REPORT TO INFORM SCREENING FOR APPROPRIATE ASSESSMENT & NATURA IMPACT STATEMENT

Ringaskiddy Basin Capital Dredging Campaign

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1 INTRODUCTION

With the introduction of the Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitat and of wild fauna and flora) came the obligation to establish the Natura 2000 network of Sites of Community Interest (SCIs), comprising a network of areas of highest biodiversity importance for rare and threatened habitats and species across the European Union (EU).

In Ireland, the Natura 2000 network of sites comprises Special Areas of Conservation (SACs, including candidate SACs) designated under domestic legislation transposing Directive 92/43/EEC, and Special Protection Areas (SPAs, including proposed SPAs) classified under the Birds Directive (Council Directive 2009/147/EC on the conservation of wild birds) and designated under the same domestic legislation.

SACs are designated for the conservation of Annex I habitats (including priority types which are in danger of disappearance) and Annex II species (other than birds). SPAs are designated for the conservation of Annex I birds and other regularly occurring migratory birds and their habitats. The annexed habitats and species for which each site is designated correspond to the qualifying interests of the sites; from these the conservation objectives of the site are derived.

SACs and SPAs make up the pan-European network of Natura 2000 sites. It should be noted that 'European sites' are defined in section 177R of the Planning and Development Act 2000, as amended ('the 2000 Act'), and also in Regulation 2(1) of the European Communities (Birds and Natural Habitats) Regulations 2011, as amended ('the Habitats Regulations').

1.1 Appropriate Assessment

1.1.1 The Habitats Directive

A key protection mechanism in the Habitats Directive is the requirement to subject plans and projects to Appropriate Assessment (AA) in line with the requirements of Article 6(3) of the Habitats Directive, which requires that–

> *Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and if appropriate, after having obtained the opinion of the general public.*

Thus, Article 6(3) provides a two-stage process:

- The first stage involves a screening for appropriate assessment; and
- The second stage arises where, having screened the proposed development, the competent authority determines that an appropriate assessment is required, in which case it must then carry out that appropriate assessment.

1.1.2 Domestic Transposition

1.1.2.1 Screening

Regulation 42 of the Habitats Regulations requires *inter alia* that screening for appropriate assessment of a project for which an application for consent is received, and which is not directly connected with or necessary to the management of the site as a European Site, shall be carried out by the public authority to assess, in view of best scientific knowledge and in view of the conservation objectives of the site, if that project, individually or in combination with other plans or projects is likely to have a significant effect on the European site.

1.1.2.2 Appropriate Assessment

Regulation 42 of the Habitats Regulations requires *inter alia* that a public authority shall determine that an appropriate assessment of a project is required where the project is not directly connected with or necessary to the management of the site as a European Site and if it cannot be excluded, on the basis of objective scientific information following screening that the project, individually or in combination with other plans or projects, will have a significant effect on a European site.

1.1.3 The Appropriate Assessment Process

According to European Commission guidance documents '*Assessment of plans and projects significantly affecting Natura 2000 sites'* (EC, 2001); '*Managing Natura 2000 sites: The Provisions of Article 6 of the 'Habitats' Directive 92/43/EEC'* (EC, 2019); and '*Guidance document on wind energy developments and EU nature legislation*' (EC, 2020), the obligations arising under Article 6 establish a step-wise procedure as illustrated in Figure 1.1.

The first part of this procedure consists of a pre-assessment stage ('screening') to determine whether, firstly, a plan or project is directly connected with or necessary to the management of the site, and secondly, whether it is likely to have a significant effect on the site; it is governed by Article 6(3), first sentence.

The second part of the procedure, governed by Article 6(3), second sentence, relates to the appropriate assessment and the decision of the competent national authorities.

A third part of the procedure (governed by Article 6(4)) comes into play if, despite adverse effects on the integrity of the site concerned, it is proposed not to reject a plan or project but to give it further consideration. In this case Article 6(4) allows for derogations from Article 6(3) under certain conditions.

The extent to which the sequential steps of Article 6(3) applies to a given plan or project depends on several factors, and in the sequence of steps, each step is influenced by the previous step. The order in which the steps are followed is therefore essential for the correct application of Article 6(3).

Each step determines whether a further step in the process is required. If, for example, the conclusion at the end of a Habitats Directive stage one screening appraisal is that significant effects on European sites can be excluded in the absence of any best practice or targeted measures intended to avoid or reduce the harmful effects of the proposed development on European sites, there is no requirement to proceed to the next step.

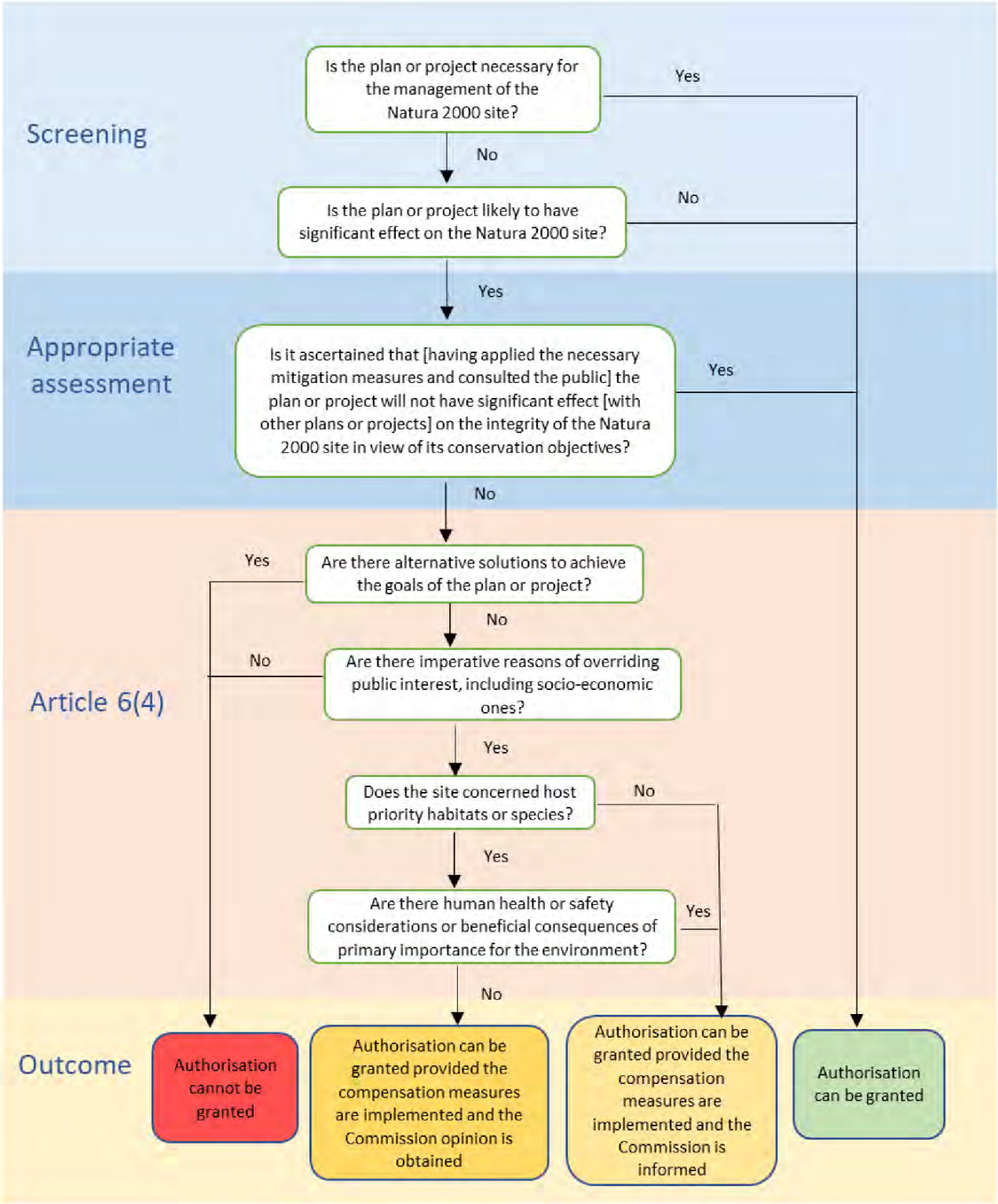

Figure 1.1: Step-wise procedure of Article 6 of the Habitats Directive *(from EC, 2021)*

1.2 Objective of the Document

The purpose of this Report to Inform Screening for Appropriate Assessment (RISAA) and Natura Impact Statement (NIS) is to provide a Habitats Regulations appraisal for the competent authority to facilitate them in carrying out a screening for appropriate assessment in the first instance and, thereafter, an appropriate assessment of the implications of the proposed loading and dumping at sea activities involved in a capital dredging campaign in Ringaskiddy Basin by the Port of Cork Company (POCC), on European sites in view of their conservation objectives.

Figure 1.2 shows the site of the proposed loading operations (dredging) at Ringaskiddy and also the licensed disposal site, located approximately 8km south of Roches Point.

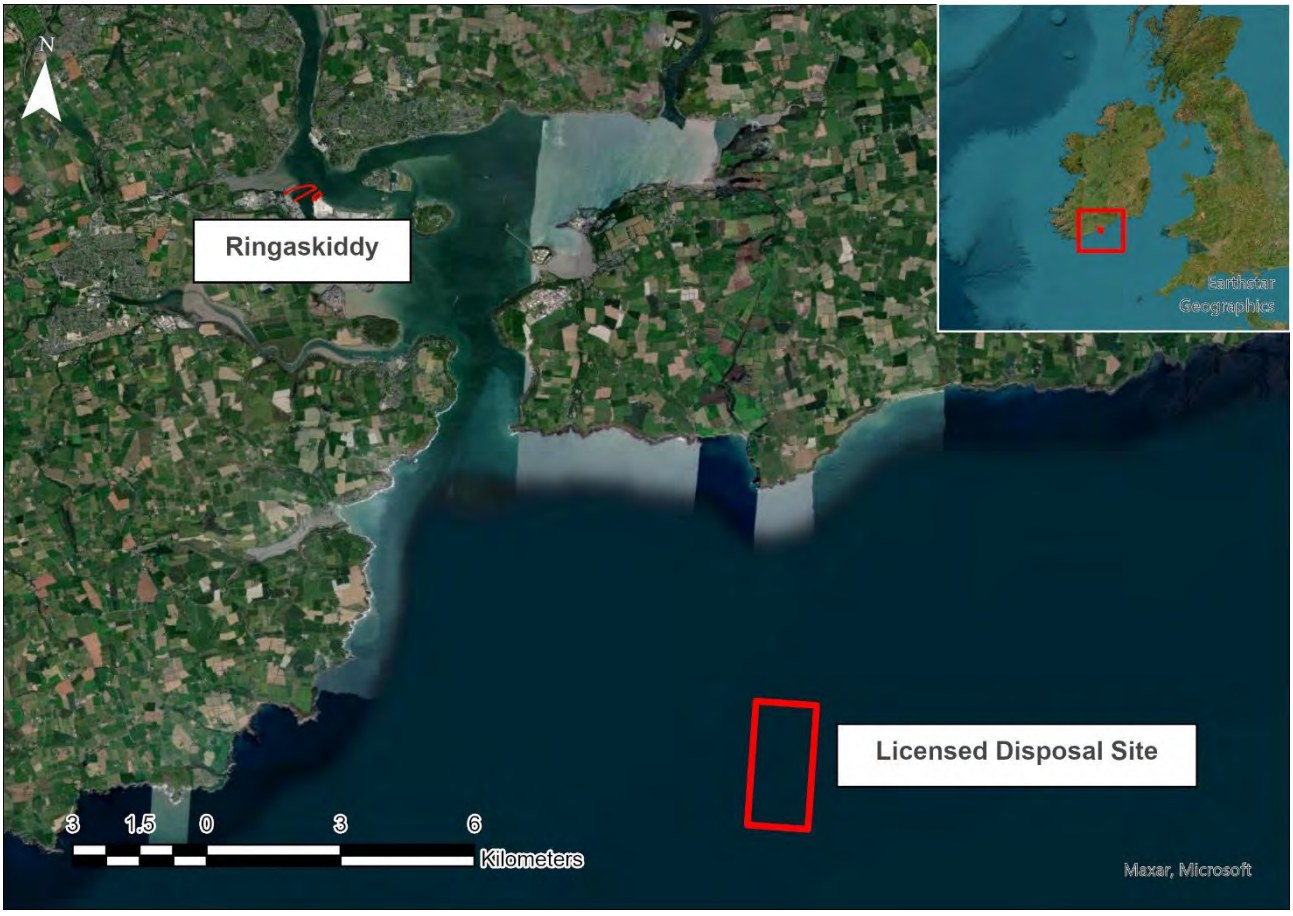

Figure 1.2: Location of Ringaskiddy in relation to the existing licensed disposal site

The Habitats Directive appraisals have been conducted by competent experts in RPS on behalf of POCC in support of an application to the Office of Environmental Sustainability of the Environmental Protection Agency for a Dumping at Sea (DAS) Permit.

This report seeks to assist the EPA as a public authority under the Habitats Regulations in fulfilling their obligations to conduct a Stage One screening for appropriate assessment, and Stage Two appropriate assessment.

1.3 Document Structure

1.3.1 Methodology and Guidance

Section 2 of the document, report sets out the methodology followed, and guidance documents used in conducting a screening appraisal for appropriate assessment and subsequent appraisal for appropriate assessment of the implications of the proposed development on European sites.

1.3.2 Proposed Development

Section 3 of the report describes the proposed development and the general methodology of activities to be undertaken.

1.3.3 Stage 1 Screening Appraisal

Section 4 of the report contains a preliminary examination and analysis to understand whether or not the proposed development is likely to have a significant effect on any European site. This is the screening appraisal for appropriate assessment. It has been undertaken in view of best scientific knowledge, in light of the Conservation Objectives of the sites concerned and considers the proposed development individually or in combination with other plans and projects. In accordance with EC guidance and settled case law of the CJEU, measures intended to avoid or reduce the harmful effects of the proposed development on European sites have not been taken into account in the screening stage appraisal.

1.3.4 Stage 2 Appraisal for Appropriate Assessment

Section 5 of the report contains an examination and analysis of the implications of the proposed development on the Conservation Objectives of those European sites where the possibility of Likely Significant Effects (LSEs) could not be excluded at the screening stage in the absence of further evaluation and analysis, including mitigation measures.

2 METHODOLOGY

2.1 Published guidance on Appropriate Assessment

Appropriate Assessment Guidelines for Planning Authorities have been published by the Department of the Environment Heritage and Local Government (DEHLG, 2010a). In addition to the advice available from the Department, the European Commission has published a number of documents which provide a significant body of guidance on the requirements of Appropriate Assessment, most notably including, 'Assessment of Plans and Projects Significantly Affecting Natura 2000 sites - Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC' (EC, 2001), which sets out the principles of how to approach decision making during the process. These principal national and European guidelines have been followed in the preparation this report. The following list identifies these and other pertinent guidance documents:

- Communication from the Commission on the Precautionary Principle., Office for Official Publications of the European Communities, Luxembourg (EC, 2000);
- Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC. Office for Official Publications of the European Communities, Luxembourg (EC, 2001);
- Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: Alternative Solutions, Imperative Reasons of Overriding Public Interest, Compensatory Measures, Overall Coherence, Opinion of the Commission. Office for Official Publications of the European Communities, Luxembourg (EC, 2007);
- Estuaries and Coastal Zones within the Context of the Birds and Habitats Directives - Technical Supporting Document on their Dual Roles as Natura 2000 Sites and as Waterways and Locations for Ports. Office for Official Publications of the European Communities, Luxembourg (EC, 2009);
- Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities. Department of the Environment, Heritage and Local Government, Dublin (DEHLG, 2010a);
- Department of Environment Heritage and Local Government Circular NPW 1/10 and PSSP 2/10 on Appropriate Assessment under Article 6 of the Habitats Directive – Guidance for Planning Authorities, Dublin (DEHLG, 2010b);
- Guidance document on the implementation of the birds and habitats directive in estuaries and coastal zones with particular attention to port development and dredging. Office for Official Publications of the European Communities, Luxembourg (EC, 2011a);
- European Commission Staff Working Document 'Integrating biodiversity and nature protection into port development' (EC, 2011b);
- Marine Natura Impact Statements in Irish Special Areas of Conservation: A working document, National Parks and Wildlife Service, Dublin (NPWS, 2012);
- Interpretation Manual of European Union Habitats. Version EUR 28. Office for Official Publications of the European Communities, Luxembourg (EC, 2013a);
- Guidelines on Climate Change and Natura 2000. Office for Official Publications of the European Communities, Luxembourg (EC, 2013b);

- Guidance on EIS and NIS Preparation for Offshore Renewable Energy Projects. Department of Communications, Climate Action and Environment, Dublin (DCCAE, 2017);
- European Commission Notice C(2018) 7621 'Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC', Office for Official Publications of the European Communities, Luxembourg (EC, 2019);
- Institute of Air Quality Management 'A guide to the assessment of air quality impacts on designated nature conservation sites (Version 1.1)', London (IAQM, 2020);
- European Commission Notice C(2020) 7730 'Guidance document on wind energy developments and EU nature legislation', Office for Official Publications of the European Communities, Luxembourg (EC, 2020);
- Office of the Planning Regulator Practice Note (PN01) 'Appropriate Assessment Screening for Development Management', Dublin (OPR, 2021);
- European Commission Notice C(2021) 6913 'Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC', Office for Official Publications of the European Communities, Luxembourg (EC, 2021); and
- European Commission Guidance document on Assessment of plans and projects in relation to Natura 2000 sites - A summary, Office for Official Publications of the European Communities, Luxembourg (EC, 2022).

2.2 Likely Significant Effects

The Commission's 2018 Notice (EC, 2019) advises that the appropriate assessment procedure under Article 6(3) is triggered not by the certainty but by the likelihood of significant effects, arising from plans or projects regardless of their location inside or outside a protected site. Such likelihood exists if significant effects on the site cannot be excluded. The significance of effects should be determined in relation to the specific features and environmental conditions of the site concerned by the plan or project, taking particular account of the site's conservation objectives and ecological characteristics.

The threshold for a Likely Significant Effect ("LSE") is treated in the screening exercise as being above a *de minimis* level. A *de minimis* effect is a level of risk that is too small to be concerned with when considering ecological requirements of an Annex I habitat or a population of Annex II species present on a European site necessary to ensure their favourable conservation condition. If low level effects on habitats or individuals of species are judged to be in this order of magnitude and that judgment has been made in the absence of reasonable scientific doubt, then those effects are not considered to be LSEs.

The analysis involved in a Stage 1 screening appraisal for Appropriate Assessment is described in EC (2021) as comprising of four steps:

- ascertaining whether the plan or project is directly connected with or necessary to the management of a Natura 2000 site;
- identifying the relevant elements of the plan or project and their likely impacts;
- identifying which (if any) Natura 2000 sites may be affected, considering the potential effects of the plan or project alone or in combination with other plans or projects;

- assessing whether likely significant effects on the Natura 2000 site can be ruled out, in view of the site's conservation objectives.

Case law of the Court of Justice of the European Union (CJEU) has confirmed that a significant effect is triggered when:

- there is a probability or a risk of a plan or project having a significant effect on a European site;
- the plan is likely to undermine the site's conservation objectives; and
- a significant effect cannot be excluded on the basis of objective information.

EC (2021) defines a LSE as being "any effect that may reasonably be predicted as a consequence of a plan or project that would negatively and significantly affect the conservation objectives established for the habitats and species significantly present on the Natura 2000 site. This can result from either on-site or off-site activities, or through combinations with other plans or projects".

The requirement that the effect in question be 'significant' exists in order to lay down a de minimis or negligible threshold – thus, plans or projects that have no appreciable or imperceptible effects on the site are thereby excluded. On this point, EHS (2002) notes that any effect that may reasonably be predicted as a consequence of a plan or project that may affect the conservation objectives of the features for which the site was designated but excluding *de minimis* or inconsequential effects.

2.3 Consideration of *Ex-Situ* Effects

EC (2019) advises that Member States, both in their legislation and in their practice, allow for the Article 6(3) safeguards to be applied to any development pressures, including those which are external to European sites but which are likely to have significant effects on any of them.

The CJEU developed this point when it issued a ruling in case C-461/17 ("Brian Holohan and Others v An Bord Pleanála") that determined inter alia that Article 6(3) of Directive 92/43/EEC must be interpreted as meaning that an appropriate assessment must on the one hand, catalogue the entirety of habitat types and species for which a site is protected, and, on the other, identify and examine both the implications of the proposed project for the species present on that site, and for which that site has not been listed, and the implications for habitat types and species to be found outside the boundaries of that site, provided that those implications are liable to affect the conservation objectives of the site.

In that regard, consideration has been given in this assessment to implications for habitats and species located both inside and outside of the European sites considered in the screening appraisal with reference to those sites' Conservation Objectives where effects upon those habitats and/or species are liable to affect the conservation objectives of the sites concerned.

2.4 Mitigation Measures at the Screening Stage

In determining whether or not likely significant effects will occur or can be excluded in the Stage 1 appraisal, measures intended to avoid or reduce the harmful effects of the proposed development on European sites, (i.e. "mitigation measures") or best practice measures have not been taken into account in this screening stage appraisal. This approach is consistent with EU guidance and the case law of the Court of Justice of the European Union (CJEU).

EC (2001) states that “project and plan proponents are often encouraged to design mitigation measures into their proposals at the outset. However, it is important to recognise that the screening assessment should be carried out in the absence of any consideration of mitigation measures that form part of a project or plan and are designed to avoid or reduce the impact of a project or plan on a Natura 2000 site”. This direction in the European Commission’s guidance document is unambiguous in that it does not permit the inclusion of mitigation at screening stage.

In April 2018, the Court of Justice of the European Union issued a ruling in case C-323/17 People Over Wind & Peter Sweetman v Coillte Teoranta (“People Over Wind”) that Article 6(3) of Directive 92/43/EEC must be interpreted as meaning that, in order to determine whether it is necessary to carry out, subsequently, an appropriate assessment of the implications, for a site concerned, of a plan or project, it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site.

The judgment in People Over Wind is further reinforced in EC (2019) which refers to CJEU Case C-323/17.

