge site is in Limerick city and the preferred discharge site in the adjacent river channel. The dredge material within the harbour is largely silt and will likely be dredged by a submersible DOP pump attached to a large crane on a 16-unit pontoon raft operating at three locations upstream of the weir and two locations downstream of the weir. Of the 9,147m^3, approximately 300m^3 is of coarser material. The dredged material will be pumped across the weir encased in a floating pipe to a discharge point midstream of the Shannon River at high flows.

2 | METHODS

The receiving environment includes the benthos, the benthic, demersal and pelagic fish in the area, and the species listed on Annex IV including marine mammals, marine turtles, otter and bats. The risk assessment was based on a review of the available literature and data sources held by the Irish Whale and Dolphin Group. The IWDG have been carrying out research on the dolphins in the Shannon Estuary since 1993 (Berrow et al. 1996) and hold a large dataset of bottlenose dolphin sightings and relevant acoustic data.

3 | LEGAL STATUS

Irish cetaceans (whales, dolphins and porpoises), pinnipeds, otter and Leatherback Turtle are all protected under national legislation and under several 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 nml limits of Irish territorial waters.

All cetaceans, otter and marine turtles 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.

4 | BASELINE ENVIRONMENT

4.1 | Ambient Noise Levels

The ambient noise levels at the site are not known with the closest site with data available is Tarbert, Co Kerry (Beck et al. 2013; O'Brien et al. 2015) approximately 50km downriver. Ambient noise levels at Tarbert were elevated compared to Galway Bay but less than that recorded in Dublin harbour. However, as Limerick is a busy shipping port, ambient noise is expected to be quite dominated by environmental noise (e.g. river and tidal movement of water and sediment) and shipping noise, with peaks in noise associated with vessel movements into and out of Sarsfield Bridge docks and small vessel traffic in Limerick city.

4.2 | Cetaceans

The area of interest for this assessment is the upper reaches of the inner Shannon Estuary, but still within the boundaries of the Lower River Shannon SAC. Bottlenose dolphins are highly mobile and are known to use the entire Shannon Estuary and adjacent waters. However, as the population is resident and genetically discrete it is important to assess the impact of dredging at the population level. If significant impacts occurred in a localised area of the estuary due to dredging, then it could potentially impact on the resident dolphins over a wider scale. A recent study by Blásquez et al. (2020) showed the potential impact of removal or excessive disturbance of just one or two adult females, including the impact of persistent pollutants on their reproductive rates. Dredging could potentially mobilise persistent pollutants through resuspension during dredging (Todd et al. 2015)

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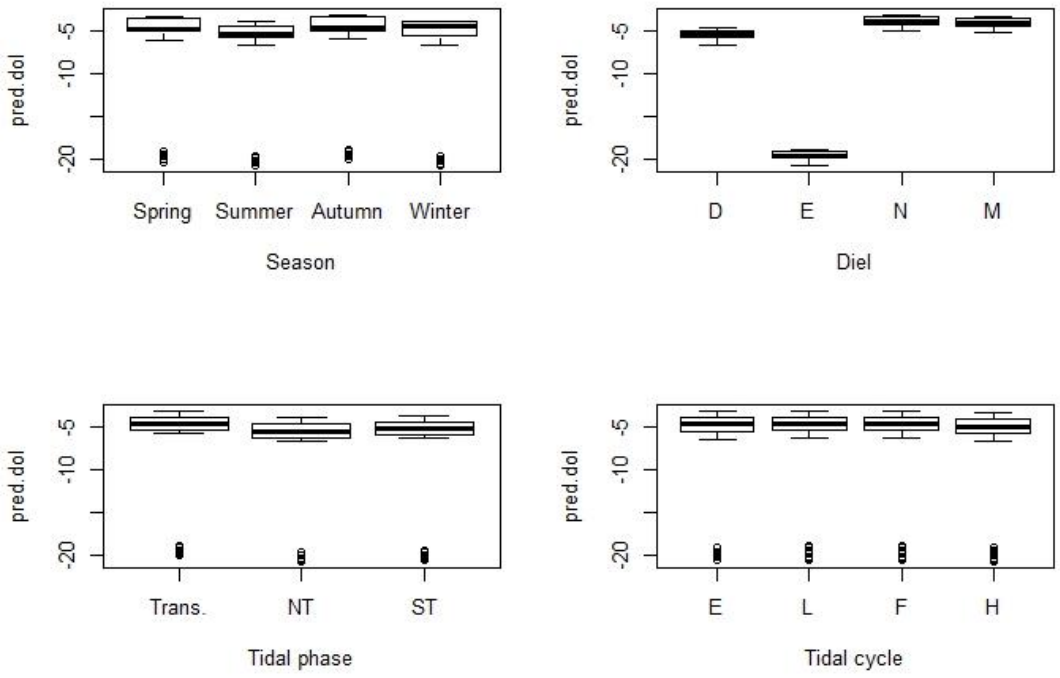
The Shannon Estuary is one of the most extensive studies sites for bottlenose dolphins in Europe. Studies have been ongoing since 1993 (Berrow et al. 1996) including extensive use of static acoustic monitoring (O'Brien et al. 2015; Carmen et al. 2021). Boat-based transects have been carried out along pre-determined routes to assess distribution, abundance and encounter rates (e.g. Berrow et al. 1996; Ingram and Rogan 2002; Berrow 2009). Photo-identification is used to record individual dolphins and can be used to determine abundance, movements, social organisation and site fidelity (Berrow et al. 2012; Baker et al. 2018). Most research and monitoring work has been carried out in the outer estuary as far upriver as Tarbert-Killimer with very little effort in the upriver of Tarbert. The docks at Limerick are at the most extremely easterly section of the inner estuary and records of dolphins in Limerick city are based on casual opportunistic sightings reported to the IWDG.

Static Acoustic Monitoring (SAM) provides a very useful tool for assessing the use of a site by bottlenose dolphins in the Shannon. SAM equipment such as CPODS log the echolocation clicks of odontocetes and record peak frequency and inter-click-intervals to assist in species identification and behaviour. Dolphins must also be vocalising to be detected acoustically. CPODs are self-contained units that can be deployed at sites of interest and left for 3-4 months before recovery and data download. All units are calibrated before deployment to ensure any differences in sensitivities of the equipment can be accounted for during analysis. The detection distance of PODs to bottlenose dolphins in the Shannon Estuary is estimated at around 800m (O'Brien et al. 2012). Recently harbour porpoise (*Phocoena phocoena*) have been recorded in the mid-estuary (O'Callaghan et al. 2021) and common dolphins, as far upriver as Beeves Rock and up the River Fergus (IWDG *unpubl. data*), however it's only bottlenose dolphins that are recorded regularly in the inner estuary defined as upriver of Foynes Island. We are confident that all SAM data from the inner estuary are bottlenose dolphin detections.



Predicted proportion of Detection Positive Hours, in the narrow band high frequency channel from Shannon Airport across season, diel (where D = day, E = evening, M = morning and N = night), tidal phase (where Trans. = transitional phase, NT = neap tide and ST = spring tide) and tidal cycle (where E = ebb, L = slack low, F = flood and H = slack high).

O'Brien and Berrow (2012) deployed a C-POD off Shannon Airport during a two-year acoustic monitoring study. Bottlenose dolphins were present on 21% of days. This compared to 25% of days off Aughinish and 40% of days off Foynes. The number of Detection positive Minutes per day (DPM) was similar at both Shannon airport and Aughinish at 0.08-0.10 DPM per day. Season had no significant effect on the presence of dolphins at Shannon Airport, neither was there a significant effect on detections on diel, tidal phase or tidal cycle.