2.5 Conservation Objectives

The conservation objectives for each European site are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the site has been selected.

The favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing;
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and
- the conservation status of its typical species is favourable.

The favourable conservation status (or condition, at a site level) of a species is achieved when:

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

2.5.1 Site-Specific Conservation Objectives

NPWS began preparing detailed Site-Specific Conservation Objectives (“SSCOs”) for European sites in 2011. The European sites in closest proximity to the proposed development which are considered in some detail in this report have all had SSCOs set. The published SSCO documents are as described in Section 4.1 of this document.

The published SSCO documents note that an appropriate assessment based on the most up to date conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.

The most up-to-date Conservation Objectives for the European sites being considered, and details in relation to the Qualifying Interests and Special Conservation Interests of these European sites is based on publicly available data on these European Sites, sourced from the NPWS website in February 2024.

2.6 In-combination Effects

Article 6(3) of the Habitats Directive requires that in-combination effects with other plans or projects are also considered. As set out in the Commission's 2018 Notice (EC, 2019), significance will vary depending on factors such as magnitude of impact, type, extent, duration, intensity, timing, probability, cumulative effects and the vulnerability of the habitats and species concerned. Whilst the Directive does not explicitly define which other plans and projects are within the scope of the in-combination provision of Article 6(3), it is important to note that the underlying intention of this provision is to take account of cumulative impacts, and these will often only occur over time.

In that context, one can consider plans or projects which are completed, approved but uncompleted, or proposed. EC (2019) specifically advises that "*as regards other proposed plans or projects, on grounds of legal certainty it would seem appropriate to restrict the in-combination provision to those which have been actually proposed, i.e. for which an application for approval or consent has been introduced*".

3 THE PROPOSED DEVELOPMENT

POCC is seeking a DAS Permit for a maximum dredge volume of 375,355m^3 and 47,862m^3 to be dredged from sites A and B respectively. **Figure 3.1** shows the locations of Area A and Area B in Ringaskiddy Basin. It is envisaged that all dredging works will be undertaken using a backhoe dredger or a trailing suction hopper dredger with a capacity of *c.* 8,000m^3 with the load per day being *c.*29,376 dry tonnes.

The proposed capital dredging works comprise of two distinct activities in respect to the generation of sediment plumes, these are:

- The dredging activities at Ringaskiddy (refer **Figure 3.1**). During this phase of the works, sediment will be released into the water column due to the turbulent interaction of the dredger and the material on the seabed.
- The dumping of dredged material at the licensed disposal site (refer **Figure 3.2**). During this phase of the works, a fraction of the sediment will become suspended in the water column as the bulk load of dredge material is released from the dredge hopper.

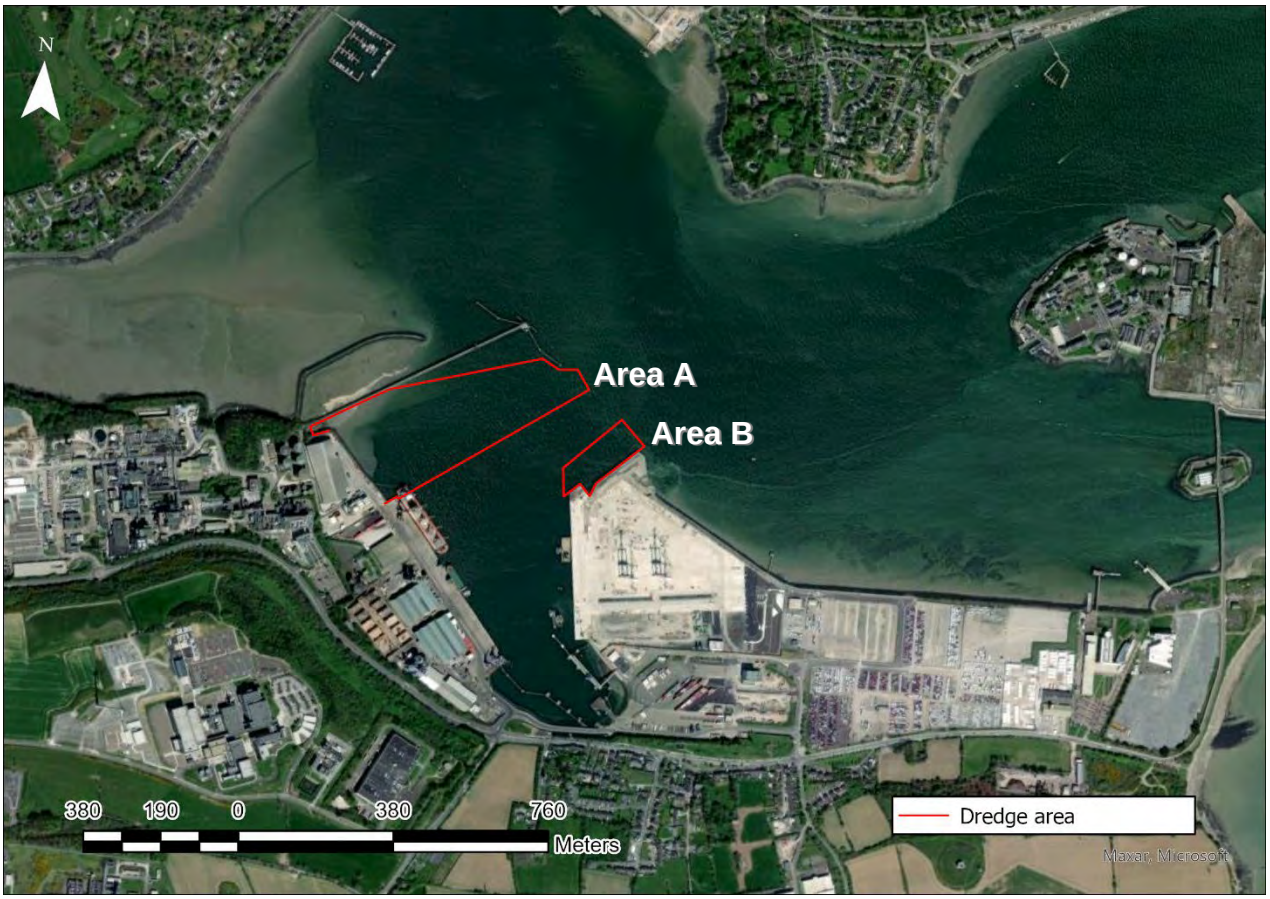

Figure 3.1: Location of the proposed dredging location within Cork Harbour

The location of the licensed disposal site in relation to Ringaskiddy is illustrated in **Figure 3.2** below.

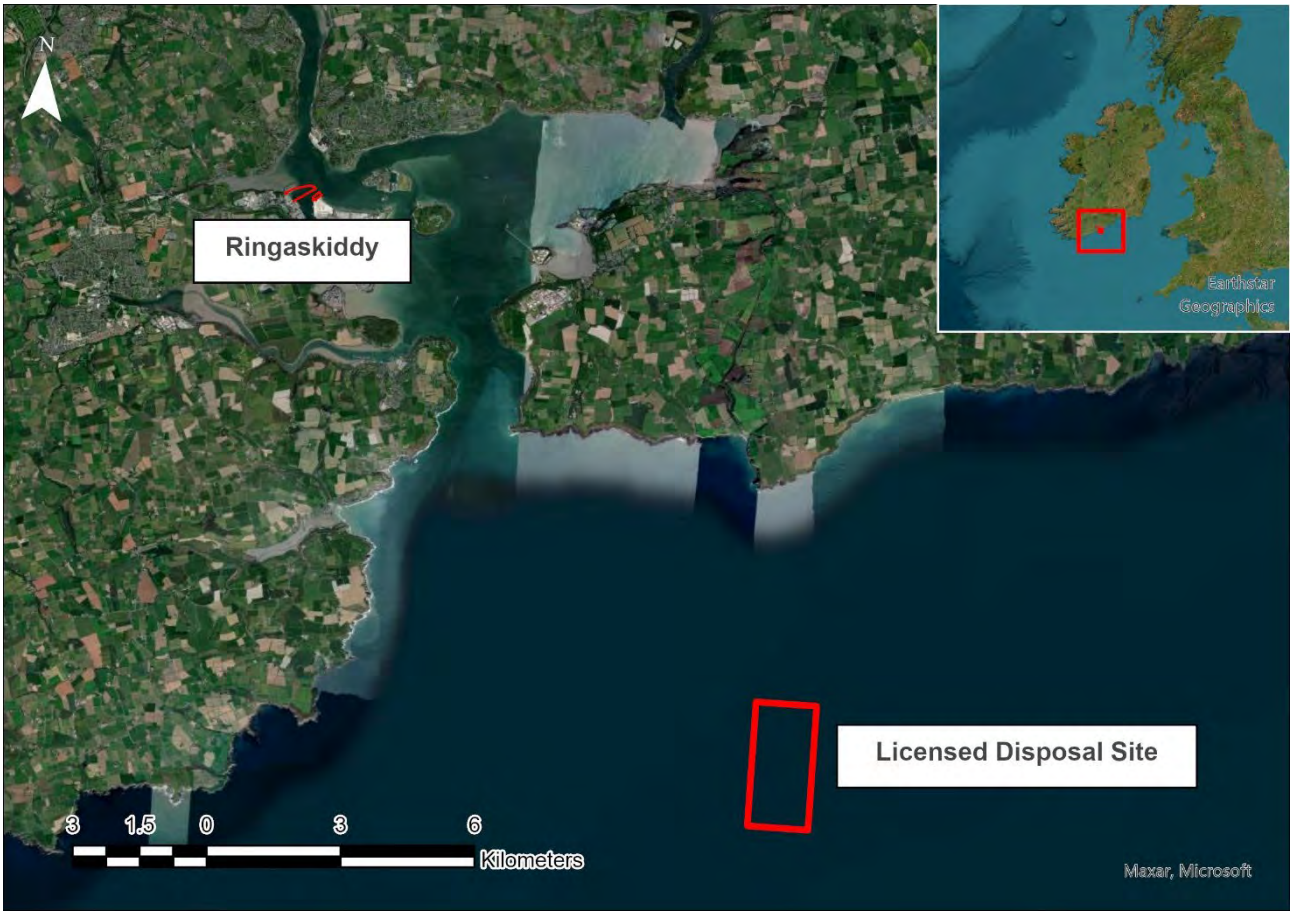

Figure 3.2: Location of Ringaskiddy in relation to the existing licensed disposal site

3.1 Sediment Characteristics

As part of the DAS application process, it was necessary to collect and analyse sediment samples to determine potential contamination and the physical nature of the sediment to be dredged. To this end, Socotec was commissioned to analyse 20 discrete sediment samples collected from Ringaskiddy.

In addition to examining the potential for contaminates, the material was also examined to quantify the percentage of sand and silt material. The results of this assessment are presented in **Table 3.1** below. As demonstrated by this information, approximately 78.8% of the material to be dredged was identified as silt whilst the remaining 21.19% of material had a grain size equivalent to or greater than that of sand material.

Table 3.1: Summary of the Dumping at Sea Material Analysis Report from Ringaskiddy

Sample ID code	Particle size >2mm %	Particle size <2mm >63um %	Particle size <63um %
MAR02152.001	0	13.87	86.13
MAR02152.002	8.16	22.49	69.35
MAR02152.003	5.02	25.56	69.42
MAR02152.004	0	17.08	82.92
MAR02152.005	1.28	9.69	89.02
MAR02152.006	2.42	7.68	89.9
MAR02152.007	3.25	19.61	77.14
MAR02152.008	0.63	16.1	83.27
MAR02152.009	0	12.58	87.42
MAR02152.010	0	15.04	84.96
MAR02152.011	1.91	15.83	82.26
MAR02152.012	0	13.42	86.58
MAR02152.013	0	14.45	85.55
MAR02152.014	0	64.31	35.69
MAR02152.015	0	28.69	71.31
MAR02152.016	0	17.84	82.16
MAR02152.017	0	16.53	83.47
MAR02152.018	0	20.58	79.42
MAR02152.019	0	18.54	81.46
MAR02152.020	8.17	23.19	68.65
AVERAGE [%]	**1.54**	**19.65**	**78.80**

3.2 Sediment plumes generated from the dredging activity

The total volume of material to be dredged in Ringaskiddy Basin equates to 375,355m^3 and 47,862m^3 from sites A and B respectively. Taking a 'worst case scenario' approach, RPS assumed that the dredging operations would be undertaken on a 24/7 basis. A typical dredging cycle is presented in **Table 3.2** below.

The path that was used to define the location and movement of the dredging source term in the numerical model is presented in **Figure 3.3**.

Table 3.2: Typical dredging cycle based on previous dredging campaigns

Cycle Phase	Duration [min]	Comment
Loading time	50	Consists of 20mins of manoeuvring and 30 mins of dredging
Sailing to Dump	90	
Dumping	10	
Sailing from Dump	90	

Figure 3.3: The path used to define the location and movement of the dredging vessel

3.3 Sediment plumes generated from the dumping activity

In addition to assessing sediment plumes generated from the dredging operation within Ringaskiddy Ferry Port, RPS also assessed the dispersion and settlement of material released from dumping dredged material at the licensed disposal site approximately 8km south of Roches Point (refer **Figure 3.2**). Dumping activities are anticipated to last for approximately 10min in every 4-hour dredging cycle.

4 STAGE 1 SCREENING APPRAISAL FOR APPROPRIATE ASSESSMENT

4.1 Directly connected with or necessary to the management of the site

The proposed POCC capital dredging campaign is to provide adequate manoeuvring and berthing depths at the quays in Ringaskiddy Deepwater Port. On this basis, the proposed development is not directly connected with or necessary to the management of any site as a European Site and must be subjected to the prior assessment procedure under Regulation 42 of the Habitats Regulations.

4.2 European Sites in proximity to the Proposed Development

A screening exercise must be undertaken by the competent authorities to determine whether, firstly, the plan or project is directly connected with or necessary to the management of the site, and secondly, whether it is likely to have a significant effect on the site; it is governed by the first sentence of Article 6(3).

In addition, the provisions of national legislation, such as Regulation 42 of the Habitats Regulations, make clear that screening for appropriate assessment of an application for consent for proposed development shall be carried out by the competent authority to assess, in view of best scientific knowledge, if that proposed development, individually or in combination with another plan or project is likely to have a significant effect on the European site.

There are a number of designated sites in and around Cork Harbour including a Special Area of Conservation, a Special Protection Area, Ramsar site, proposed Natural Heritage Area, Important Bird Area and Nature Reserves.

This screening assessment considers European sites designated under European Council Directives 92/43/EEC and 2009/147/EC. The proposed development will be screened against those European sites in order to appraise whether, firstly, the project is directly connected with or necessary to the management of the site and, secondly, whether it is likely to have a significant effect on the site.

The most up-to-date Conservation Objectives (all of which are appended to this document) for the European sites under consideration, and details in relation to the Qualifying Interests and Special Conservation Interests of these European sites are provided in **Table 4.1**.

The information contained in these tables is based on publicly available data on these European Sites, sourced from NPWS in February 2024.

SACs described in **Table 4.1** are illustrated in **Figure 4.1**. SPAs described in **Table 4.1** are illustrated in **Figure 4.2**.

Figure 4.1: SACs considered in the Habitats Directive Appraisals

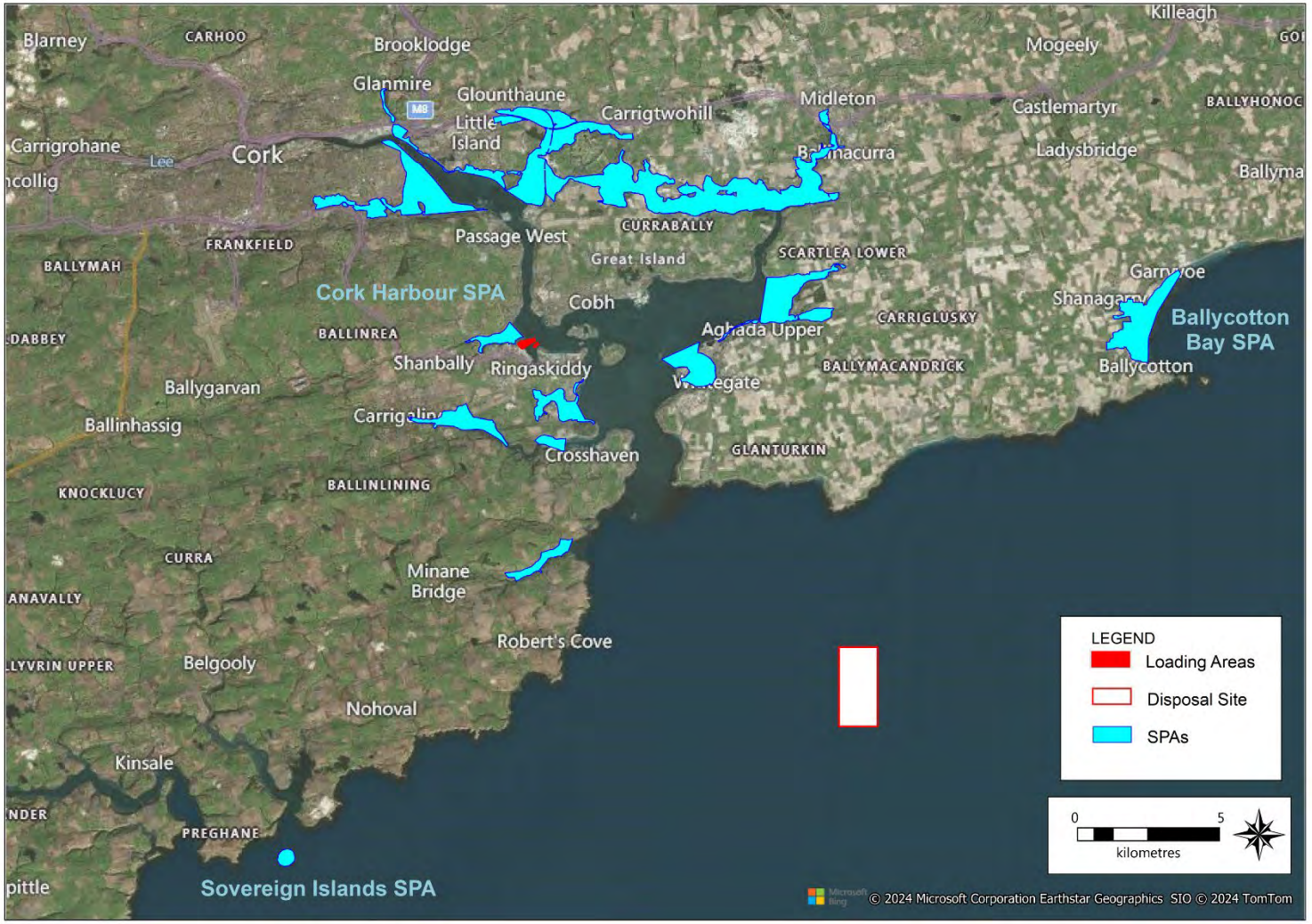

Figure 4.2: SPAs considered in the Habitats Directive Appraisals

Table 4.1: Qualifying Interests and Conservation objectives of European sites considered

Site Code	Site Name	Qualifying Interests & Conservation Objectives			Distance from proposed development
IE001058	Great Island Channel SAC	**Conservation Objectives Specific Version 1.0 (06/06/14)** To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in Great Island Channel SAC, which is defined by the following list of attributes and targets:			4.75 km from proposed loading activities 15.6 km from proposed sea disposal activities
		Attribute	**Measure**	**Target**	
		Habitat area	Hectares	The permanent area is stable or increasing, subject to natural processes	
		Community distribution	Hectares	Conserve the following community type in a natural condition: Mixed sediment to sandy mud with polychaetes and oligochaetes community complex.	
		To restore the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) in Great Island Channel SAC, which is defined by the following list of attributes and targets:			
		Attribute	**Measure**	**Target**	
		Habitat length	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Bawnard - 0.29ha; Carrigatohil - 1.01ha	
		Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes	
		Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions	
		Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	
		Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	
		Vegetation structure: zonation	Occurrence	Maintain range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	
		Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	
		Vegetation structure: vegetation cover	Percentage cover at a representative number of monitoring stops	Maintain more than 90% area outside creeks vegetated	
		Vegetation composition: typical species and subcommunities	Percentage cover at a representative number of monitoring stops	Maintain range of subcommunities with typical species listed in SMP (McCorry and Ryle, 2009)	

Site Code	Site Name	Qualifying Interests & Conservation Objectives			Distance from proposed development
		Vegetation structure: negative indicator species - *Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1% where it is known to occur	
IE004030	Cork Harbour SPA	**Conservation Objectives Specific Version 1.0 (16/12/14)** To maintain the favourable conservation condition of – 23 no. overwintering species in the SPA, as defined by 2 no. attributes and targets; 1 no. breeding and passage species, as defined by a wider range of attributes and targets; and wetland habitats in the SPA as a resource for the regularly-occurring migratory waterbirds that utilise it, as defined by 1 no. attribute and target. **Special Conservation Interests** Little Grebe *Tachybaptus ruficollis* [A004]			110 m from proposed loading activities 10.0 km from proposed sea disposal activities
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by little grebe, other than that occurring from natural patterns of variation	
		Great Crested Grebe *Podiceps cristatus* [A005]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by great crested grebe, other than that occurring from natural patterns of variation	
		Cormorant *Phalacrocorax carbo* [A017]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by cormorant, other than that occurring from natural patterns of variation	
		Grey Heron *Ardea cinereal* [A028]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by grey heron, other than that occurring from natural patterns of variation	
		Shelduck *Tadorna tadorna* [A048]			
		Attribute	**Measure**	**Target**	

Site Code	Site Name	Qualifying Interests & Conservation Objectives			Distance from proposed development
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by shelduck, other than that occurring from natural patterns of variation	
		Wigeon *Anas penelope* [A050]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by wigeon, other than that occurring from natural patterns of variation	
		Teal *Anas crecca* [A052]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by teal, other than that occurring from natural patterns of variation	
		Pintail *Anas acuta* [A054]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by pintail, other than that occurring from natural patterns of variation	
		Shoveler *Anas clypeata* [A056]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by shovler, other than that occurring from natural patterns of variation	
		Red-breasted Merganser *Mergus serrator* [A069]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by red-breasted merganser, other than that occurring from natural patterns of variation	
		Oystercatcher *Haematopus ostralegus* [A130]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by oystercatcher, other than that occurring from natural patterns of variation	
		Golden Plover *Pluvialis apricaria* [A140]			