A more detailed analysis of 738 days of data collected between 2011 and 2013 was carried out by Carmen et al. (2021). This showed that although the number of detection positive days were less upriver compared to well-studied sites such as Money Point in the mid-estuary, the proportion of time spent foraging was higher, suggesting that the inner estuary provides important foraging areas. Season was not included as a variable in the best model for the foraging at Shannon Airport, indicating that this location was an equally important feeding area year-round. Tidal cycle had the largest effect on foraging as well as tidal phase and diel cycle, with neap phases and slack low tides as predictors of highest foraging.

Casual sightings of bottlenose dolphins in Limerick City are reported very occasionally to the IWDG. For example, bottlenose dolphins were photographed from Sarsfield Bridge on 19 April 2021 and 22 February 2024. Clearly although bottlenose dolphins within the Lower River Shannon SAC do on occasion travel upriver as far as Limerick city there is no evidence of regular or prolonged occurrence or that Limerick city is regularly used as a foraging area. Thus, it is extremely unlikely they will be exposed to any effects of the proposed dredging.

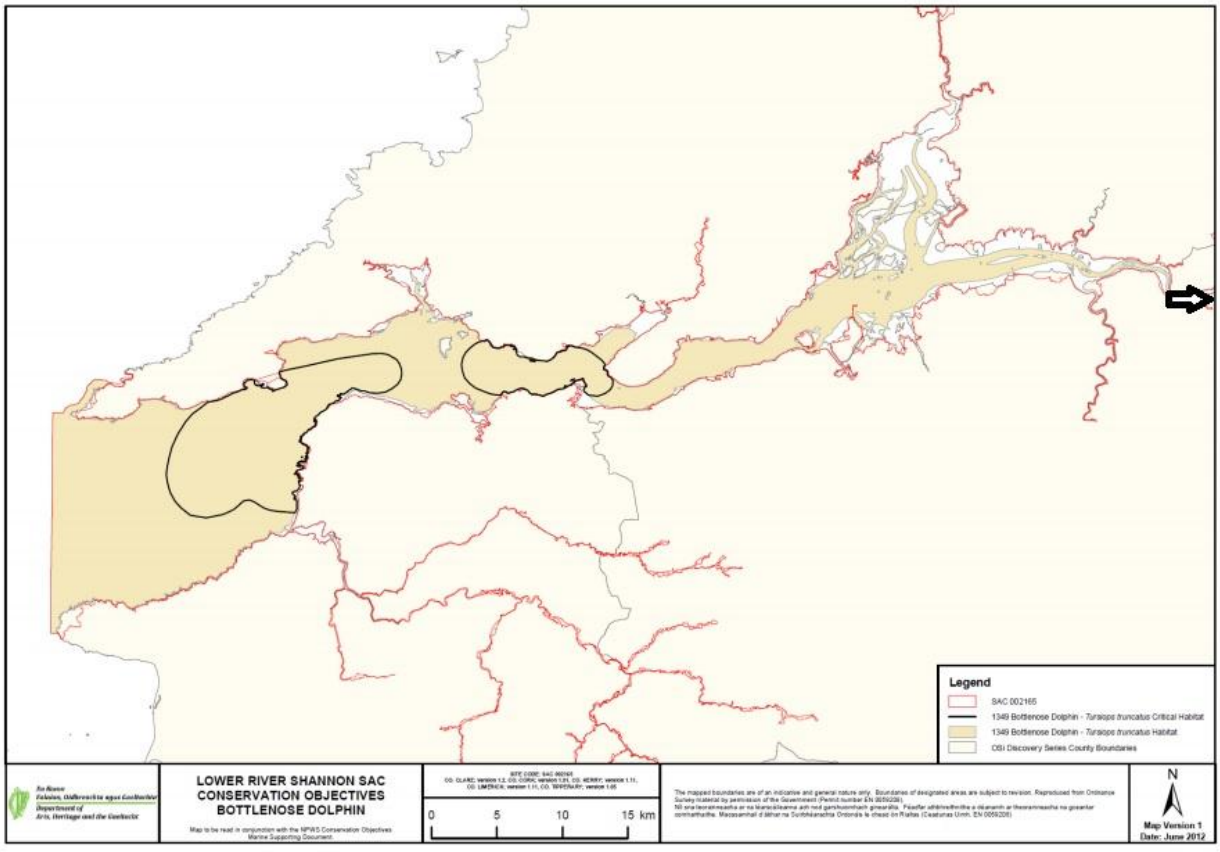


Figure 2. Location of dredging and discharge site in relation to important dolphin sites within the Lower River Shannon SAC (from NPWS 2012) (black arrow points to dredging site, which occurs just off the map)

4.3 | Lower River Shannon SAC Conservation Objectives

The dredge and discharge site is entirely within the Lower River Shannon Special Area of Conservation (SACs) (Site Code 002165), which includes bottlenose dolphin and otter as qualifying interests. All species within an SAC for which they are qualifying interests must be maintained at favourable conservation status.

The Conservation Objectives published by the NPWS (2012) require that:

i) bottlenose dolphins must not be restricted by artificial barriers,
ii) critical areas should be maintained in a natural condition,
iii) human activities should occur at levels which do not adversely affect the population.

For otters objectives are similar and with respect to marine habitat must not experience a significant decline (NPWS 2012).

4.4 | Other Annex IV species

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

4.4.1 Marine turtles

Of the other five species of marine turtles recorded in Ireland none have been recorded in the area of interest or adjacent waters and are therefore not given any further consideration.

4.4.2 Otter

The distribution of otter (*Lutra lutra*) in Ireland was provided by Bailey and Rochford (2006) and Reid et al. (2013). Densities in the Shannon region were considered low at 0.0-0.1 otters per km^2. Otters are known to occur in Limerick city and are typically observed along the riverbanks and in adjacent riparian habitats and have not been reported on the river channel. Records from NBDC are shown in Figure 8.



Figure 8. Map of otter distribution in Limerick City (map courtesy of the National Biodiversity Data Centre).

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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 a*l. 2014).

4.4.3 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 only is listed in Annex II of the EU Habitats Directive, while all bat species are listed in Annex IV of the Directive. This 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).