Site Code	Site Name	Qualifying Interests & Conservation Objectives			Distance from proposed development
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by golden plover, other than that occurring from natural patterns of variation	
		Grey Plover *Pluvialis squatarola* [A141]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by grey plover, other than that occurring from natural patterns of variation	
		Lapwing *Vanellus vanellus* [A142]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by lapwing, other than that occurring from natural patterns of variation	
		Dunlin *Calidris alpina* [A149]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by dunlin, other than that occurring from natural patterns of variation	
		Black-tailed Godwit *Limosa limosa* [A156]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by black-tailed godwit, other than that occurring from natural patterns of variation	
		Bar-tailed Godwit *Limosa lapponica* [A157]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by bar-tailed godwit, other than that occurring from natural patterns of variation	
		Curlew *Numenius arquata* [A160]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	

Site Code	Site Name	Qualifying Interests & Conservation Objectives			Distance from proposed development
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by curlew, other than that occurring from natural patterns of variation	
		Redshank *Tringa totanus* [A162]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by redshank, other than that occurring from natural patterns of variation	
		Greenshank *Tringa nebularia* [A164]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by greenshank, other than that occurring from natural patterns of variation	
		Black-headed Gull *Croicocephalus ridibundus* [A179]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by black-headed gull, other than that occurring from natural patterns of variation	
		Common Gull *Larus canus* [A182]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by common gull, other than that occurring from natural patterns of variation	
		Lesser Black-backed Gull *Larus fuscus* [A183]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by lesser black-backed gull, other than that occurring from natural patterns of variation	
		Common Tern *Sterna hirundo* [A193]			
		Attribute	Measure	**Target**	
		Breeding population abundance: Apparently occupied nests (AONs)	Number	No significant decline	
		Productivity rate: fledged young per	Mean number	No significant decline	

Site Code	Site Name	Qualifying Interests & Conservation Objectives			Distance from proposed development
		breeding pair			
		Distribution: breeding colonies	Number; location; shape; area (hectares)	No significant decline	
		Prey biomass available	Kilograms	No significant decline	
		Barriers to connectivity	Number; location; shape; area (hectares)	No significant increase	
		Disturbance at breeding site	Level of impact	Human activities should occur at levels that do not adversely affect the breeding common tern population	
		Wetlands [A999]			
		Attribute	**Measure**	**Target**	
		Habitat area	Hectares	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 2,587 hectares, other than that occurring from natural patterns of variation.	
IE004022	Ballycotton Bay SPA	**Conservation Objectives Specific Version 1.0 (26/08/14)** To maintain the favourable conservation condition of – 11 no. overwintering species in the SPA, as defined by 2 no. attributes and targets; and wetland habitats in the SPA as a resource for the regularly-occurring migratory waterbirds that utilise it, as defined by 1 no. attribute and target. **Special Conservation Interests** Teal *Anas creca* [A052]			29.0 km from proposed loading activities 16.3 km from proposed sea disposal activities
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by teal, other than that occurring from natural patterns of variation	
		Ringed Plover *Charadrius hiaticula* [A137]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by ringed plover, other than that occurring from natural patterns of variation	
		Golden Plover *Pluvialis apricaria* [A140]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by golden plover, other than that occurring from natural patterns of variation	
		Grey Plover *Pluvialis squatarola* [A141]			
		Attribute	**Measure**	**Target**	

		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by grey plover, other than that occurring from natural patterns of variation	
		Lapwing *Vanellus vanellus* [A142]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by lapwing, other than that occurring from natural patterns of variation	
		Black-tailed Godwit *Limosa limosa* [A156]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by black-tailed godwit, other than that occurring from natural patterns of variation	
		Bar-tailed Godwit *Limosa lapponica* [A157]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by bar-tailed godwit, other than that occurring from natural patterns of variation	
		Curlew *Numenius arquata* [A160]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by curlew, other than that occurring from natural patterns of variation	
		Turnstone *Arenaria interpres* [A169]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by turnstone, other than that occurring from natural patterns of variation	
		Common Gull *Larus canus* [A182]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	
		Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by common gull, other than that occurring from natural patterns of variation	
		Lesser Black-backed Gull *Larus fuscus* [A183]			
		Attribute	**Measure**	**Target**	
		Population trend	Percentage change	Long term population trend stable or increasing	

<table>
<tr><td></td><td></td><td>Distribution</td><td>Range, timing and intensity of use of areas</td><td>No significant decrease in the range, timing or intensity of use of areas by lesser black-backed gull, other than that occurring from natural patterns of variation</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Wetlands [A999]</td><td></td></tr>
<tr><td></td><td></td><td>Attribute</td><td>Measure</td><td>Target</td><td></td></tr>
<tr><td></td><td></td><td>Habitat area</td><td>Hectares</td><td>The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 281 hectares, other than that occurring from natural patterns of variation.</td><td></td></tr>
<tr><td>IE004124</td><td>Sovereign Islands SPA</td><td colspan="3">Conservation Objectives (First Order) Site-Specific Version 1.0 (12/10/22)
To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:

Cormorant Phalacrocorax carbo [A017]</td><td>23.4 km from proposed loading activities

19.6 km from proposed sea disposal activities</td></tr>
<tr><td>IE000101</td><td>Roaringwater Bay and Islands SAC</td><td colspan="3">Conservation Objectives Specific Version 1.0 (19/07/11)
To maintain the favourable conservation condition of the following qualifying interests (QIs) in Roaringwater Bay and Islands SAC. Note that only conservation attributes and targets are listed for marine mammal QIs. Other QIs are not included in this appraisal.

• Large shallow inlets and bays [1160]
• Reefs [1170]
• Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
• European dry heaths [4030]
• Submerged or partially submerged sea caves [8330]
• Phocoena phocoena (Harbour Porpoise) [1351]
• Lutra lutra (Otter) [1355]
• Halichoerus grypus (Grey Seal) [1364]</td><td>97.4 km from proposed loading activities

89.5 km from proposed sea disposal activities</td></tr>
<tr><td></td><td></td><td colspan="3">To maintain the favourable conservation condition of Harbour Porpoise in Roaringwater Bay and Islands SAC, which is defined by the following list of attributes and targets:</td><td></td></tr>
<tr><td></td><td></td><td>Attribute</td><td>Measure</td><td>Target</td><td></td></tr>
<tr><td></td><td></td><td>Access to suitable habitat</td><td>Number of artificial barriers</td><td>Species range within the site should not be restricted by artificial barriers to site use</td><td></td></tr>
<tr><td></td><td></td><td>Disturbance</td><td>Level of impact</td><td>Human activities should occur at levels that do not adversely affect the harbour porpoise community at the site</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">To maintain the favourable conservation condition of Otter in Roaringwater Bay and Islands SAC, which is defined by the following list of attributes and targets:</td><td></td></tr>
<tr><td></td><td></td><td>Attribute</td><td>Measure</td><td>Target</td><td></td></tr>
<tr><td></td><td></td><td>Distribution</td><td>Percentage positive survey sites</td><td>No significant decline</td><td></td></tr>
<tr><td></td><td></td><td>Extent of terrestrial habitat</td><td>Hectares</td><td>No significant decline</td><td></td></tr>
<tr><td></td><td></td><td>Extent of marine habitat</td><td>Hectares</td><td>No significant decline</td><td></td></tr>
<tr><td></td><td></td><td>Extent of freshwater (river) habitat</td><td>Kilometres</td><td>No significant decline</td><td></td></tr>
<tr><td></td><td></td><td>Couching sites and holts</td><td>Number</td><td>No significant decline</td><td></td></tr>
<tr><td></td><td></td><td>Fish biomass available</td><td>Kilograms</td><td>No significant decline</td><td></td></tr>
<tr><td></td><td></td><td>Barriers to connectivity</td><td>Number</td><td>No significant increase</td><td></td></tr>
</table>

		To maintain the favourable conservation condition of Grey Seal in Roaringwater Bay and Islands SAC, which is defined by the following list of attributes and targets:			
		Access to suitable habitat	Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use.	
		Breeding behaviour	Breeding sites	The breeding sites should be maintained in a natural condition.	
		Moulting behaviour	Moult haul-out sites	The moult haul-out sites should be maintained in a natural condition	
		Resting behaviour	Resting haul-out sites	The resting haul-out sites should be maintained in a natural condition	
		Population composition	Number of cohorts	The grey seal population occurring within this site should contain adult, juvenile and pup cohorts annually	
		Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the harbour porpoise community at the site	
IE000707	Saltee Islands SAC	**Conservation Objectives Specific Version 1.0 (21/10/11)** To maintain the favourable conservation condition of the following qualifying interests (QIs) in Saltee Islands SAC. Note that only conservation attributes and targets are listed for marine mammal QIs. Other QIs are not included in this appraisal. • Mudflats and Sandflats not covered by seawater at low tide [1140] • Large shallow inlets and bays [1160] • Reefs [1170] • Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] • Submerged or partially submerged sea caves [8330] • **Halichoerus grypus (Grey Seal) [1364]**			119.6 km from proposed loading activities 106.6 km from proposed sea disposal activities
		To maintain the favourable conservation condition of Grey Seal in Saltee Islands SAC, which is defined by the following list of attributes and targets:			
		Access to suitable habitat	Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use.	
		Breeding behaviour	Breeding sites	The breeding sites should be maintained in a natural condition.	
		Moulting behaviour	Moult haul-out sites	The moult haul-out sites should be maintained in a natural condition	
		Resting behaviour	Resting haul-out sites	The resting haul-out sites should be maintained in a natural condition	
		Population composition	Number of cohorts	The grey seal population occurring within this site should contain adult, juvenile and pup cohorts annually	
		Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the harbour porpoise community at the site	

4.3 Establishing an Impact Pathway

The possibility of significant effects is considered in this report using the source-pathway-receptor model. Source' is defined as the individual elements of the proposed works that have the potential to affect the identified ecological feature (or receptor). 'Pathway' is defined as the means or route by which a source can affect the ecological receptor. 'Ecological receptor' is defined as the Special Conservations Interests (for SPAs) or Qualifying Interests (of SACs/cSACs) for which conservation objectives have been set for the European sites under consideration (refer to **Table 4.1**). Each element can exist independently however an effect is created when there is a linkage between the source, pathway and receptor. Possible effects are discussed under four themes:

- Habitat loss;
- Water quality and habitat deterioration;
- Underwater noise and disturbance; and
- Aerial noise and visual disturbance.

It is noted that the above effects relate to those which may arise during the proposed dredging or disposal works, as the proposals will not lead to any significant change in the operational use of Port of Cork beyond its continued safe operation. Potential effects upon European sites arising as a result of the day-to-day operation of the port are currently well understood and managed within the Port's operational and maintenance procedures. As such the proposed works do not comprise an operational phase in the usual sense and there is therefore no potential for a likely significant effect to arise following completion of the proposed works.

4.4 Potential Effects

4.4.1 Habitat Loss

The red line boundary of the proposed dredge (loading) area is in close proximity to Cork Harbour SPA. Although this site is located 110 m from proposed dredge area A (refer **Figure 3.1**), there is no direct overlap and dredging is not proposed within these European sites. The area to be dredged is separated from the SPA in Monkstown Creek by the ADM Jetty structure and the training wall. There will be no direct habitat loss and there will be no accidental dredging in the SPA. There will be no likely significant effect (LSE) as a result of loading of dredge material.

4.4.2 Water Quality and Habitat Deterioration

4.4.2.1 Suspended Solids

As set out above, in Section 3, the proposed development will involve the dredging of the seabed across two areas shown in **Figure 3.1**, and on each occasion will result in temporary suspension and release of sediments at the loading sites and dump site. Disposal of dredged material or spoil will take place within the long-established licensed dumping site approximately 8km south of Roches Point as shown in **Figure 3.1**.

Given the nature of the proposed works, it is considered that the only pathway for a LSE upon water quality and habitat deterioration associated with the proposals is as a result of suspended sediment and sedimentation. This suspended sediment, including silts and mud is the principal activity posing a risk to the aquatic environment generated by the proposed dredging works. Such sediments would arise in association with the proposed loading and dumping operations and may potentially enter the nearby European sites and potentially those further afield, as a result of their mobilisation and transportation in the water column.

4.4.2.2 Pollution Incidents

There is a risk involved with any vessel activity in the marine environment that a pollution incident might arise and result in spills or leaks of polluting substances into the water. There is potential for pollution events to occur from discharges from vessels using the port (ballast water, wastewater, oil spillages, fuel bunkering).

The risk of such pollution events occurring must be managed to ensure their likelihood is low and that there are effective measures will be put in place in the event that they do occur to prevent any wide reaching or long term adverse effects.

4.4.2.3 Potential Effects on the proximate European sites

4.4.2.3.1 Great Island Channel SAC

The proposed works involve the dredging of sediments within 5 km of Great Island Channel SAC. There is a low level risk that the activities could result in potential effects upon the habitats within this SAC. Dredging activities could result in a plume of suspended sediments entering the SAC and the implications of this must be considered.

Great Island Channel SAC is designated for mudflats and sandflats not covered by seawater at low tide and Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*).

NPWS (2014) notes that in relation to the conservation objective for mudflats and sandflats not covered by seawater at low tide habitat that to be in favourable condition, the permanent habitat area is stable or increasing, subject to natural processes.

In relation to the conservation objectives for Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), NPWS (2014) notes that, in order for the habitat to be in favourable condition:

- the area should be stable or increasing, subject to natural processes, including erosion and succession.
- No decline or change in habitat distribution, subject to natural processes.
- Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions
- Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession
- Maintain natural tidal regime
- Maintain range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
- Maintain structural variation within sward
- Maintain more than 90% area outside creeks vegetated
- Maintain range of subcommunities with typical species listed in SMP
- No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1% where it is known to occur

Given that the proposed dredging works which could result in a plume of suspended sediments entering the SAC, it is not possible to exclude the possibility of LSEs on the qualifying interests of Great Island Channel SAC in the absence of further examination or mitigation measures.

4.4.2.3.2 Cork Harbour SPA

The proposed works will involve the dredging of sediments within 110 m of Cork Harbour SPA which could result in potential effects upon the wetlands of the SPA, where the qualifying populations of waders and waterbirds of Cork Harbour SPA occur. Dredging activities could result in a plume of suspended sediments entering the SPA and the implications of this must be considered.

Cork Harbour SPA is designated for 24 no regularly occurring migratory waterbird, including one breeding species of tern, and wetland habitat.

Looking firstly at the overwintering species, the conservation objectives for the overwintering species SCIs is to maintain the favourable conservation condition of the target species, as defined by 2 no SSCO attributes and targets:

Population trend:	Long term population trend stable or increasing
Distribution:	No significant decrease in the range, timing or intensity of use of areas by the target species, other than that occurring from natural patterns of variation

The targets for the SSCO attribute 'Population trend' is measured in '% change'. The target for 'Distribution' is measured in 'Range, timing and intensity of use of areas'. The Cork Harbour SPA Conservation Objectives Supporting Document (NPWS, 2014) notes that factors that that can adversely affect the achievement of these objectives include:

- Habitat modification: activities that modify discrete areas or the overall habitat(s) within the SPA in terms of how one or more of the listed species use the site (e.g. as a feeding resource) could result in the displacement of these species from areas within the SPA and/or a reduction in their numbers
- Disturbance: anthropogenic disturbance that occurs in or near the site and is either singular or cumulative in nature could result in the displacement of one or more of the listed waterbird species from areas within the SPA, and/or a reduction in their numbers
- Ex-situ factors: several of the listed waterbird species may at times use habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it. The reliance on these habitats will vary from species to species and from site to site. Significant habitat change or increased levels of disturbance within these areas could result in the displacement of one or more of the listed waterbird species from areas within the SPA, and/or a reduction in their numbers.

NPWS (2014) also notes in relation to the conservation objective for wetland habitat that to be in favourable condition, the permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 2,587 ha, other than that occurring from natural patterns of variation.

It notes that the wetland habitats can be categorised into four broad types: subtidal; intertidal; supratidal and associated habitats; and lagoon and associated habitats Over time and through natural variation these subcomponents of the overall wetland complex may vary due to factors such as changing rates of sedimentation, erosion etc. Waterbird species may use more than one of the habitat types for different reasons (behaviours) throughout the tidal cycle.

This document advises that the maintenance of the 'quality' of wetland habitat lies outside the scope of Objective 2. However, for the species of Special Conservation Interest, the scope of Objective 1 covers the need to maintain, or improve where appropriate, the different properties of the wetland habitats contained within the SPA.

Given that the proposed dredging works which could result in a plume of suspended sediments entering the SPA and the fact it is not stipulated as to what time of year dredging will take place and it is therefore

not possible to exclude the possibility of LSEs on the breeding or overwintering SCIs of Cork Harbour SPA.

In addition to mobilised suspended sediments due to dredging or dumping, spillages of polluting substances are also a potential source of pollution to the marine environment during the proposed works and are limited to the discharge from dredging vessels including ballast water, wastewater, oil or fuel. It is not stipulated as to what time of year dredging will take place and it is therefore not possible to exclude the possibility of LSEs on the breeding or overwintering SCIs of Cork Harbour SPA.

Looking next at the breeding species SCIs of Cork Harbour SPA, the conservation objectives for common tern are defined by 6 no attributes, however, these are not presented or discussed in the Cork Harbour SPA Conservation Objectives Supporting Document.

One of the conservation objectives for breeding common tern is considered here under the Water Quality and Habitat Deterioration impact pathway theme, with the remainder being assessed under the disturbance impact pathway theme.

The SSCO attribute 'Prey Biomass available' is measured in weight (kg), and the target is for 'no significant decline'.

The conservation target is for no significant decline in prey biomass available, and these species forage over a considerable range, within the port, close to it and for many kilometres offshore. The question is whether or not a reduction in prey biomass available would likely be significant if it were to occur temporarily and only in a small part of the SPA.

Given the foraging ranges of common terns and the known areas where they do forage, and that elevated concentrations of suspended sediments would occur in the water column as a result of dredging next to the SPA and disposal of dredge spoil at the dump site at a time of the year when terns are present in the port, it is considered that a decrease in in prey biomass available, while unlikely, may potentially occur, within a small proportion of the known foraging habitat for these species and as such the possibility of LSEs cannot be excluded.

There are other potential sources of pollution of the marine environment that may arise as a result of the proposed works, limited to the release of substances from vessels, including oil and fuel. Significant mixing of seawater occurs in Cork Harbour with freshwater flowing in from the Lee, Glashaboy, Owennacurra and Owenabue. The mixing of any polluting materials that escape to the marine environment as a result of the presence of dredging vessels would be further aided by the tidal currents, wind and wave climate which transport the mix of seawater and freshwater (and any polluting substances) and help them disperse throughout Cork Harbour.

The capacity of the Cork Harbour to dilute any elevated concentrations of polluting substances that escape into the marine environment is very significant and is considered to exclude the possibility of likely significant effects of polluting substances escaping into the marine environment providing a hydrological pathway of effect leading to a deterioration of key resources upon which the supported breeding bird populations depends within Cork Harbour SPA.

4.4.2.3.3 Ballycotton Bay SPA

The SPA is designated for eleven overwintering species of waterbird and the wetlands that they use. Given the above analysis and the fact that that the marine and coastal habitats of Ballycotton Bay SPA are located more than 16km from the proposed dump site and more than 25km from the proposed dredging areas, LSEs as a result of water quality and habitat deterioration effects can be excluded at the screening stage. That is the case in the absence of mitigation measures.

4.4.2.3.4 Sovereign Islands SPA

The SPA is designated for one species of waterbird. Given the above analysis and the fact that that the marine and coastal habitats of Sovereign Islands SPA are located more than 19km from the proposed dump site and more than 23km from the proposed dredging areas, LSEs as a result of water quality and habitat deterioration effects can be excluded at the screening stage. That is the case in the absence of mitigation measures.

4.4.3 Underwater Noise and Disturbance

As described in Section 3, the proposed works will involve activities producing underwater noise in order to remove 423,217 m^3 of dredge material from sites A and B at Ringaskiddy, and associated disposal of dredged material at sea at the licenced Dump Site.

These activities carry an inherent risk of noise induced effects upon some marine species as a result of underwater acoustic energy being released into the marine environment. The purpose of the screening assessment is to determine whether or not such risks can be discounted.

An Annex IV Species Risk Assessment has been prepared by Irish Whale and Dolphin Group Consulting ("IWDG") and is included at Appendix A to this report. It has been taken into account in the screening stage appraisal as it contains a comprehensive baseline of pinniped and cetacean marine mammals in Cork Harbour and the western Celtic Sea including records from the IWDG Sightings dataset from 2010 to 2023.

Underwater noise is not a persistent effect, and once the noise source ceases noise levels drop very quickly to pre-existing levels. The natural underwater soundscape of Cork Harbour is not silent - biological sounds from fish and marine mammals are mixed with sounds from waves and surface noise; current flow and turbulence; rain and wind/storm noise; and noise from shipping and leisure craft activities. The ambient noise levels in coastal and inshore water, bays and harbours are subject to huge variation.

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

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

NPWS (2014d) 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) carried out underwater noise measurements during a 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 has 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 SPLRMS and 140 dB re 1µPa² s SEL. Noise levels were below the NOAA general behavioural threshold for marine mammals of 160 dB re 1 µPa SPLRMS (McKeown 2016).

There are no designated sites with marine mammals as qualifying interests within 50 km of the proposed loading or dumping activities. Roaringwater Bay and Islands SAC is located 89.5 km from the proposed dump site (and 97.4 km from the proposed loading areas in Ringaskiddy Basin). The Saltee Islands SAC is located 106.6 km from the proposed dump site (and 119.6 km from the proposed loading areas in Ringaskiddy Basin).