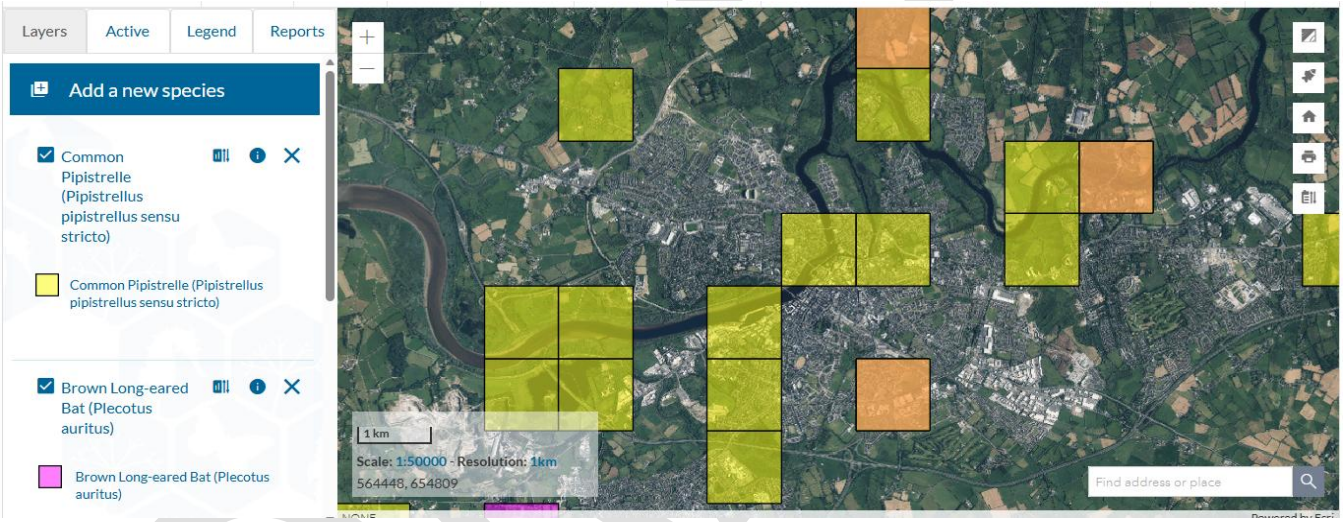

Figure 9a. Map of bat distribution in Limerick City (map courtesy of the National Biodiversity Data Centre).

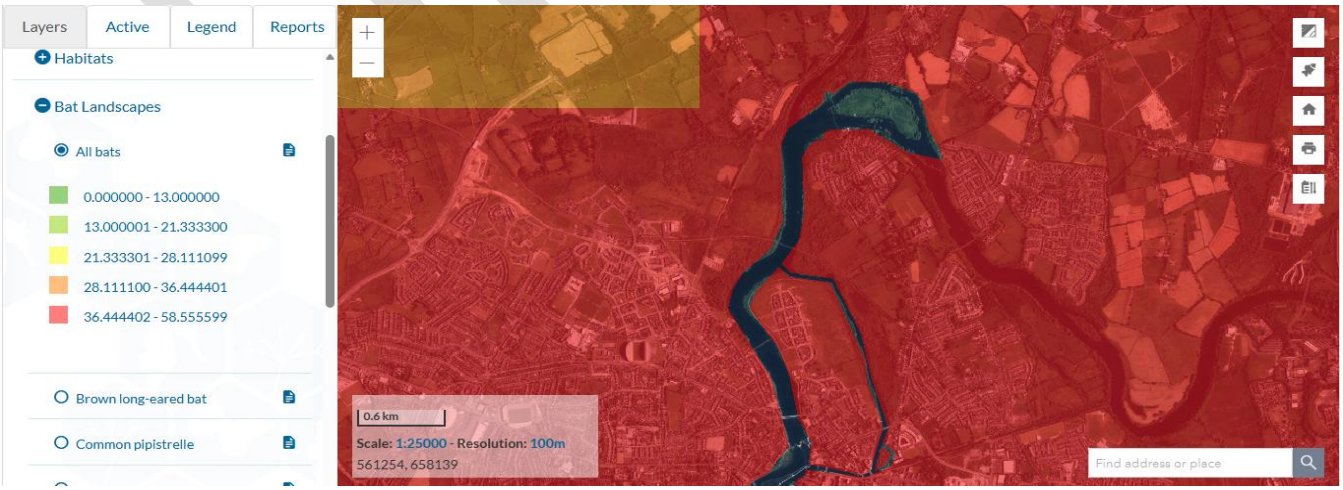

Figure 9b. Map of bat landscapes adjacent to Limerick City (map courtesy of the National Biodiversity Data Centre).

A review of existing bat records within a 10km radius of the study site (sourced from BCIreland's National Bat Records Database) showed that only a two Irish bat species have been recorded locally, namely Common Pipistrelle ad Brown Long-eared bat according to data supplied by the National Biodiversity Data Centre (Fig 9a). Lundy et al. (2011) reported high densities of bats (36.444402 - 58.555599 'habitat suitability' index) as predicted by modeling of bat landscapes (Fig 9b).

5 | IMPACT ASSESSMENT

5.1 | Description of Activities

As part of the proposed site works the activities likely to impact on marine mammals include:

5.1.1 Dredging

The dredge site is in the docks adjacent to Sarsfield Bridge in Limerick City. The material will be dredged by a submersible DOP pump attached to a large crane on a 16-unit pontoon raft operating at three locations upstream of the weir and two locations downstream of the weir. Approximately 6,355m^3 of material will be dredged in year 1 (2021) and less (2,118m^3) in subsequent years. The dredging operation would likely be carried out over a two-week period, from dawn to dusk on an ebbing tide after spring tides during September/early October to allow for material to be washed downriver on discharge.