The Saltee Islands SAC off Co Wexford and Roaringwater Bay and Islands SAC are important breeding sites for grey seals and seals from these sites could forage as far as Cork Harbour during the pup rearing period. Roaringwater Bay and Islands SAC is also designated for harbour porpoise and certainly porpoise using this SAC are part of a wider population that also occur off Cork Harbour. The Conservation Objectives of these two SACs in relation to grey seals (NPWs 2011a; 2011b) are to maintain their favourable conservation condition (refer to **Table 4.1**) which is defined by a number of attributes and targets:

i) Access to suitable habitat

   Species range within the site should not be restricted by artificial barriers to site use

ii) Breeding behaviour

   The breeding sites should be maintained in a natural condition

iii) Moulting behaviour

   The moult haul-out sites should be maintained in a natural condition

iv) Resting behaviour

   The resting haul-out sites should be maintained in a natural condition

v) Population composition

   The grey seal population occurring within this site should contain adult, juvenile and pup cohorts annually

vi) Disturbance: Level of impact

   Human activities should occur at levels that do not adversely affect the grey seal population

The only attribute which could potentially be impacted is the 'disturbance' attribute. The Conservation Objectives Supporting Document for Marine Features in Roaringwater Bay and Islands SAC further explains the intention behind this conservation objective, noting on p15 that "*proposed activities or operations should not introduce man-made energy (e.g., aerial or underwater noise, light or thermal energy) at levels that could result in a significant negative impact on individuals and/or the population of grey seal within the site*".

It is clear from this amplification of the conservation objective attribute, target and measure that levels of disturbance within the site are of concern. The proposed dredging and dumping activities are located ~90 km by sea from this SAC, and over 100 km by sea from the Saltee Islands SAC. LSEs upon the grey seal population in Roaringwater Bay and Islands SAC or Saltee Islands SAC will not occur. That is the case in the absence of mitigation measures.

Regarding the conservation objectives for harbour porpoise within the Roaringwater Bay and Islands SAC, the objectives aim to maintain their favourable conservation condition as defined by a number of attributes and targets (refer to **Table 4.1**):

i) Access to suitable habitat

   Number of artificial barriers

ii) Disturbance

Level of impact

No artificial barriers will be created and disturbance, if it occurs at all will be temporary and very localised to the loading areas or dump site, ~90 km from the SAC itself. LSEs upon the harbour porpoise community of Roaringwater Bay and Islands SAC will not occur. That is the case in the absence of mitigation measures.

There are no recorded grey seal breeding sites in Cork Harbour (O'Cadhla *et al.* 2007; Morris and Duck 2019), however grey seals have been noted hauled out in Cork Harbour.

Given these findings and the distance between the proposed dredging and disposal works and the nearest designated site with marine mammal special conservation interests, it is considered that there is no potential for disturbance as a result of underwater noise to the special conservation interests of any European site as a result of the proposed dredging and disposal works.

As such, LSEs as a result of underwater noise and disturbance can therefore be excluded at this stage of the screening appraisal. That is the case in the absence of mitigation measures.

It is important to note that screening for appropriate assessment concerns itself with the qualifying interests and conservation objectives of European sites. The purpose of an Annex IV Species Risk Assessment is broader than this narrow objective. The Annex IV Species Risk Assessment recommends application of the NPWS (2014) guidance to manage the risk to marine mammals from man-made sound sources in Irish Waters. This is to safeguard and prevent death, injury or disturbance of individuals of many species of marine mammals and not exclusively those which are also Annex II qualifying interests of European sites.

This Stage 1 screening appraisal for appropriate assessment does not take into account the application of the NPWS (2014) guidelines to reach its finding of no likely significant effect. This accords with the approach set out in Section 2.4 above in accordance with EC guidance and the case law of the CJEU.

4.4.4 Aerial Noise and Visual Disturbance

4.4.4.1 Cork Harbour SPA

4.4.4.1.1 Overwintering Waterbirds

Whereas habitats are not, species can be vulnerable to aerial noise and visual triggers of disturbance. All of the SPAs considered in this exercise are designated for waders or waterbirds falling into that category. One site, Cork Harbour SPA, is in close proximity to the proposed capital dredging project, whereas other sites considered occur at much greater distances where the prospect of noise or visual disturbance caused by the proposed capital dredging is not likely.

The proposed capital dredging will involve activities emitting aerial noise and associated with the movement of vessels. These activities will however not occur in isolation but occur as a series of shipping vessel movements in the operational berths and navigational areas of the Cork Harbour shipping lanes. Cork Harbour is an existing busy shipping lane and there is no possibility whatsoever that an additional ship will trigger behavioural changes or disturbance in the SCI waterbird population. The loading activities will simply be viewed as another ship in a place that ships regularly visit or transit.

As such it is considered that there is no potential for disturbance to the overwintering special conservation interests of Cork Harbour SPA from aerial noise or visual disturbance associated with the proposed dredging and disposal works. As such, LSEs can be discounted at the screening stage. That is the case in the absence of mitigation measures.

4.4.4.1.2 Breeding Seabirds

As with overwintering birds, breeding species can be vulnerable to aerial noise and visual triggers of disturbance. Cork Harbour SPA has one breeding special conservation interest, common tern, which has been known to breed at a number of sub-colonies across Cork Harbour, and not always within the boundary of the SPA. As works could occur within any month throughout the year (excluding November and February), there is potential for dredging to occur within the period terns are breeding within Cork Harbour. However, the proposed capital dredging will involve activities emitting aerial noise and associated with the movement of shipping vessels.

The conservation objective for common tern is to maintain the favourable conservation condition of the species in Cork Harbour SPA, as defined by six conservation attributes and targets. Prey biomass available is dealt with in Section 4.4.2.3.2. The remaining conservation targets are:

Breeding population abundance: apparently occupied nests (AONs):	No significant decline
Productivity rate: fledged young per breeding pair:	No significant decline
***Distribution*; *breeding colonies*:**	No significant decline
***Barriers to connectivity*:**	No significant increase
***Disturbance at breeding site*:**	Human activities should occur at levels that do not adversely affect the breeding common tern population

The target for the SSCO attribute '*Breeding population abundance: apparently occupied nests (AONs)'* is measured in 'number'. The target for the SSCO attribute '*Productivity rate: fledged young per breeding pair'* is measured in 'mean number'. The target for the SSCO attribute '*Passage population: Individuals*' is measured in 'number'. The target for '*Distribution: breeding colonies'* is measured in 'Number; location; area (hectares)'. The target for '*Distribution: Roosting areas*' is measured in 'Number; location; area (hectares)'. The target for '*Barriers to connectivity'* is measured in 'Number; location; area (hectares)'. The target for '*Disturbance at breeding site'* is measured in 'Level of impact'. The target for '*Disturbance at roosting site'* is measured in 'Level of impact'.

In relation to the common tern special conservation interests of Cork Harbour SPA, no direct impacts are predicted on the breeding sites of the terns as where these sites lie within the zone of proposed operations (for example, Ringaskiddy Deepwater Berth), they are already subject to high levels of disturbance associated with the movement of commercial ships and other vessels. As such it is considered that there is no potential for disturbance to the breeding special conservation interests of Cork Harbour SPA from aerial noise or visual disturbance associated with the proposed dredging and disposal works. As such the possibility of LSEs can be excluded at the screening stage and this is the case in the absence of mitigation measures.

4.4.4.2 Other more distant SPA sites

For Ballycotton Bay SPA and Sovereign Islands SPA at a greater distance, there is no possibility that noise or visual triggers of disturbance, arising as a result of the proposed works could likely significantly affect their overwintering special conservation interests when tested against their conservation objectives.

The proposed capital dredging project will therefore not delay or prevent achieving the target for the long-term population trend of the feature species to be stable or increasing. The proposed capital dredging project will also not delay or prevent achieving the target for no significant decrease in the range, timing or intensity of use of areas by the feature species other than that occurring from natural patterns of variation.

Potential aerial noise and visual disturbance phase effects as a result of the construction and operation of the proposed capital dredging project on these more distant SPA sites shall not arise. In the absence of any further evaluation and analysis and the application of any measures intended to avoid or reduce the harmful effects of the proposed development on these more distant SPAs, LSEs as a result of potential noise and visual disturbance can be excluded at screening stage.

4.5 In-Combination Effects

Article 6(3) of the Habitats Directive and Irish national law requires that in-combination effects with other plans or projects are considered. The significance of any identified combined effects of the proposed development and other past, present or reasonably foreseeable future plans or projects must also be evaluated. On this basis, a range of other projects were considered in terms of their potential to have in-combination effects with the proposed capital dredging project.

Article 6(3) of the Habitats Directive and Irish national law requires that in-combination effects with other plans or projects are considered. The significance of any identified combined effects of the proposed development and other past, present or reasonably foreseeable future plans or projects must also be evaluated.

A search was undertaken on the Dumping at Sea Register[1] of the Environmental Protection Agency (EPA) to ascertain other dredging activities for which an application has been submitted or permit granted. A search was also undertaken of the Foreshore licensing register and the MARA licensing register. Results are presented in Table 4.2 below.

Table 4.2: Other Projects Considered for In-combination Effects

No.	Status	Applicant	Development
S005-01	Granted Dec 2010	Department of Defence	Maintenance Dredging at Haulbowline Naval Base. Activities have been completed.
S005-02	Granted Jan 2017	Department of Defence	Maintainance dredging at Haulbowline Naval Base and dumping of the dredged material at the Port of Cork Dump Site. Activities have been completed.
S005-03	Applied Jul 2023	Department of Defence	Loading of dredged material from the Naval Basin and Entrance Channel. Disposal of suitable dredged materials at the previously used Dumping at Sea site
S0013-02	Granted Jul 2014	Port of Cork Company	Maintenance dredging campaign in River Lee and Cork Harbour. Activities have been completed.
S0013-03	Granted Aug 2023	Port of Cork Company	Maintenance dredging campaign in River Lee and Cork Harbour. Activities to be completed by end of 2030.
S0021-01	Granted Jul 2015	Port of Cork Company	Capital dredging campaign for Ringaskiddy Port Redevelopment Project. Activities to be completed by end of 2020, and activities have been completed.
S0021-02	Granted Jun 2017	Port of Cork Company	Capital dredging campaign for Ringaskiddy Port Redevelopment Project. Activities to be completed by end of 2019, and activities have been completed.

[1] http://www.epa.ie/pubs/forms/lic/das/dumpingatsearegister.html

No.	Status	Applicant	Development
S0032-01	Granted Oct 2023	Cork County Council	Ballycotton Harbour dredging and associated dumping at sea. Activities to be completed by end of 2024.
S0034-01	Granted Feb 2023	PSE Kinsale Energy Limited	The permitted 'dumping at sea' activity is to retain in place the redundant gas export pipeline, the in-field gas pipelines, the in-field umbilicals and umbilical contents.
S0035-01	Granted Feb 2023	PSE Seven Heads Limited	The permitted 'dumping at sea' activity is to retain in place the redundant in-field gas pipelines, the in-field umbilicals and umbilical contents.

4.5.1 S005-01

An application for a permit to dump dredge spoil at sea was submitted by Hydrographic Surveys Ltd on behalf of the Department of Defence for dredging at Haulbowline Naval Base, Co. Cork in November 2009. A permit was granted in December 2010 and dredging activities took place in 2011.

As works permitted under S0005-01 took place in 2011, and given that plumes disperse rapidly through the water column and through the tidal cycle, and concentrations of suspended sediments decrease within a short period of time, there can be **no risk of in-combination effects**.

4.5.2 S005-02

An application for a permit to dump dredge spoil at sea was submitted by Hydrographic Surveys Ltd on behalf of the Department of Defence for dredging at Haulbowline Naval Base, Co. Cork in March 2016. A permit was granted in January 2017 for activities between 1st February 2017 and 31st July 2017.

As works permitted under S0005-02 took place in 2017, and given that plumes disperse rapidly through the water column and through the tidal cycle, and concentrations of suspended sediments decrease within a short period of time, there can be **no risk of in-combination effects.**

4.5.3 S005-03

An application for a permit to dump dredge spoil at sea was submitted by ByrneLooby on behalf of the Department of Defence for dredging of the Haulbowline Naval Base Basin and Entrance Channel to -5.5m CD as both capital dredging and maintenance dredging. A report to inform Screening for Appropriate Assessment was submitted with the application and was prepared by APEM. This report notes that c.37,300 m^3 of seabed material is expected to be removed from the site, with the majority of this material being disposed of at sea, at the same location proposed by this Ringaskiddy Basin Capital Dredging campaign. Works are anticipated to occur over one season, and take approximately 5-6 months to complete. The APEM report notes that "*subject to the outcome of the procurement of a suitably qualified contractor, the dredging activities will be carried out using either a long reach back-hoe excavator, positioned on a dredging barge and/or a pier deck or, a suction dredger*".

Loading activities for this proposed project in the Naval Basin are located approximately 2 km from proposed loading activities in Ringaskiddy Basin. In the absence of any condition temporally separating the loading activities of the two proposed projects, dredging could conceivably occur for both projects simultaneously. As such, suspended sediment plumes arising from both projects occurring simultaneously could interact and result in higher concentrations of suspended sediments than would otherwise occur from one or other of the projects dredging alone.

Despite the fact that sediment plumes disperse rapidly through the water column and through the tidal cycle, and concentrations of suspended sediments decrease within a short period of time, the risk of

likely significant in-combination effects on Cork Harbour SPA or Great Island Channel SAC cannot be excluded at the screening stage in the absence of further evaluation or the application of mitigation measures.

4.5.4 S0013-02

An application for a permit to dump dredge spoil at sea was submitted by RPS on behalf of the Port of Cork Company for dredging at Cork Harbour, Co. Cork in January 2014. A permit was granted in July 2014. Condition 3.1 of the permit stated that all loading and dumping activities shall be completed within 7 years of the date of commencement of activities.

Permit condition 3.2 states “loading of dredged material from the Main Loading Areas shall be carried out by trailing suction hopper dredger as part of three loading campaigns in 2014, 2017 and 2020.”

As works permitted under S0013-03 were in relation to campaigns ending in 2020, and the proposed dredging activities will not commence until 2022, and given that plumes disperse rapidly through the water column and through the tidal cycle, and concentrations of suspended sediments decrease within a short period of time, there can be **no risk of in-combination effects.**

4.5.5 S0013-03

An application for a permit to dump dredge spoil at sea was submitted by Port of Cork Company for dredging of the River Lee and Cork Harbour in November 2021. A permit was granted in August 2023. Condition 3.1 of the permit stated that all loading and dumping activities shall be completed by 31st December 2030.

POCC shall not dispose of dredged material arising from the proposed Ringaskiddy Basin capital dredging at the licensed dump site at the same time as disposal arising from the maintenance dredging activities permitted under S0013-03. Loading activities could however occur at the same time, and loading from the already permitted maintenance dredging campaign under S0013-03 is scheduled to occur in Ringaskiddy Basin and areas of the navigation channel in close proximity to Ringaskiddy between Monkstown, Cobh, Ringaskiddy and Haulbowline.

In the absence of any condition temporally separating the loading activities of the two proposed projects, dredging could conceivably occur for both projects simultaneously. As such, suspended sediment plumes arising from both projects occurring simultaneously could interact and result in higher concentrations of suspended sediments than would otherwise occur from one or other of the projects dredging alone.

Despite the fact that sediment plumes disperse rapidly through the water column and through the tidal cycle, and concentrations of suspended sediments decrease within a short period of time, the risk of likely significant in-combination effects on Cork Harbour SPA or Great Island Channel SAC cannot be excluded at the screening stage in the absence of further evaluation or the application of mitigation measures.

4.5.6 S0021-01

An application for a permit to dump dredge spoil at sea was submitted by RPS on behalf of the Port of Cork Company for dredging at Cork Harbour, Co. Cork in October 2014. A permit was granted in July 2015. Condition 3.1 of the permit stated that all loading and dumping activities shall be completed by 31st December 2020.

As works permitted under S0021-01 must be completed by end December 2020, and the proposed dredging activities will not commence until 2022, and given that plumes disperse rapidly through the water column and through the tidal cycle, and concentrations of suspended sediments decrease within a short period of time, there can be **no risk of in-combination effect.**

4.5.7 S0021-02

An application for a permit to dump dredge spoil at sea was submitted by RPS on behalf of the Port of Cork Company for dredging at Cork Harbour, Co. Cork in September 2016. A permit was granted in June 2017. Condition 3.1 of the permit stated that all loading and dumping activities shall be completed by 31st March 2019.

As works permitted under S0021-02 were completed by end March 2019, and the proposed dredging activities will not commence until 2022, and given that plumes disperse rapidly through the water column and through the tidal cycle, and concentrations of suspended sediments decrease within a short period of time, there can be **no risk of in-combination effect**.

4.5.8 S0032-01

An application for a permit to dump dredge spoil at sea was submitted by Cork County Council in August 2021. The proposed activities are dredging an area adjacent to the main pier in Ballycotton Harbour to -3.5m CD, and the remainder of the harbour adjacent to the breakwater to bedrock or to -2.5m CD; disposal of suitable dredged materials at the previously used Dumping at Sea site South of Power Head, 16km southwest of Ballycotton; and disposal of contaminated dredged material to a suitably licenced landfill facility. In total, 19,500 m^3 of material is to be dredged.

As noted above, no LSEs have been identified on Ballycotton Bay SPA or Sovereign Islands SPA as a result of the proposed development alone. A Natura Impact Statement has been prepared for the proposed Ballycotton Bay dredging works and has applied mitigation measures to prevent LSEs as a result of accidental pollution on *inter alia* the waterbird SCIs of Cork Harbour SPA. LSEs were excluded at the screening stage on the QI habitats of Great Island Channel SAC.

As one of the identified impact pathways as a result of the proposed Ballycotton Bay dredging project is the same as the potential impact pathways identified for the proposed development, there is a **risk of in-combination effects** on the waterbirds of Cork Harbour SPA.

4.5.9 S0034-01 & S0035-01

Applications for a permit to retain in place the redundant gas pipelines and associated infrastructure at Kinsale Head and Seven Heads gas fields and along the route of the gas export pipeline to the shoreline at Inch, Co. Cork, were submitted by PSE Kinsale Energy Limited and PSE Seven Heads Limited respectively, in October 2021. The project is referred to as the Kinsale Area Decommissioning Project ("KADP"), and development consent has been sought for the project (in two phases) under the Petroleum and Other Minerals Development Act 1960 as amended.

A screening for appropriate assessment has been submitted with the DAS application and concludes that no LSEs at all are predicted for the proposed KDAP. As such, there can be **no risk of in-combination effects** between the proposed development and the KDAP.

4.6 Conclusion of the Screening Appraisal

Table 4.3 summarises the outcome of the screening exercise for each European site considered.

The Screening appraisal was completed in compliance with EU and Irish law and the relevant European Commission and national guidelines to determine whether or not Likely Significant Effects on any European site could be excluded as a result of the construction and operation of the proposed capital dredging project.

4.6.1 Special Areas of Conservation

4.6.1.1 Great Island Channel SAC

The possibility of likely significant Habitat Loss effects can be excluded for this European site, even without consideration of mitigation measures.

The possibility of likely significant Water Quality and Habitat Deterioration effects cannot be excluded be excluded for this European site.

The possibility of likely significant Underwater Noise and Disturbance effects can be excluded for this European site, even without consideration of mitigation measures.

The possibility of likely significant Aerial Noise and Visual Disturbance effects can be excluded for this European site, even without consideration of mitigation measures.

The proposed development, individually or in combination with other plans or projects is likely to have significant water quality and habitat deterioration effects on Great Island Channel SAC. It cannot be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or project, will have a significant effect on this European site.

4.6.2 Special Protection Areas

4.6.2.1 Cork Harbour SPA

The possibility of likely significant Habitat Loss effects can be excluded for this European site, even without consideration of mitigation measures

The possibility of likely significant Water Quality and Habitat Deterioration effects on the wetland habitat as a resource for the regularly occurring breeding terns that utilise it cannot be excluded for this European site.

The possibility of likely significant Underwater Noise and Disturbance effects can be excluded for this European site, even without consideration of mitigation measures.

The possibility of likely significant Aerial Noise and Visual Disturbance effects on the breeding Special Conservation Interest species can be excluded for this European site, even without consideration of mitigation measures.

The proposed development, individually or in combination with other plans or projects is likely to have significant water quality and habitat deterioration effects on Cork Harbour SPA. It cannot be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or project, will have a significant effect on this European site.

4.6.2.2 Ballycotton Bay SPA

The possibility of likely significant Habitat Loss effects can be excluded for this European site, even without consideration of mitigation measures.

The possibility of likely significant Water Quality and Habitat Deterioration effects can be excluded for this European site, even without consideration of mitigation measures.

The possibility of likely significant Underwater Noise and Disturbance effects can be excluded for this European site, even without consideration of mitigation measures.

The possibility of likely significant Aerial Noise and Visual Disturbance effects can be excluded for this European site, even without consideration of mitigation measures.

The proposed development, individually and in combination with other plans or projects, is not likely to have a significant effect on Ballycotton Bay SPA. It can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or project, will have a significant effect on this European site.

4.6.2.3 Sovereign Islands SPA

The possibility of likely significant Habitat Loss effects can be excluded for this European site, even without consideration of mitigation measures.

The possibility of likely significant Water Quality and Habitat Deterioration effects can be excluded for this European site, even without consideration of mitigation measures.

The possibility of likely significant Underwater Noise and Disturbance effects can be excluded for this European site, even without consideration of mitigation measures.

The possibility of likely significant Aerial Noise and Visual Disturbance effects can be excluded for this European site, even without consideration of mitigation measures.

The proposed development, individually and in combination with other plans or projects, is not likely to have a significant effect on Sovereign Islands SPA. It can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or project, will have a significant effect on this European site.

4.6.3 Scope of the Stage 2 Assessment

Having regard to the methodology employed and the findings of the screening stage appraisal, it is concluded that an appropriate assessment of the implications of the proposed capital dredging project on the following European sites in view of their conservation objectives is required:

(i) The possibility of likely significant Water Quality and Habitat Deterioration effects on mudflats and sandflats not covered by seawater at low tide and Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) cannot be excluded for Great Island Channel SAC.

(ii) The possibility of likely significant Water Quality and Habitat Deterioration effects on the intertidal areas of Cork Harbour as a resource for the regularly occurring migratory waterbirds that utilise it cannot be excluded for Cork Harbour SPA.

Table 4.3: Screening Summary for European sites considered

Site Code	Site Name	Can the possibility of Likely Significant Effects be excluded at the Screening Stage of assessment?			
		Habitat Loss	Water Quality and Habitat Deterioration	Underwater Noise and Disturbance	Aerial Noise and Visual Disturbance
IE001058	Great Island Channel SAC	✓	X Mudflats, sandflats and Atlantic salt meadows	✓	✓
IE004030	Cork Harbour SPA	✓	X Wetlands	✓	✓
IE004022	Ballycotton Bay SPA	✓	✓	✓	✓
IE004124	Sovereign Islands SPA	✓	✓	✓	✓

5 STAGE 2 APPRAISAL FOR APPROPRIATE ASSESSMENT

5.1 Adverse Effects on the Integrity of European sites

The European Commission's 2018 Notice (EC, 2019) advises that the purpose of the appropriate assessment is to assess the implications of the plan or project in respect of the site's COs, either individually or in combination with other plans or projects. The conclusions should enable the competent authorities to ascertain whether the plan or project will adversely affect the integrity of the site concerned. The focus of the appropriate assessment is therefore specifically on the species and/or the habitats for which the European site is designated.

EC (2021) notes the difference between the tests for screening (stage 1) and appropriate assessment (stage 2), summarised in Table 5.1 below.

EC (2019) also emphasises the importance of using the best scientific knowledge when carrying out the appropriate assessment in order to enable the competent authorities to conclude with certainty that there will be no adverse effects on the integrity of the site. This guidance notes that it is at the time of adoption of the decision authorising implementation of the project that there must be no reasonable scientific doubt remaining as to the absence of adverse effects on the integrity of the site in question.

The judgment of the Court of Justice of the European Union (CJEU) confirmed in its ruling in Case C-258/11 that 'Article 6(3) of the Habitats Directive must be interpreted as meaning that a plan or project not directly connected with or necessary to the management of a site will adversely affect the integrity of that site if it is liable to prevent the lasting preservation of the constitutive characteristics of the site that are connected to the presence of a priority natural habitat whose conservation was the objective justifying the designation of the site in the list of SCIs, in accordance with the directive.

The precautionary principle should be applied for the purposes of that appraisal'. EC (2019) advises that the logic of such an interpretation would also be relevant to non-priority habitat types and to habitats of species.

As regards the meaning of 'integrity', this clearly relates to ecological integrity. This can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having the sense of resilience and ability to evolve in ways that are favourable to conservation.

EC (2019) notes that if the competent authority considers the mitigation measures are sufficient to avoid the adverse effects on site integrity identified in the appropriate assessment, they will become an integral part of the specification of the final plan or project or may be listed as a condition for project approval.

EC (2020) advises that it is for the competent authorities, in the light of the conclusions made in the appropriate assessment on the implications of a plan or project for the European site concerned, to approve the plan or project. This decision can only be taken after they have made certain that the plan or project will not adversely affect the integrity of the site. That is the case where no reasonable scientific doubt remains as to the absence of such effects.

EC (2020) also reaffirms that the authorisation criterion laid down in the second sentence of Article 6(3) of the Habitats Directive integrates the precautionary principle and makes it possible effectively to prevent the protected sites from suffering adverse effects on their integrity as the result of the plans or projects.

Table 5.1: Differences between Screening and Appropriate Assessment

Screening	Appropriate Assessment
Ascertains whether significant negative effects on a European site are likely as a result of implementing the plan or project in view of the site's conservation objectives.	Assesses the likely effects on the Natura 2000 site in view of its conservation objectives and assesses whether adverse effects on the integrity of the site will or might occur.
If the occurrence of significant effects cannot be excluded with certainty, the plan or project has to undergo an appropriate assessment.	The plan or project can be authorised only if adverse effects on the integrity of the Natura 2000 site can be excluded.
Typically based on existing data, available knowledge and experience, and expert opinion.	Requires a detailed examination, often field surveys, expert advice, and an expert assessment of the specific case.
Mitigation measures **cannot** be considered.	Assesses mitigation measures to eliminate or reduce adverse effects.

A less stringent authorisation criterion could not as effectively ensure the fulfilment of the objective of site protection intended under that provision. The onus is therefore on demonstrating the absence of adverse effects rather than their presence, reflecting the precautionary principle. It follows that the appropriate assessment must be sufficiently detailed and reasoned to demonstrate the absence of adverse effects, in light of the best scientific knowledge in the field.

The **'integrity of the site'** can be usefully defined as the coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated (EC, 2019).

Regulation 42 of the Habitats Regulations requires *inter alia* that in carrying out an appropriate assessment a public authority shall take into account:

- the Natura Impact Statement;
- any other plans or projects that may, in combination with the project under consideration, adversely affect the integrity of a European Site;
- any supplemental information furnished in relation to any such statement;
- if appropriate, any additional information sought by the authority and furnished by the applicant in relation to a Natura Impact Statement;
- any information or advice obtained by the public authority;
- if appropriate, any written submissions or observations made to the public authority in relation to the application for consent for proposed project; and

- any other relevant information.

The 2018 Commission Notice (EC, 2019) advises that the purpose of the appropriate assessment is to assess the implications of the project in respect of the site's conservation objectives, either individually or in combination with other plans or projects, drawing conclusions to enable the competent authorities to ascertain whether the project will adversely affect the integrity of the sites concerned, where no reasonable scientific doubt remains as to the absence of such effects. Case law confirms that such an assessment must identify all the aspects of the project which can, either individually or in combination with other plans or projects, affect the conservation objectives of the sites concerned in the light of the best scientific knowledge in the field. EC (2019) advises that an appropriate assessment should:

- include a comprehensive identification of all the potential effects of the project likely to be significant on the sites concerned;
- take into account cumulative and other effects likely to arise as a result of the combined action of the project under assessment with other plans or projects;
- apply the best available techniques and methods to assess the extent of the effects of the project on the integrity of the sites concerned;
- describe the assessment on the site's integrity based on the best possible indicators specific to the qualifying interests of the European site;
- be sufficiently detailed to demonstrate how the final conclusion was reached, and on what scientific grounds.

5.2 Water Quality and Habitat Deterioration Effects

The screening stage appraisal concluded that an appropriate assessment of the implications of the proposed capital dredging project on the following European sites is required, as a result of the potential for diminution of water quality and associated habitat deterioration effects, in view of their conservation objectives and in combination with any other relevant plans or projects:

- Great Island Channel SAC
  - Mudflats and sandflats not covered by seawater at low tide
  - Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- Cork Harbour SPA
  - Wetlands

5.2.1 Assessment of Dredging Techniques

The environmental assessment of dredge techniques proposed and presented in the following Sections has been based on:

- Project specific, bespoke numerical modelling using an industry standard software package (at Appendix B),
- Site specific environmental monitoring including a tracer dispersion study and assessment of deposition at sediment pins throughout the study area (Van Oord, 2012), and

- Environmental aspect of dredging: Machines Methods and Mitigation (R. N. Bray, 2008).

5.2.1.1 Trailer Suction Hopper Dredger

Modelling simulations were based on dredging operations being undertaken using a TSHD as opposed to a backhoe dredger. The percentage of fines lost at the dredger head was assumed to be 3%, this equated to a loss of *c.*45.3kg/s during active dredging times (i.e. 30 minutes of every 4hr dredging cycle). Results are presented in Appendix B and summarised below.

5.2.1.2 Mechanical Dredging

Whilst both TSHD and mechanical methods may be used, mechanical dredging is a slower and less efficient method of dredging than a TSHD, used in circumstances where there are access limitations or consolidated sediments. Mechanical dredgers include all plant which makes use of mechanical excavation equipment for cutting and raising material. In general, mechanical dredging techniques can be split into bucket line dredgers (BLD), backhoe dredgers (BHD) and grab dredgers (GD). Naturally, each technique has different environmental attributes in respect of accuracy, creation of spill and output rates.

In general, BHD is used for relatively small projects in areas with consolidated soil conditions as the mechanical forces which can be applied are considerable. Recent developments in sophisticated monitoring and control equipment have significantly improved the accuracy of BHD. As such, this dredging technique is particularly attractive for more precise dredging projects in areas where debris is expected or where physical constraints such as surrounding infrastructure prevent the use of more traditional equipment.

In effect, the BHD is a conventional hydraulic excavator mounted on a pontoon equipped with a spud carriage system. The bed material is excavated by the crane's bucket which is then raised about the waver by the movement of the crane arm. With modern monitoring equipment, dredge accuracies down to 10cm can be achieved (albeit with reduced productivity) and very limited overspill.

Owing to the slow dredge rate and development of sophisticated monitoring equipment, the potential for dredge overspill and thus dispersion and settlement to the wider environment is considered negligible.

Based on the rationale above, it is RPS' expert opinion that environmental impact associated with mechanical dredging will be significantly less than those associated with TSHD which has been considered in extensive detail in Appendix B.

5.2.2 Suspended sediments from dredging and dumping

Sediment Plume modelling was required to assess in an appropriate manner whether or not proposed loading and dumping activities would result in adverse effects upon the wetland habitat of Cork Harbour SPA or the Mudflats, sandflats and Atlantic salt meadow habitats of Great Island Channel SAC.

The sediment plume dispersion assessment at Appendix B contains model simulations using the MIKE 21 Flow Model software by the Danish Hydraulic Institute (DHI) to assess the impact of the proposed capital dredging works on the sediment transport regime in Cork Harbour and the dump site.

5.2.2.1 Dredging Operations

The total suspended sediment concentrations (SSCs) during typical dredging operations within Area A of the Ringaskiddy Basin are presented in Figure 4.2 - Figure 4.5 of the Plume Dispersion report at Appendix

B, while Figure 4.6 - Figure 4.9 therein represent total suspended concentrations within Area B of the Ringaskiddy Basin. These modelled simulations represent low water, mid-flood, high water and mid-ebb stages of the tidal cycle. Sediment deposition in the Ringaskiddy area upon completion of the dredging operations is illustrated in Figure 4.10 of the Plume Dispersion report at Appendix B.

Based on the output of the modelling results it was found that:

- Sediment plumes did not *generally* extend for more than *c*.400m along a north – south axis during period of flood or ebb tidal flows. The SSC of these plumes was generally less than 100mg/L.
- Sediment plumes did not *generally* extend for more than *c*.1,000m along an east – west axis during period of high or low water phases. Again, the SSC of these plumes was generally less than 100mg/L.
- Material that became suspended as a result of dredging operations typically settled back onto the seabed or was fully dispersed within 75 minutes.
- The spatial dispersion of suspended material generated by operations within the inner regions of Areas A and B was generally limited given the sheltered nature of the Ringaskiddy harbour, whilst material suspended by operations further east tended to disperse further given the stronger tidal flows.

Figure 4.3 and Figure 4.7 of Appendix B shows an elevated plume from dredging activities approaching but not extending into Cork Harbour SPA at Monkstown Creek. This occurs on a mid-flood tide. This elevated plume has been shown to disperse within 75 minutes and is only a transient elevation on SSCs, in an estuarine area already subject to high fluctuations in SSCs. The key information from modelling is illustrated in Figure 4.10 of Appendix B, which shows that deposition levels of up to 16mm following suspension, but only within Ringaskiddy Basin. No deposition was modelled to occur outside of Ringaskiddy Basin, in the Monkstown Creek portion of Cork Harbour SPA or any more distant footprint of any European site. As such, there is not subtidal or intertidal wetland smothering effect at all.

Silt dispersion simulations show that there will be no dredging or dumping plumes carrying sufficient concentrations of suspended sediments so as to cause significant deposition on the mudflat, sandflat or saltmarsh habitats of Great Island Channel SAC or wetland habitats of Cork Harbour SPA.

Given that the dredge plume will disperse quickly after dredging activity; that the dredge plume will be largely limited to areas within the immediate zone of operations, that the breeding tern population supported within the SPA has large foraging area which is unlikely to be significantly affected by the low levels of modelled sediment increase in the relatively confined area in which works are propose, it is not at all likely that the proposed capital dredging works will result in a significant decrease in the range, timing or intensity of use of this area by the breeding feature species of Cork Harbour SPA that use it.

5.2.2.2 Dumping at Sea Operations

In addition to assessing sediment plumes generated from the dredging operation within Ringaskiddy Basin, RPS also assessed the dispersion and settlement of material released from dumping dredged material at the licensed disposal site approximately 8km south of Roches Point.

Dumping activities were modelled to last for approximately 10 mins in every 4-hour dredging cycle. Given that the maximum proposed THSD has a hopper capacity of 8,000 m^3, a suitable spill rate was determined for the model. As described in Section 2.1 of the Plume Assessment report at Appendix B, analysis of sediment samples taken throughout Cork Harbour has demonstrated that the material to be dredged comprised 78% of silt material, with the remaining 22% being sand or other material. As before, RPS modelled a worst-case scenario and assumed that the dredging operations would be undertaken on a 24/7 basis. As such, the findings presented in the following Section of this report represent approximately

423,217 m^3 of sediment material being dumped at the licensed disposal site over the course of the dredging operations.

Figure 4.13 of Appendix B illustrates the path used to define the location and movement of the dumping activity. Figure 4.14 of Appendix B shows the average total SSCs at and surrounding the licensed disposal site during the course of the capital dredging operations. As demonstrated by this Figure, the highest total SSC are observed within the confines of the licensed disposal site. The average total SSC beyond the immediate vicinity of the licensed disposal site does not generally exceed 3mg/L and is quickly dispersed to less than 1mg/L approximately 2km from the disposal site boundary. Elevated plumes do not reach any European site, even temporarily or on a short term basis.

Sediment deposition at the licensed disposal site at the end of the dredging operation is illustrated in Figure 4.15 of Appendix B. It can be seen from this figure that almost all the sediment dumped remains within the confines of the licensed disposal site. Beyond the immediate vicinity of the licensed disposal site, change in bed levels do not generally exceed 5mm. Additional deposition as a result of dumping operations does not reach any European site. The risk of smothering of any marine habitat of an European site does not arise.

5.3 Mitigation Measures

5.3.1 Dredging and Disposal

The following key mitigation measures will apply to the loading and dumping activities associated with the capital dredging campaign. These measures are required to be applied as mitigation in a stage 2 appropriate assessment to permit the modelled outcomes presented in Appendix B, and the interpretation and reliance placed on that modelling information in this Natura Impact Statement to remain valid:

- A full record of loading and dumping tracks and record of the material being dumped will be maintained for each trip;
- No over-spilling (overflowing) from the dredger(s) will be permitted;
- Dumping will be carried out through the vessel's hull;
- Dumping will be limited to 29,376 dry tonnes per day;
- No dumping will occur in either November or February;
- No dumping will occur at the same time as the Port of Cork's maintenance dredging permit using separate dredging plant;
- The dumpsite will be divided into subsections with each used sequentially to ensure uniform spread of the dredged sediments;
- A 250m radius exclusion zone will be implemented around an archaeological anomaly at location 188723.5, 54463.1 (ITM coordinates);
- An Archaeologist will witness all the work in line with the Underwater Archaeology Impact Assessment;
- A Marine Mammal Observer will witness all the work in line with the Annex IV Species Risk Assessment at Appendix A;
- Water Quality monitoring of the loading areas will be undertaken at locations to be agreed with the EPA;
- A documented Accident Prevention Procedure will be put in place prior to commencement; and

- A documented Emergency Response Procedure will be put in place prior to commencement.

6 CONCLUSION OF THE HABITATS DIRECTIVE APPRAISALS

Having regard to the relevant legislation and the methodology followed, a Stage 1 screening appraisal was prepared of as to whether or not the proposed capital dredging project is likely to have a significant effect on the SACs and SPAs as described in Table 4.1.

LSEs could not be excluded at screening stage for the following European sites, without further evaluation and analysis, or the application of measures intended to avoid or reduce the harmful effects of the proposed development on the sites concerned:

- The possibility of likely significant Water Quality and Habitat Deterioration effects on mudflats and sandflats not covered by seawater at low tide and Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) of Great Island Channel SAC;
- The possibility of likely significant Water Quality and Habitat Deterioration effects on the wetland habitat of Cork Harbour as a resource for the breeding waterbirds of Cork Harbour SPA.

A subsequent Stage 2 appraisal of the implications of the proposed capital dredging project on European sites in view of their conservation objectives was undertaken and a Natura Impact Statement ("NIS") was prepared, to determine if the proposed development would adversely affect the integrity of any European site. The NIS considered the Water Quality and Habitat Deterioration impact theme.

Having conducted further evaluation and analysis of dredging techniques, the proposed POCC capital dredging campaign will not adversely affect the integrity of any European site with the application of measures intended to avoid or reduce certain harmful effects of the proposed development.

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Appendices

Appendix A: Annex IV Species Risk Assessment

RISK ASSESSMENT FOR ANNEX IV SPECIES

PORT OF CORK COMPANY
CAPITAL DREDGING AND ASSOCIATED DISPOSAL AT SEA
AT RINGASKIDDY DEEPWATER PORT

Prepared by
[redacted]

IWDG Consulting, Merchants Quay, Kilrush, Co Clare

Issued to the Port of Cork Company as Final Rev 02, March 2024

CONTENTS

Figures

1 | INTRODUCTION

The Irish Whale and Dolphin Group (IWDG) was contracted by RPS to carry out an Annex IV Species Risk Assessment of proposed capital dredging by the Port of Cork Company (POCC) at Ringaskiddy and subsequent disposal of dredge material off Roches Point. Annex IV species include cetaceans, marine turtle, otter and bats. Although not listed on Annex IV, we have included pinnipeds (seals) in this assessment as they frequently occur in Cork Harbour and are listed on the Habitats Directive.

This report will assess the potential impacts of capital dredging at Ringaskiddy, with a total 423,217 m^3 of dredged material to be removed and disposed.

Proposed works

POCC is required to undertake dredging of its berths, basins and navigation channels to maintain advertised depths for the safe passage of vessels. POCC now propose to submit a Dumping At Sea (DAS) application to the Environmental Protection Agency for a permit under Section 5 of the Dumping at Sea Act 1996, as revised[1]. The DAS application is for the loading and dumping of dredged material arising from the proposed capital dredging at Ringaskiddy, as illustrated in Figure 1. This Annex IV Species Risk Assessment is to accompany the DAS application as required by the EPA and as part of POCC's commitment to protect species listed on Annex IV of the Habitats Directive from injury and disturbance.

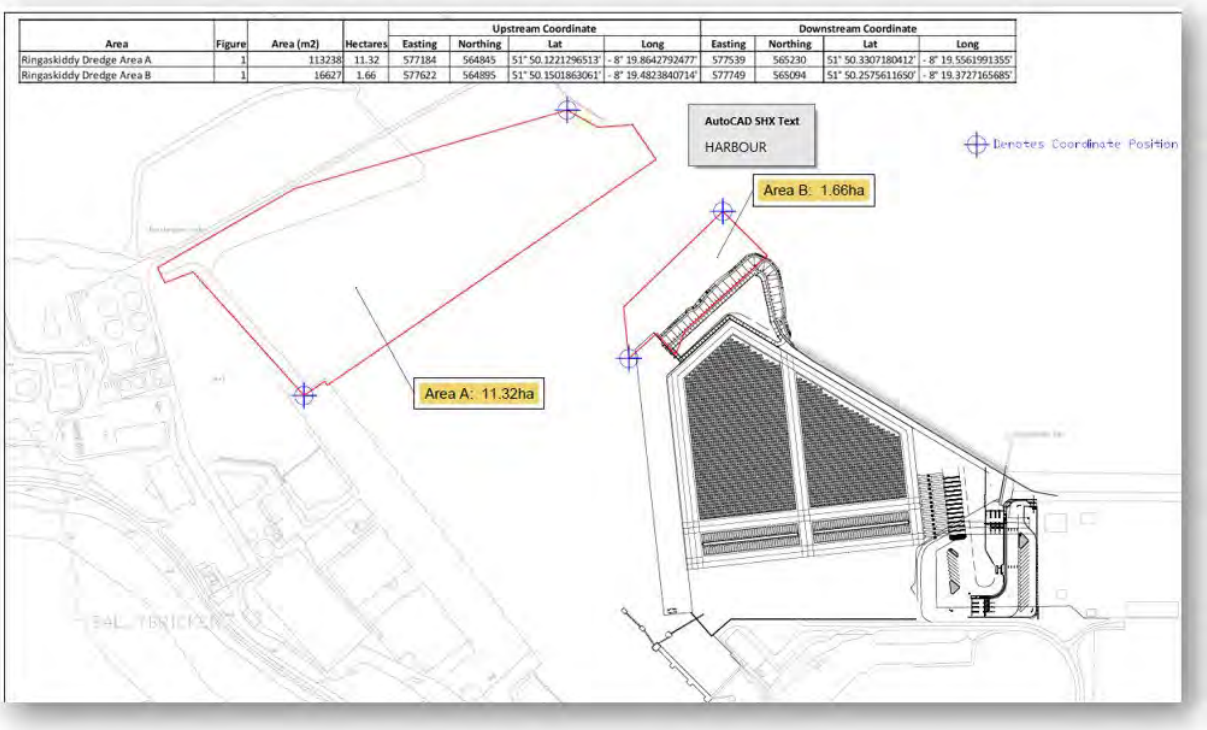

Figure 1: Two sites in Ringaskiddy to be dredged and the site of the proposed spoil ground

The loading of dredged material will be restricted to two sites at Ringaskiddy, which contain sediments which are suitable for disposal at sea (Class 1: uncontaminated, no biological effects likely). Confirmation of the suitability of the dredged sediments for disposal at sea is made through a programme of sediment chemistry

[1] https://revisedacts.lawreform.ie/eli/1996/act/14/revised/en/html

sampling and analysis and eco-toxicological testing. It is proposed to dispose of the dredged sediments at the existing licensed offshore disposal site located off Roches Point at the entrance to Cork Harbour, as illustrated in Figure 2.