5.1.2 Dumping

The discharge site is adjacent to the dredged area in the river channel. The dredged material will be pumped across the weir encased in a floating pipe to a discharge point midstream of the Shannon River at high flows. The site has been dredged before, but this is a new method of disposal.

5.1.3 Vessel noise

There will be no vessel noise as the dredged material is pumped.

5.2 | Literature Review of Impacts and Mitigation

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).

A risk assessment, following NPWS Guidelines, was conducted based on the published literature, data from the IWDG and our local knowledge of the study area.

5.2.1 Dredging Impacts

Todd *et al.* (2015) provides a very useful review of the state of current knowledge and potential impacts of dredging on marine mammals. Dredging produces continuous, broadband, low frequency sound, below 1 kHz, with sound pressure levels between 168dB and 186dB re 1µPa at 1m (Todd *et al.* 2015). In most cases the noise

is continuous in nature. There have been few studies on the effects of marine dredging (Thomsen *et al.* 2006; Nowacek *et al.* 2007).

Recently Pirotta *et al.* (2013) carried out the most 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.

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). They found that if the Sound Exposure Level was kept constant significant shifts were induced by longer duration exposures but not for shorter exposures.

Shipping noise

Odontocetes are more tolerant of shipping noise, being repeatedly exposed to many vessels, small and large. 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). Many odontocetes show considerable tolerance to vessel traffic. Sini *et al.* (2005) showed bottlenose dolphins resident in the Moray Firth generally exhibited a positive reaction to medium (16-30m) and large vessels (>30m) and showed some evidence of habituation. Buckstaff (2004) suggested an exposure level of 110-120 dB from vessel noise solicited no observable effect on bottlenose dolphins.

Turbidity

Sedimentation and any increases in turbidity are unlikely to affect marine mammals, which use echolocation. 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, 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.

5.3 Risk Assessment

The potential effects of dredging and dumping on marine mammals in the Shannon Estuary was addressed by initially assessing the likelihood that any Annex IV species would be exposed or interact with the activity. Impacts assessed include likelihood disturbance or displacement from dredging activity or the likelihood of dredge

material impacting individuals. Disturbance from noise emitted during dredging and dumping was considered. Acoustic disturbance includes the ability of the individual to detect increased noise levels over ambient, masking, Temporary Threshold Shift (TTS) and Permanente Threshold Shift (PTS) and behavioural impacts, i.e. resulting in a behavioural change by individuals.

The maximum amount to be dredged in any period is estimated at 6,355m^3 (12,075 tonnes). This is a very small amount compared to larger dredging operations in ports including Foynes Harbour. The risk of a negative interaction was restricted to the likelihood of a marine mammal being in the vicinity of the operation during dredging and dumping.

5.4 Acoustic disturbance

Noise associated with dredging

The potential for disturbance to marine mammals (including otter) 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 dredging and dumping.

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). They 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, but this applies to dredge vessels and not pumping activity. 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 dredge material on marine mammals.

Disturbance during discharge

The discharge site has been dredged previously and material taken away on land. This is the first time the dredged material has been discharged back into the Shannon Estuary, so no animals in this area have been exposed to dumping. However, the site is small, and marine mammals are highly mobile. The presence of an additional vessel and associated noise is extremely unlikely to be significant, and it will only be at the dump site for very short periods. Indirect impacts on food resources are unlikely and very local.

Physical Disturbance

The risk of injury or mortality is considered extremely low as i) it is extremely unlikely to be any seals or dolphins in the area nor otters in the immediate vicinity of the activity and ii) any otters, if present in the area, are exposed to marine activity on a regular basis and would be aware of their presence. The chance of releasing dredged material on top of a marine mammal is extremely unlikely.