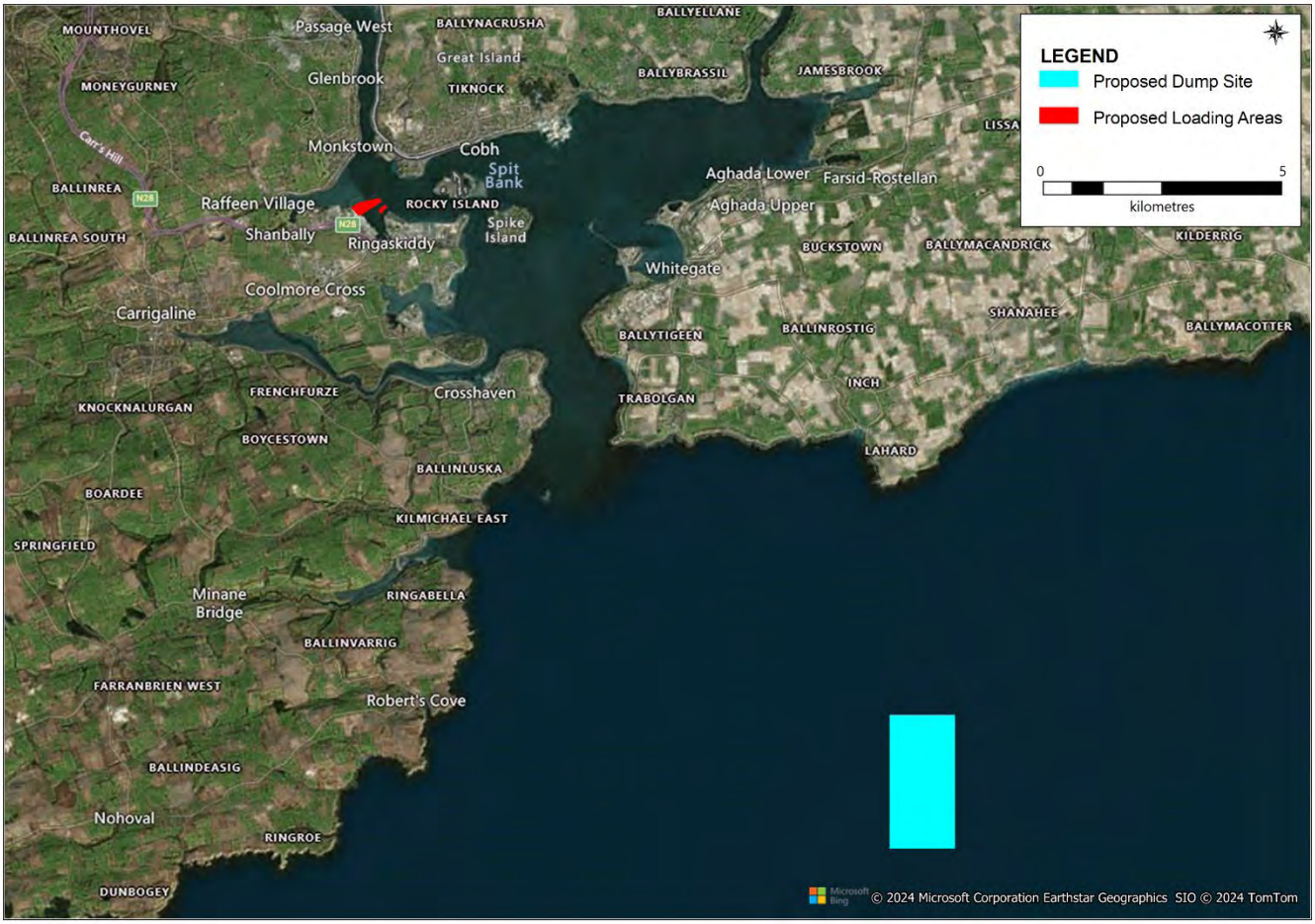

Figure 2: Dredge sites in Ringaskiddy and proposed Dump site off Roches Point

Dredging and Dumping

POCC proposes to remove 423,217 m^3 of dredge material from two sites at Ringaskiddy (375,355 m^3 and 47,862 m^3 from sites A and B respectively), with a maximum of c.29,376 dry tonnes per day. No dumping will occur in either November or February. POCC has been carrying out dredging at these sites since 1978, and a capital dredging programme as part of the development of the Cork Container Terminal in recent years, during which period an estimated 7 million tonnes of material have been deposited at the current proposed dump site.

NPWS (2014)[2] provides guidance on mitigating the impact of sound sources on marine mammals, including from dredging activity. Dredging is defined as "*the excavation of sand, gravel, loose rock and other material from the seabed*". The concern for dredge activities is due to the potential of the operation to produce noise sources up to 190 dB re 1 µPa and at frequencies which can overlap with some marine mammal hearing and therefore has the potential to impact and disturb these species (NPWS, 2014). The guidance requests that sound from the attendant vessels also to be considered but provide no detail on the actual dumping of dredged material. We consider dredging to include both the excavation and dumping of material as the same operation.

[2] https://www.npws.ie/sites/default/files/general/Underwater%20sound%20guidance_Jan%202014.pdf

Once dredging has commenced, following the effective visual monitoring by a qualified MMO, the operation should be able to continue if dredging and/or dumping or either activity is underway. Once dredging is underway "*there is no need to halt operations at night time or if weather conditions deteriorate*" unless there is a break in sound output from the TSHD of >30 minutes (NPWS, 2014). No such guidelines exist for otters or marine turtles.

Dredging

The dredge material will be removed from areas as illustrated in Figure 1 and described in detail in Sections 2.1 and 4.2.1 of the Sediment Plume Dispersion Assessment report accompanying the DAS application. Both the dredge areas and the proposed dump site are illustrated in Figure 2.

TSHD trails its suction pipe when working, and loads the dredge spoil into one or more hoppers in the vessel. When the hoppers are full, the TSHD sails to a disposal area and either dumps the material through doors in the hull or pumps the material out of the hoppers. The TSHD's to be used in the present operation are 97-128m in length and with a capacity not exceeding 8,000 m^3 of dredged material. The suction pipe diameter are 0.90-1.10 m. The dredging operation can be carried out during fair weather. Limiting sea states for dredging are defined as significant wave height of approximately 2.5 m and wind speeds of approximately Beaufort Force 6.

During dredging the TSHD will sail with a speed around 1 to 3 knots, depending on the dredge location, surrounding marine activities, sea conditions and soil parameters. Previous studies on sound production by TSHDs in silt/mud substrates have found that maximum source levels from the various activities associated with TSHD dredging (including the dredging process, transit to dump site, placement, pumping and rainbowing) to be very similar with dredging itself and not producing sounds louder than those produced by the dredger during transit (de Jong *et al.* 2010). This study was carried out on the sound production by seven TSHDs during construction of a 2,000 ha harbour extension of the Port of Rotterdam. More recently, Robinson *et al*. (2011), found that emitted sound levels from TSHDs at frequencies below 500 Hz were similar to a deep-draft draught cargo ship travelling at a moderate speed.

Mechanical dredgers include all plant which makes use of mechanical excavation equipment for cutting and raising material. In general, mechanical dredging techniques can be split into bucket line dredgers (BLD), backhoe dredgers (BHD) and grab dredgers (GD). Naturally, each technique has different environmental attributes in respect of accuracy, creation of spill and output rates.

In general, BHD is used for relatively small projects in areas with consolidated soil conditions as the mechanical forces which can be applied are considerable. Recent developments in sophisticated monitoring and control equipment have significantly improved the accuracy of BHD. As such, this dredging technique is particularly attractive for more precise dredging projects in areas where debris is expected or where physical constraints such as surrounding infrastructure prevent the use of more traditional equipment.

In effect, the BHD is a conventional hydraulic excavator mounted on a pontoon equipped with a spud carriage system. The bed material is excavated by the crane's bucket which is then raised about the waver by the movement of the crane arm. With modern monitoring equipment, dredge accuracies down to 10cm can be achieved (albeit with reduced productivity) and very limited overspill.

Dumping at Sea

Dumping will be carried out from the dredge vessel in the prescribed dump site, around 8km south of Roches Point. This site has been used for many years with an estimated 7 million tonnes of dredged material dumped over the last 35 years. The dredger or split hopper barge will take around 1-2 hours to transit to the site, and

a similar time to return to the dredge site. During dumping the TSHD or barge will sail at between 0-3 knots depending on sea conditions, dredged material, etc. During this period the bottom valves are opened and all material is discharged from the hopper in a very controlled short period taking only a few minutes. These activities are described in more detail in Sections 2 and 4 of the Sediment Plume Dispersion Assessment report prepared to support the applications for a Dumping at Sea Permit and Foreshore Licence. Dumping will be limited to c.29,376 dry tonnes per day and the dumpsite will be divided into subsections with each used sequentially to ensure uniform spread of the dredged sediments.

Receiving Environment

The receiving environment includes the area being dredged and the area in which the dredged material is disposed or dumped. The route between the dredge and the dump site could also be impacted through increased noise associated with the movement of the dredger as it transits to and from the dump site. The receiving environment includes the benthos, the benthic, demersal and pelagic fish in the area, otters marine mammals and to a lesser extent seabirds. Here we only consider the risk to Annex IV species from the dredging operations and especially at the dump site and during transit between the dredge and dump site.

The ecological effects of dumping dredge material on marine mammals are not well studied. Widdows *et al.* (2007) carried out an assessment of the likely effects of annual maintenance dredging on the Tamar Estuary, SW England as it is a Special Area of Conservation (SAC). The study concluded that there was no evidence of ecological changes related to the dredging activity in the Tamar and any significant changes to fish catches, and the number of over-wintering ducks appeared to be related to large scale climatic events rather than anthropogenic factors within the Tamar estuary. They did not consider the effects on marine mammals as they did not occur in the estuary. Messiaeh *et al.* (1991) considered the greatest impact of dumping on marine fish and mammals in continental shelf waters of eastern Canada was the re-suspension of contaminants that had become fixed in the sediment. They are no studies on the effects of dredging and disposal at sea on otter and marine turtles.

Sediment

The composition of material to be dredged was determined to comprise approximately 78% silt (with the remaining 22% of material having a grain size equivalent to or greater than that of sand) which is described in more detail in Section 2.1 of the Sediment Plume Dispersion Assessment report (with silt specifications summarised in Table 2.1 of that report).

2 | METHODS

This risk assessment was based on original data collected by the IWDG and a review of the available literature. The IWDG Sightings dataset, which is validated and updated daily, was accessed (on 4 February 2024) and data from 2014 to present was exported and mapped. Marine mammals are highly mobile and although there are no SACs for marine mammals in the vicinity of Cork Harbour, recent advice suggests considering the wider area and potential for impacts on SACs with marine mammal as qualifying interests which may range from these protected areas. The IWDG datasets, including casual and ship survey data were combined with data from seismic surveys and cetacean surveys including CODA, SCANS II and ObSERVE surveys and NPWS surveys and mapped for the south coast and present as kernel density estimators (KDEs).

Kernel density estimators (KDEs) have become increasingly popular for the spatial analysis of species home ranges, distribution and abundance (Freiberg 2007). Density maps allow visual estimation of dense features or event concentrations over a study area. Such maps are very useful for assessment of the distribution

patterns of the features. Heatmaps are used to easily identify clusters where there is a high concentration of activity. The values in the kernel raster are an estimate of the expected density of records in each cell. The higher the value, the greater the estimated usage. Interpolation is based on the assumption that spatially distributed objects are spatially correlated; in other words, things that are close together tend to have similar characteristics. Conceptually, a smoothly curved surface is fitted over each point. The surface value is highest at the location of the point and diminishes with increasing distance from the point, reaching zero at the Search radius distance from the point. The density at each output raster cell is calculated by adding the values of all the kernel surfaces where they overlay the raster cell centre (ESRI, 2016). Due to the mobile nature of cetacean species, a 20,000m bandwidth (*h*) was chosen based on the available literature. The bandwidth was also chosen to eliminate over smoothing of under recorded data. Use of a bandwidth less than 20km did not adequately smooth across areas where effort/sightings were low, and a bandwidth that was greater than 20km excessively smoothed the observations, whereby the structure in the data was washed out by the wide kernel. Density was calculated using a count field *i.e.* the number of animals at each location.

3 | LEGAL STATUS

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

All cetaceans, pinnipeds, otter and Leatherback Turtle are protected under Annex IV of the EC Habitats Directive (92/43/EEC). The Directive lists Annex IV species of community interest 'in need of strict protection'. Under this Directive, the harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), grey seal (*Halichoerus grypus*), harbour seal (*Phoca vitulina*), leatherback turtle (*Dermochelys coriacea*) and otter (*Lutra lutra*) are designated Annex II species 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) which include mitigation measures specific to dredging. The guidelines recommend that listed coastal and marine activities (including dredging) 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

Ambient, or background noise, is defined as any sound other than the sound being monitored (primary sound) and, in the marine environment, is a combination of naturally occurring biologically and physical sound sources including sediment transfer, waves and rain and that of a biological origin including fish, crustaceans and from marine mammals. The impact of noise created by human activity is strongly influenced by background or ambient noise, the impact is less in a noisy environment compared to a quiet environment and it's the intensity and frequency of this increased noise compared to the ambient levels at a site, which defines its impact. As ambient noise levels increase, the ability to detect a biologically important sound decreases. The point at which a sound is no longer detectable over ambient noise is known as acoustic masking. The range at which an animal is able to detect these signals reduces with increasing levels of ambient noise (Richardson *et al.* 1995). This is important when considering the impact of sound sources on marine mammals by the proposed works.

Ambient noise levels worldwide have been on the rise in recent decades with developments in industry and, in particular, in commercial shipping. In the North Pacific, low frequency background noise has approximately doubled in each of the past four decades (Andrew *et al.* 2002), resulting in at least a 15- to 20-dB increase in ambient noise. In recent years, interest has grown in the effects of anthropogenic noise on marine life.

A high-resolution autonomous underwater sound recording device was deployed outside Cork Harbour in 2012 as part of a pilot scheme to explore monitoring obligations under the Marine Strategy Framework Directive (Sutton *et al.* 2014) (refer Figure 3). The RTSYS system was deployed for 16 days (April to August) with a sampling rate of 156.25 kHz. This deployment recorded background noise at a maximum of around 80 dB re 1 µPa, which fluctuated mainly in response to environmental variables, the major peaks (at around 120 – 130 dB re 1 µPa) coincided with windy events. Anthropogenic sound was dominated by shipping activity, whose sound emissions dominated the ambient noise for a short period of time, with levels returning to background between ship passing events.

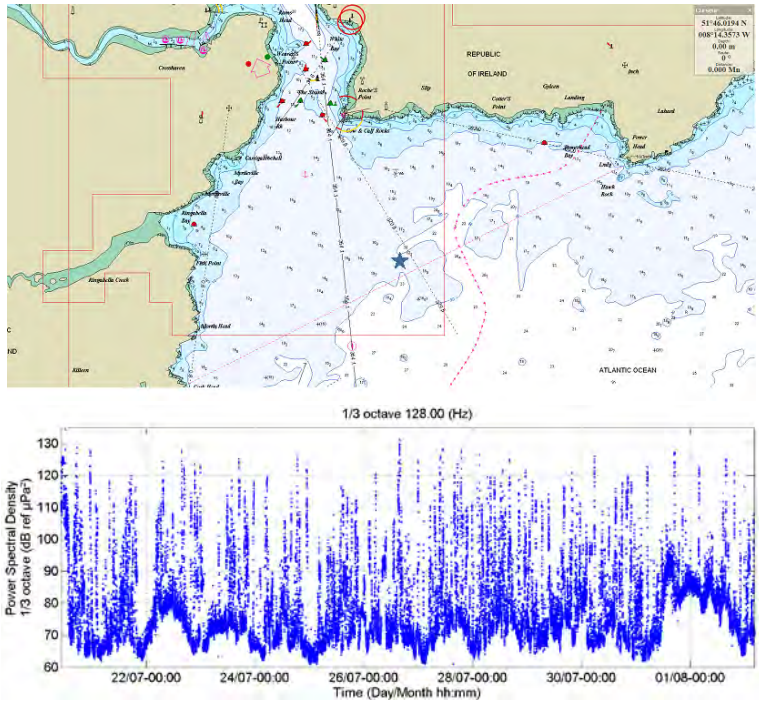

Figure 3: Location and results of RTSYS system deployed at the dump site in 2012
(from Sutton et al. 2014)

4.2 | Marine Mammals

4.2.1 Marine Mammals sighted during Previous Dredging Campaigns

Sightings of marine mammals have been recorded during previous dredging campaigns in Cork Harbour. Russell and Levesque (2014) recorded a total of 25 marine mammal sightings during dredging and dumping operations over 30 days between 13 September and 13 October 2014. Grey seal was the most commonly recorded species with 15 records (60%) followed by common dolphin (20%), harbour porpoise (12%) and two sightings (8%) of fin whales. The only marine mammal observed during dredging was grey seal with all other sightings on transit at the mouth of the harbour or on the disposal site.

O'Dwyer (2017) recorded a total of 32 marine mammal sightings during dredging and dumping operations over 36 days from 25 September to 30 October 2017. Grey seal was the most commonly recorded species with 15 records (47%) followed by harbour porpoise with 14 records (44%). There were two records (6%) of common dolphins and one record (3%) of a minke whale. The animals were well distributed with sightings occurring at both dump and dredge sites as well as while transiting between these. The only marine mammal observed during dredging was grey seal

Shine (2000) recorded a total of **54** sightings of marine mammals between 19 August and 5 October 2020. Most sightings were of common dolphins outside Cork Harbour or off Roches Point but unidentified cetaceans were recorded off Passage West and Ringaskiddy. At least six other species were recorded and three unidentified downgrades (e.g. seal sp.). Most sightings (39, or 72%) were observed during pre-watches. Marine mammal activity was, at times, high around the spoil grounds, however delays were rarely enacted. This was due to animals usually not being observed within the 500m mitigation radius at the commencement of dumping operations.

4.2.2 Cetaceans

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 one the most frequently recorded cetacean species during dredging operations over the September-October period (Russell and Levesque, 2014; O'Dwyer 2017. Sightings were outside of Cork Harbour, during transit to and at the disposal site. Harbour porpoise are widespread and have been sighted within Cork Harbour and on the spoil ground (Figure 4). Harbour porpoise are typically encountered as individuals or in small groups of 2-3 animals throughout the year, but with a peak in group size during the autumn off the Cork coast. They normally will avoid medium and large vessels.

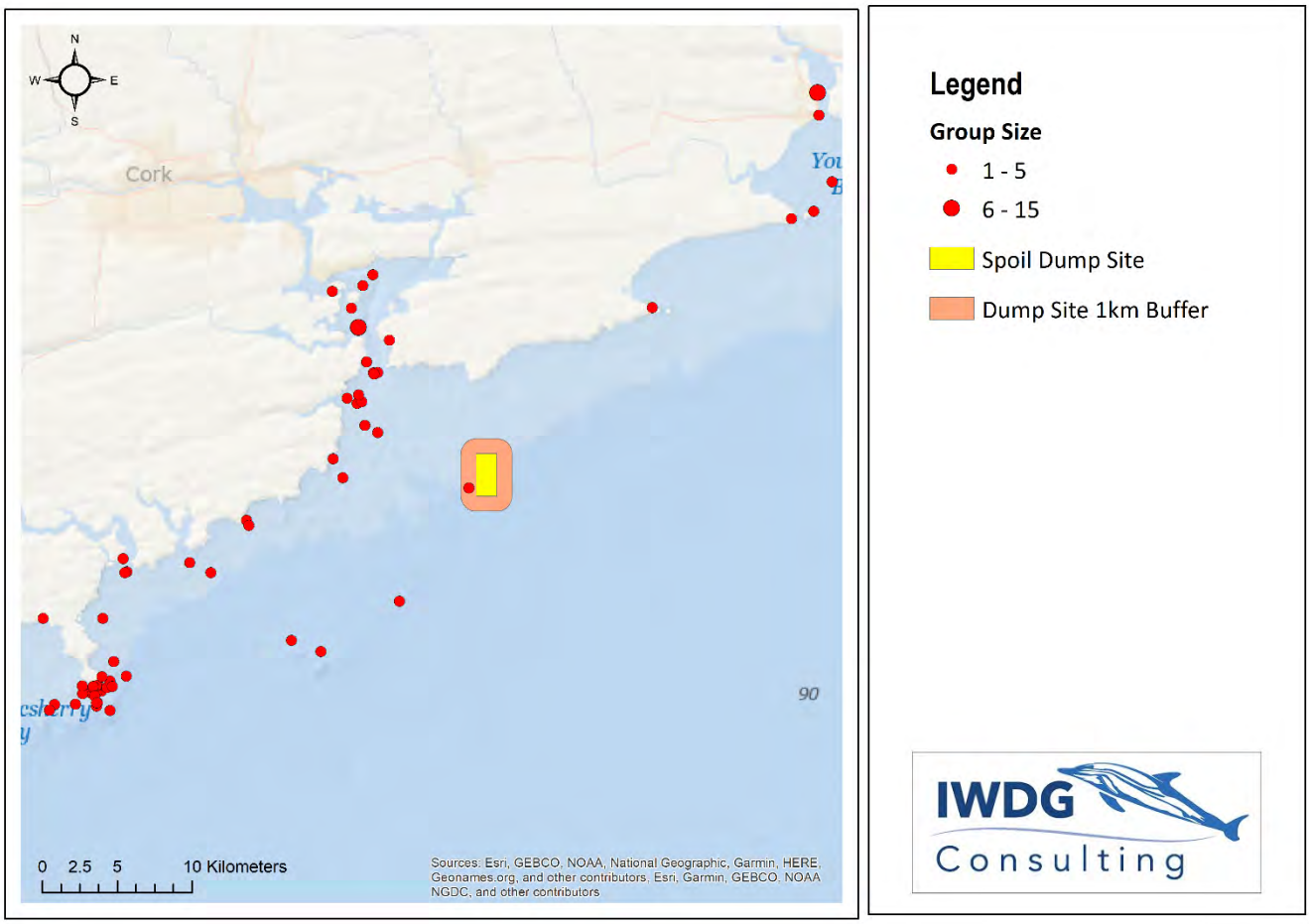

Figure 4: Sightings of Harbour Porpoise in Cork Harbour and adjacent waters. Spoil ground shown in yellow

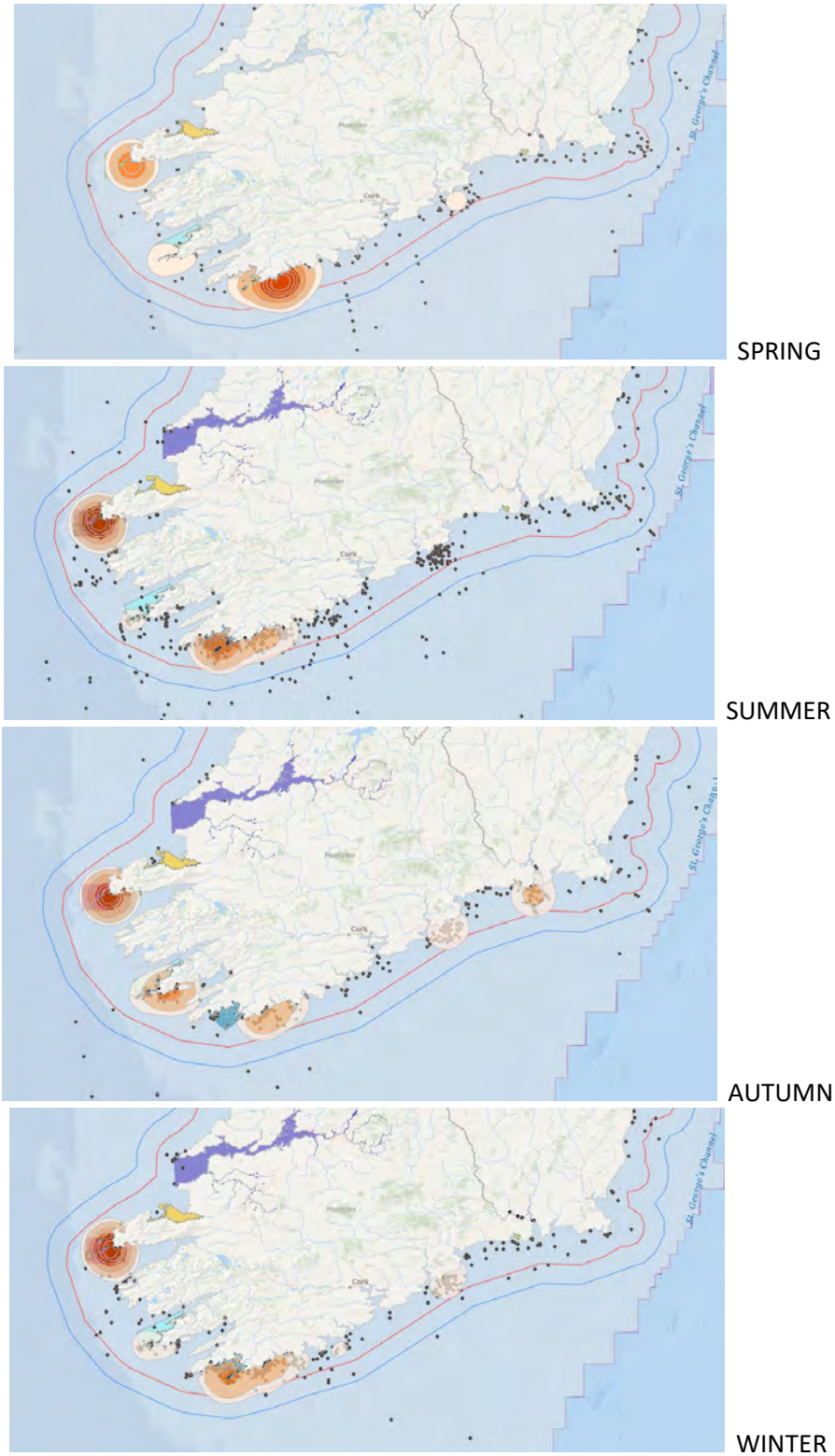

Figure 5: Sightings of Harbour porpoise along the south coast of Ireland by season from Keogh, H. 2020 (https://storymaps.arcgis.com/stories/189026d7e50f4abea635c37a0af6aeb0).

Data from the broader dataset show that although harbour porpoise are frequently observed along the south coast throughout the year (Figure 5) most sightings off Cork Harbour occur in the autumn. Densities are highest off the southwest tip in and adjacent to the Roaringwater Bay and Islands SAC. There is no evidence of large movements from this SAC to the area around Cork Harbour.

Common dolphin (Dephinus delphis)

Common dolphins occur frequently and at high densities off the Cork coast (Wall *et al.* 2013). They are frequently encountered in the area for most of the year (Figure 6) including in the inner harbor near the city, though these individuals frequently live strand and die. Abundance typically falls to a minimum during April and May but peaks in the vicinity of Cork Harbour during autumn and winter, coinciding with the presence of pelagic schooling fish in the area (Wall *et al.* 2013). Common dolphins are regularly recorded at the spoil grounds (Fig. 5). They are gregarious and commonly occur in group sizes of tens of animals. During the autumn and winter group sizes numbering many tens or even hundreds of animals are not uncommon off the Cork coast. They readily approach vessels and may bow ride for extended periods.

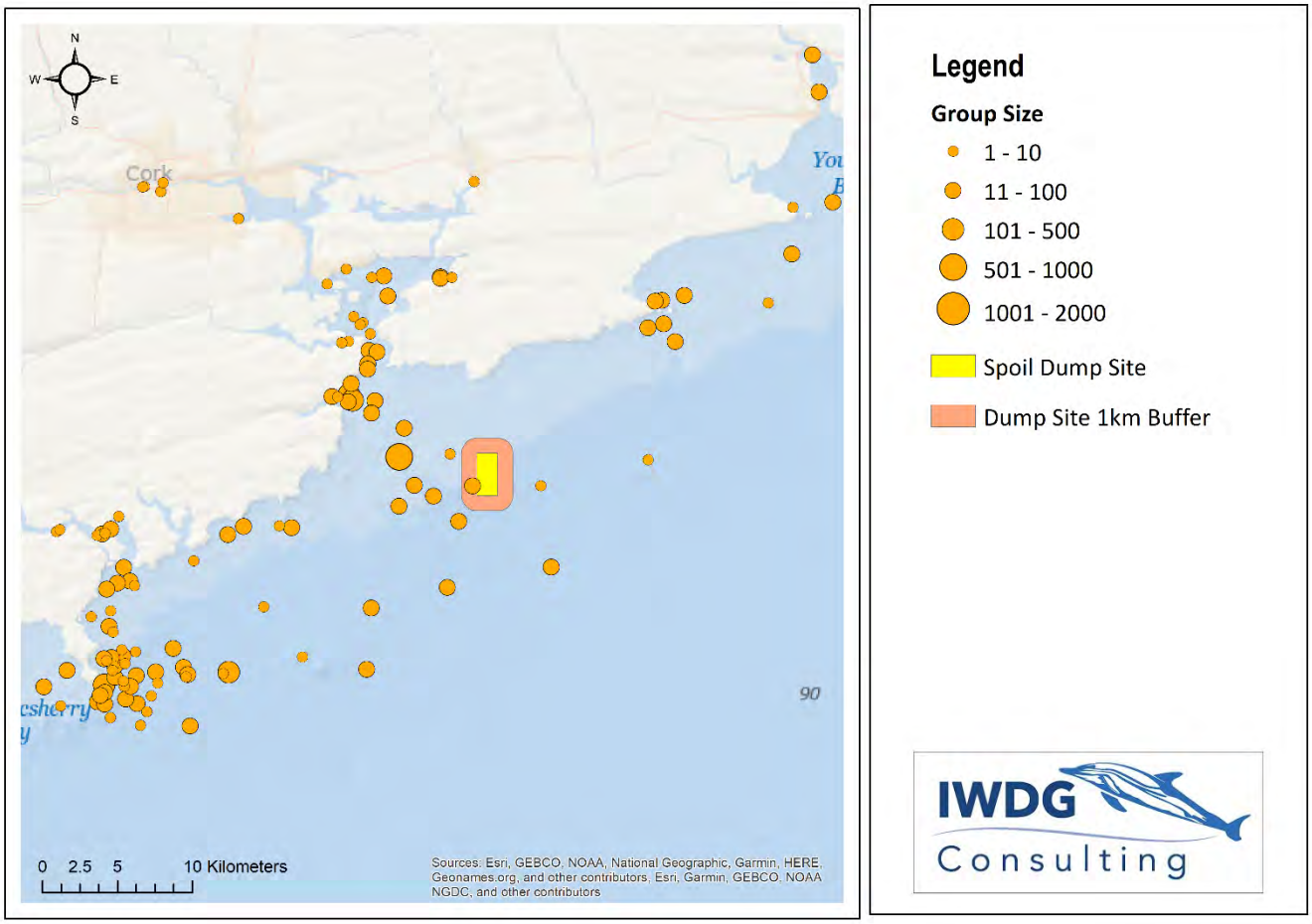

Figure 6: Sightings of Common Dolphin in Cork Harbour and adjacent waters. Spoil ground shown in yellow

Bottlenose dolphin (Tursiops truncatus)

Bottlenose dolphins occur off the Cork coast (Figure 7) but at relatively lower frequency than along the west coast (Berrow et al. 2010). Animals encountered inshore are likely to derive from a coastal population which range around the entire Irish coastline and to adjacent UK and mainland Europe coasts (O'Brien *et al.* 2009; Robinson *et al.* 2012). Many historic bottlenose dolphin sightings in the vicinity of Cork Harbour relate to a small pod of 6-7 bottlenose dolphins which were resident at the mouth of Harbour (Ryan *et al.* 2010). Although bottlenose dolphins are frequently recorded no sightings of this "resident" group have been reported since

May 2013. Sightings of non-resident dolphins are infrequent for most of the year but data from land-based effort watches indicate a peak in late autumn / early winter which may coincide with the presence of pelagic schooling fish in the area. Bottlenose dolphins are typically encountered in group sizes of 5 to 30 animals, larger group sizes have been recorded but predominantly in offshore areas. Inshore animals will readily approach vessels but are less likely to engage in extended periods of bow riding than common dolphins.

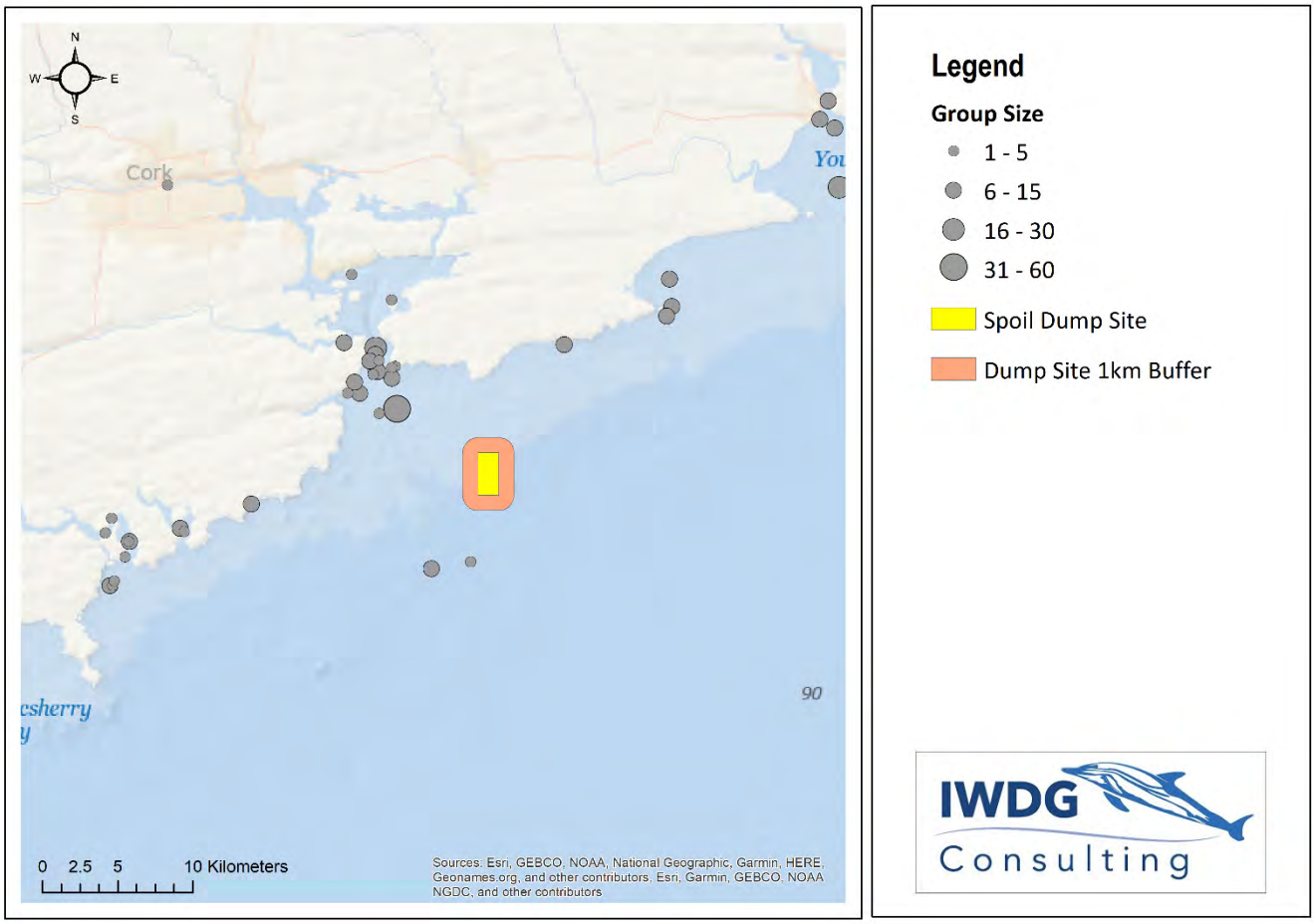

Figure 7: Sightings of Bottlenose Dolphin in Cork Harbour and adjacent waters. Spoil ground shown in yellow

Risso's dolphin (Grampus griseus)

Risso's dolphins are sighted occasionally at the entrance to Cork Harbour and adjacent waters. Risso's dolphins are not abundant in Irish waters but tend to be patchily distributed (Wall *et al.* 2013). There were only 3 Risso's dolphin sightings over the last 10 years in the area of interest.

Killer whale (Orca orcinus)

Killer whales are sighted occasionally sighted in waters adjacent to Cork Harbour. A group of three killer whales entered the harbour for six weeks in 2001 (Ryan and Wilson 2003) but this was exceptional. Most killer whales sighted in Ireland are the 'West Coast' killer whale community. Killer whales are typically encountered as individuals or in a small loose group of 2-10 animals. There were no killer whale sightings over the last 10 years in the area of interest.

Minke whale (Balaenoptera acutorostrata)

Minke whales occur frequently off the Cork coast and at the entrance to Cork Harbour, including on the spoil ground (Figure 8). They occur from late spring to early winter but are largely absent during winter and early spring (Berrow *et al. 2010*). Minke whale abundance in the vicinity of Cork Harbour peak in late summer and autumn, and coincide with the presence of pelagic schooling fish in the area (Wall *et al.* 2013). Minke whales were recorded off Roches Point during transit to the disposal site during dredging operations in 2014 and 2017 (Russell and Levesque, 2014; O'Dwyer 2017). Minke whales are typically encountered as individuals. In the late summer and autumn loose feeding aggregations of two to five animals may be encountered. They do not typically approach large vessels but can be quite inquisitive and may approach slow moving or static vessels.

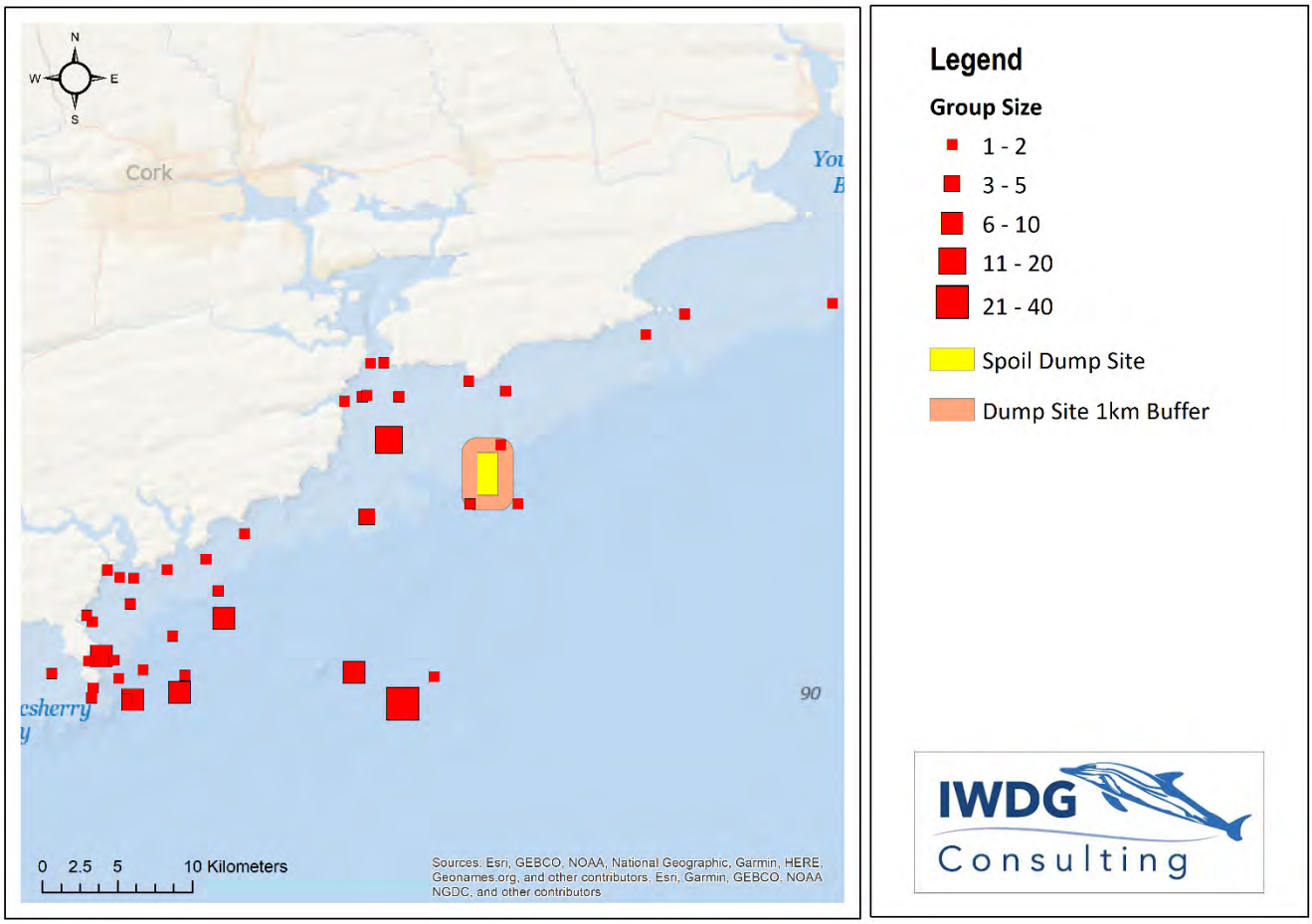

Figure 8: Sightings of Minke Whale in Cork Harbour and adjacent waters. Spoil ground shown in yellow

Fin whale (Balaenoptera physalus)

Fin whales regularly occur off the Cork coast (Whooley *et al.* 2011) and have been recorded at the entrance to Corrk Harbour and near the spoil ground (Figure 9). They occur from June to January but are largely absent from from February to May (Berrow *et al.* 2010). Fin whale abundance in the vicinity of Cork Harbour coincides with the presence of pelagic schooling fish (Wall *et al.* 2013). Fin whales were observed during dredging operations in 2014 (Russell and Levesque, 2014). Photo-identification studies indicate a significant degree of site fidelity by fin whales using these foraging grounds (Whooley *et al.* 2011). Fin whales are typically encountered as individuals or in small groups of 2-3 animals but during autumn and early winter loose feeding aggregations of up to 10 - 12 animals may be encountered. They do not typically approach large vessels.

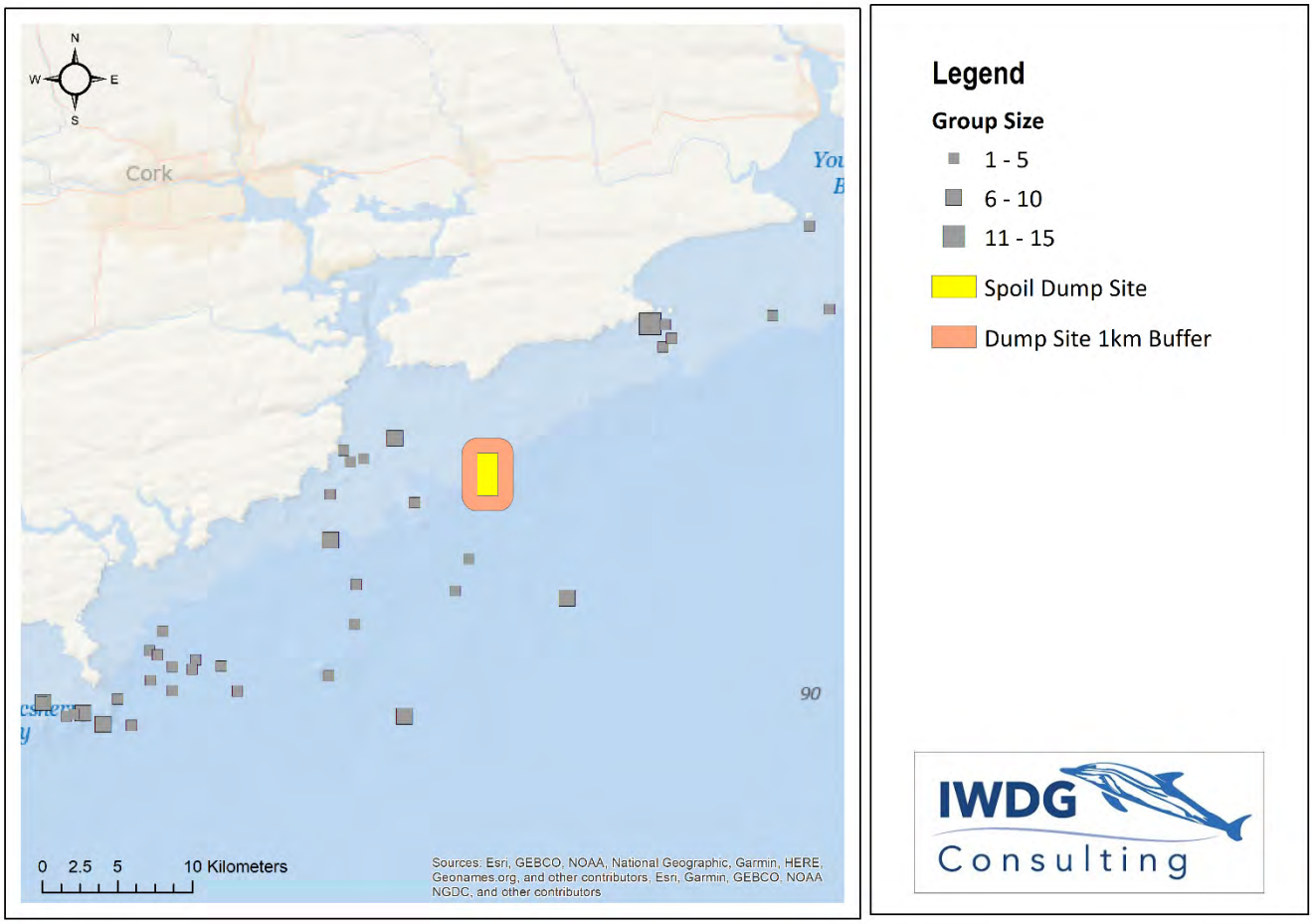

Figure 9: Sightings of Fin Whale in Cork Harbour and adjacent waters. Spoil ground shown in yellow

Humpback whale (Megaptera novaengliae)

Humpback whales occur regularly but in smaller numbers than fin whales off the Cork coast. They are recorded from June to January but are largely absent from February to May. Humpback whales occur in the vicinity of Cork Harbour peak in autumn and early winter (Figure 10), which coincides with the presence of pelagic schooling fish in the area (Wall *et al.* 2013). Photo-identification studies indicate a significant degree of site fidelity by humpback whales using these foraging grounds (Ryan *et al.* 20125). Recently Blásquez *et al.* (2023) estimated around around 154 ± 9humpback whales occurred in Irish coastal waters. Humpback whales are typically encountered as individuals or in pairs off the Cork coast. They do not readily approach large vessels but can be quite inquisitive and may approach slow moving or static vessels.