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Potential disturbance to life cycle

The risk of disrupting the life cycle of marine mammals in the area is considered extremely low. Dolphins are only very occasionally recorded in the immediate area and there will be very little downriver effects as the river has strong tides and high sediment load. It is extremely unlikely that the activity would cause even temporary displacement from the immediate area if there were marine mammals in the area, but this is extremely unlikely and if present the effect is likely to be very short-term. Otter and bats do occur at the site but are unlikely to be exposed to marine operations for any prolonged periods and any effect is very localized and of short duration.

Otter and Marine Turtles

Marine turtles and otter are unlikely to occur at the site. Based on these findings it is concluded that the proposed works are very **unlikely** to have an impact on Annex IV species even without mitigation.

Bats

The area has low suitability for bats and no linear features which could function as significant commuting routes and/or feeding areas will be affected. 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.

5 Mitigation Measures

Potential mitigation measures during the dumping operation are limited. Similar activities along coasts and harbours both nationally and internationally have been monitored through the provision of a Marine Mammal Observer (MMO) who ensures that there are no marine mammals within a pre-agreed distance prior to dumping during daylight hours. The MMO can also record any reaction to the dumping operation.

Due to the extremely low likelihood of marine mammals being in the vicinity during the dredging and discharge operations, the provision of an MMO is not considered necessary. Otter and bats may occur at the site, but neither are sensitive to disturbance or habitat modification, including acoustic. Any sightings that may be made during the operation should be submitted to the IWDG at https://records.iwdg.ie/sighting.php?sid=x to improve our understanding of their upriver presence.

6.0 | NPWS Assessment Criteria

1. **Do individuals or populations of Annex IV species occur within the proposed area?**

   Bottlenose dolphins have very occasionally been reported as far upriver as Limerick City. Otters are present along the riverbanks in low densities and bats at moderate to high densities. No marineturtles occur.

2. **Is the plan or project likely to result in death, injury or disturbance of individuals?**

   The project will not cause injury or death and disturbance or displacement, including from noise associated with the project is also considered very minimal.

3. **Is it possible to estimate the number of individuals of each species that are likely to be affected?**

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The proposed discharge site in the River Shannon estuary is part of the habitat for a resident group of bottlenose dolphin whose population is estimated at 145 individuals (Blásquez *et al.* 2020). This part of the estuary is used by a sub-set of this population numbering around 30-40 individuals (Baker *et al.* 2018). Small numbers of otters also occur.

4. **Will individuals be disturbed at a sensitive location or sensitive time during their life cycle?**

The proposed works are recommended to be carried out in the winter. This lies outside all breeding and pupping periods.

5. **Are the impacts likely to focus on a particular section of the species' population, e.g., adults vs. juveniles, males vs. females?**

There are no data to suggest that any seal or cetacean gender or age group predominates occurs more frequently off Limerick city.

6. **Will the plan or project cause displacement from key functional areas, e.g., for breeding, foraging, resting or migration?**

Bottlenose dolphins and seals only very infrequently occur in the area, and the likelihood of even temporary disturbance is very small.

7. **How quickly is the affected population likely to recover once the plan or project has ceased?**

Even if temporary disturbance did occur, they are likely to recover within hours.

6.1| Mitigation

Timing of Dredging and Discharge at Sea

Dredging during autumn months (September/early October) is outside breeding and calving periods for bottlenose dolphins.

6.2| Residual Impacts

Even without mitigation, it is very unlikely that there will be any negative residual impacts from the proposed dredging works on marine mammals in the area.

7| SUMMARY

Although the proposed activities occur within the Lower River Shannon SAC which includes bottlenose dolphin and otter as qualifying interests, it is extremely unlikely any marine mammal will be exposed to the proposed activities. We do not consider implementing the NPWS Guidelines to minimise the acoustic impacts of dredging be is required as there will be no significant impacts to marine mammals.

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