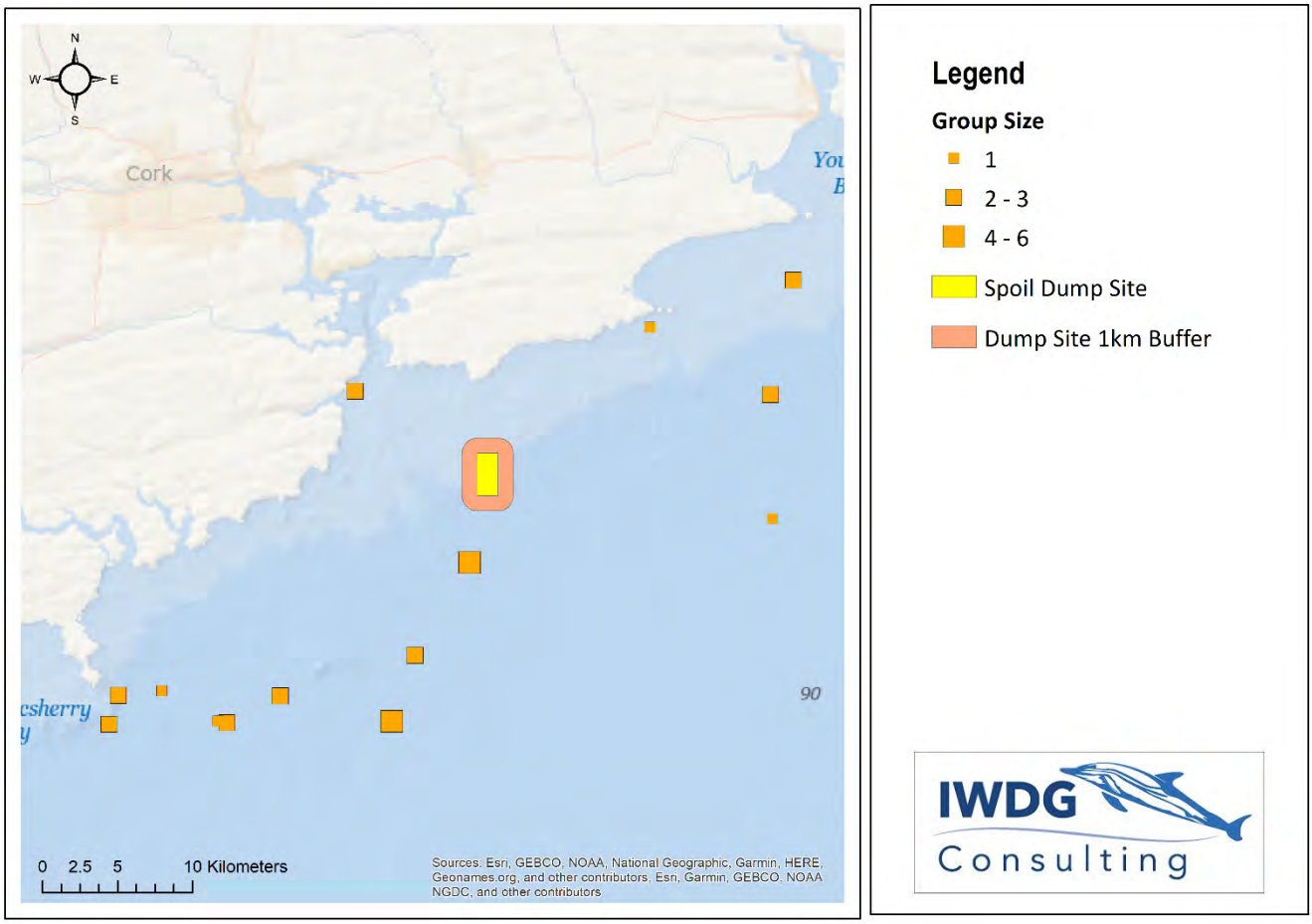

Figure 10: Sightings of Humpback Whale in Cork Harbour and adjacent waters. Spoil ground shown in yellow

Otter (Lutra lutra)

No site specific survey of otters was available but otters are widespread around Cork Harbour. Smiddy (1993) surveyed the east side of Cork Harbour and suggested it provided good habitat for otters. Reid *et al.* (2013) categorised Co Cork as having intermediate densities of otters (0.100/15 females per km^2) compared to other parts of Ireland. Otters were present in all 10km^2 blocks reported around Cork Harbour between 2007-2011 presented in Reid *et al.* (2013) (shown in Figure 11a, 11b). Coastal dwelling otters require access to a freshwater source as they must regularly cleanse their fur of salt as this can affect its insulating properties and therefore their territorial range will be directed by access to freshwater. In Ireland, the territory of female otters is 6.5 ± 1.0km in coastal environments (de Jongh et al. 2010) and for males it may be a larger extent, where for both females and males a total width of coastal water body would be 80m (NPWS, *Lutra lutra* (1355) Conservation Status Assessment Report). Underwater, hearing sensitivity is significantly reduced compared to pinniped species, demonstrating that otter hearing is primarily adapted to receive airborne sounds (Ghoul et al., 2014).

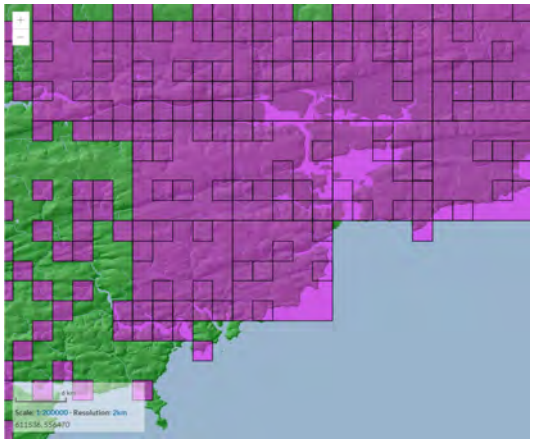

Figure 11a: Map of otter distribution around Cork Harbour (courtesy of the National Biodiversity Data Centre).

Figure 11b: Map of otter distribution around Cork Harbour (from Reid *et al*. 2013).

4.3 | Marine turtles

Five species of marine turtle have been recorded in Irish waters (King and Berrow 2009; Botterell *et al*. 2020) including: Leatherback (or Leathery) turtle (*Dermochelys coriacea)*, loggerhead (*Caretta caret*ta), Kemps Ridley (*Lepidochelys kempii*), Hawksbill (*Eretmochelys imbricata*) and green turtle (*Chelonia mydas*). Hawksbill and Green are very rare. Records of hard-shell turtles stranded in the UK , including loggerhead turtles and Kemp's ridley turtles, have significantly increased over the last 100 years but with a notable decrease in records in the most recent years. The majority of records of hard-shell turtles were juveniles and occurred in the boreal winter months when the waters are coolest in the North-east Atlantic. In contrast to hard-shell turtles, leatherback turtles were most commonly recorded in the boreal summer months with the majority of strandings being adult sized, of which there has been a recent decrease in annual records (Botterell *et al*. 2020). All five species of marine turtles reported in Ireland are listed on Annex IV of the EU Habitats Directive.

4.3.1 Leatherback turtle

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

4.3.2 Loggerhead turtle

Loggerhead turtles are stranded regularly in Ireland with records reported once every few years (King and Berrow, 2009: Marine Environmental Monitoring annual reports). They are very rarely sighted alive in Irish waters. Attempts to rehabilitate individual stranded loggerhead turtles have been successfully on a number of occasions. Loggerhead turtles have also been recorded off Cork Harbour but are very rare (King and Berrow 2009).

4.4 | Pinnipeds

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

Grey Seal (Halichoerus grypus)

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

Harbour or Common Seal (Phoca vitulina)

There were no harbour seal haul-out sites or breeding sites recorded within Cork Harbour during National Parks and Wildlife Service (NPWS) surveys (Cronin *et al.* 2004; Morris and Duck 2019). A small number of harbour seals (six) were recorded hauled out at Kinsale harbour, to the west (Cronin *et al.* 2004). Harbour seals are much less frequently recorded within Cork Harbour and at the dump site but have been recorded at both locations and along the shipping channel. Harbour seals pup in June-July and the moulting period occurs after breeding, starting in June and ending in November, with a peak in mid-September (Cronin et al. 2014).

5 | IMPACT ASSESSMENT

The potential effects of dredging and dumping on marine mammals was addressed by assessing the likelihood that marine mammals would be exposed, or interact, with the activity. Impacts assessed include likelihood of collision, dumping of dredge material on top of individuals and disturbance especially from noise emitted during dredging and dumping and from the dredge vessel. Acoustic disturbance includes the ability of the individual to detect increased noise levels over ambient levels, masking, Temporary Threshold Shift (TTS) and Permanente Threshold Shift (PTS) and behavioural impacts, i.e. resulting in a behavioural change by individuals. The potential effects of increased turbidity and indirect impacts on preferred prey are also considered.

5.1 | Description of Activities

5.1.1 Dredging Operations

Total Volume

The total volume to be dredged in 423,217 cubic metres, with a maximum of c.29,376 dry tonnes per day. No dumping will occur in either November or February.

Dredging operations

Dredging will be carried out by a Trailing Suction Hopper Dredging supported by Bed Levelling and/or mechanical dredging. The dredge areas are illustrated in Figure 1 above, with dredge tracks shown in Figure 4.1 of the Sediment Plume Dispersion Assessment report. Both the dredge areas at Ringaskiddy and the dump site are shown in Figure 12.

A Trailing Suction Hopper Dredger is a vessel that is suited for deep-sea navigation with the ability to load material into its own hopper by means of centrifugal pump(s) and suction pipe(s). Trailing Suction Hopper Dredgers belong to the type of nonstationary dredgers. This means that TSHD are required to sail during dredging operations. This is where the dredging vessel drags a pipe on the river bed and material is sucked up into the hold of the vessel. The material settles in the hold and excess water from the suction operation is returned to the sea as the hold reaches capacity. Once the hold is full the vessel proceeds to the approved spoil dump site and discharges the material through bottom doors in her hull that open to release the hold contents. The vessel continuously passes over the area to the dredged gradually increasing the depths to the required levels. This method of dredging in addition to the various mechanical dredging techniques also described in Section 1 have been employed by the Port of Cork for previous dredging campaigns at this site.

The dredge material will be removed from the two identified areas in Ringaskiddy. TSHD trails its suction pipe when working, and loads the dredge spoil into one or more hoppers in the vessel. When the hoppers are full, the TSHD sails to a disposal area and either dumps the material through doors in the hull or pumps the material out of the hoppers. The TSHD's to be used in the present operation are 97-128m in length and with a capacity of up to 8,000 m^3 of dredged material. The suction pipe diameter are 0.90-1.10 m. The dredging operation can be carried out during fair weather. Limiting sea states for dredging are defined as significant wave height of approximately 2.5 m and wind speeds of approximately Beaufort Force 6.

Previous studies on sound production by TSHDs in silt/mud substrates have found that maximum source levels from the various activities associated with TSHD dredging (including the dredging process, transit to dump site, placement, pumping and rainbowing) to be very similar with dredging itself and not producing sounds louder than those produced by the dredger during transit (de Jong *et al.* 2010). This study was carried out on the sound production by seven TSHDs during construction of a 2,000 hectare harbour extension of the Port of Rotterdam. More recently, Robinson *et al*. (2011), found that emitted sound levels from TSHDs at frequencies below 500 Hz were similar to a deep-draft draught cargo ship travelling at a moderate speed.

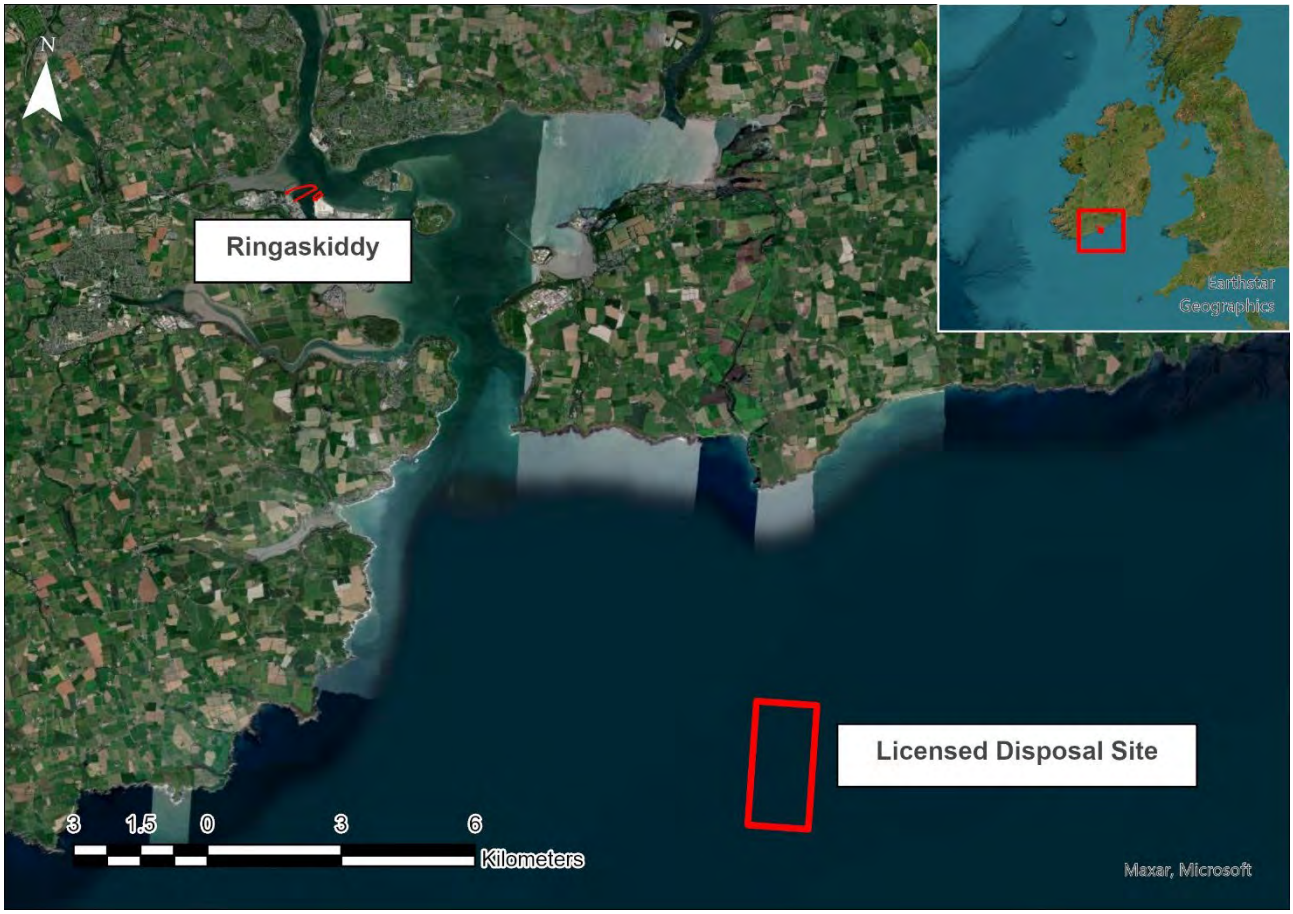

Figure 12: The location of the existing licenced offshore dump site at Burford Bank

5.1.2 Dumping

Dumping will be carried out from the dredge vessel in the prescribed dump site, around 8km south of Roches Point (refer Figure 12). This site has been used for many years with an estimated 7 million tonnes of dredged material dumped over the last 35 years. The dumpsite will be divided into subsections with each used sequentially to ensure uniform spread of the dredged sediments. The vessel will take around 1-2 hours to transit to the site, and a similar time to return to the dredge site. An indicative vessel is illustrated in Figure 13. During dumping the TSHD will sail at between 0-3 knots depending on sea conditions, dredged material, etc. When the TSHD/barge is positioned in the correct position the bottom valves are opened and all material is discharged from the hopper in a very controlled short period taking only a few minutes.

Dumping will be limited to c.29,376 dry tonnes per day, and no dumping will occur at the same time as the Port of Cork's current maintenance dredging DAS Permit (S0013-03). The dumpsite will be divided into subsections with each used sequentially to ensure uniform spread of the dredged sediments.

Figure 13: TSH dredger (Taccola) used during the POCC maintenance dredging campaign 2020.
Photo: Andrew Shine/IWDG

5.1.3 Vessel noise

The TSHD once filled with dredged material will transit to the disposal site. It will take around 5-6 hours for a round trip back to the loading area. This increase in vessel noise relative to the daily traffic accessing Cork Harbour is very low and is unlikely to cause any significant disturbance as other vessels regularly use this area.

5.1.4. Turbidity

Seabed disturbance through extraction, rejection, and disposal of sediments, along with outwash of excess materials, can result in increased turbidity and creation of sediment plumes. Sediment plumes have the ability to extend the impact of dredging over larger areas that would otherwise remain unaffected (Todd *et al.* 2014). Marine mammals often inhabit turbid environments and many utilize acoustic techniques to communicate and navigate.

5.1.5 Indirect impacts on prey

Indirect impacts may occur on marine mammals and otters if the distribution or abundance of their preferred prey is impacted by dredging and disposal activities.

5.2 | Literature Review of Impacts

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).

5.2.1 Dredging Impacts

Todd *et al.* (2015) provide 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. Robinson *et al.* (2011) measured noise levels of six TSHDs, stating that operating dredgers are similar in noise level to that of merchant vessels, and that the primary source of noise is produced as material passes through the drag head, suction pipe and pump. Previous studies on sound production by TSHDs in silt/mud substrates have found that maximum source levels from different activities (loading, transit, direct dumping, rainbowing or pumping ashore) associated with TSHD dredging did not produce louder sounds than the dredger during transit (De Jong *et al.* 2010). Dredging by mechanical methods will not result in any underwater noise levels of a greater magnitude than THSD methods.

Baleen whales

Of the baleen whales in Irish waters, minke and fin whales are potentially exposed to dredge disposal activity and to a lesser extent humpback whales which have occasionally been recorded adjacent to the disposal site. Richardson *et al.* (1995) reported on a controlled exposure experiment on Bowhead whales which received broadband levels of <113 – 131 dB re 1 µPa (<11 – 30 dB above ambient) from a suction dredger which lead to weak and inconspicuous avoidance, however he considered the low frequency components were under-represented. Off the southeast coast of the US Northern Right whales exposed to intensive dredging by noisy hopper dredges apparently show some tolerance of this noise (cited in Richardson *et al.* 1995). The best documented case of long-term change by baleen whales is from Baja California where Gray whales breeding in lagoons subjected to industrial activities, including dredging were virtually absent during years with shipping which led to the suggestion that the constant dredging may have been the main source of disturbance (cited in Richardson *et al.* 1995).

Odontocetes

The effects of dredging on dolphins and porpoise have been poorly studied. Belugas showed less reaction to stationary dredges than moving barges in the Mackenzie estuary, Canada and it was concluded that passage of belugas along a shoreline was temporarily blocked by a dredging operation involving frequent barge traffic but not by a dredging operation with little barge traffic (cited in Richardson *et al.* 1995).

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 effecting the dolphins prey within this prey patch.

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 really 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).

Seals

Although there are fewer studies on pinnipeds or odontocetes these animals do tolerate considerable noise from such sources (Richardson *et al.* 1995). Elevated noise from dredging could also affect seals which are sensitive to a lower frequency range (Todd *et al.* 2015). Todd *et al.* (2015) reported on observations of dredging operations in Geraldton, Western Australia between 2002 and 2003, reported that New Zealand fur seals and Australian sea lions showed no sign of disturbance reactions, despite the relative closeness of dredging to popular haul-out sights. Similarly, Hawaiian monk seals showed no adverse reactions to bucket dredgers around Tern Island. Anderwald *et al.* (2013) found that grey seals showed some level of avoidance to high construction vessel traffic in Ireland, although it should be noted that observations were undertaken from a cliff, so animals possibly taking advantage of increased food close to operating dredgers may have been missed by observers.

Despite these references to the potential effects of dredging on marine mammals there is little consideration of the impact of the actual dumping of dredge material as opposed to removal of material from the site to be dredged. This is either an oversight, or more likely reflects the extremely low impact of the dumping of dredged material on marine mammals, compared to the effects of dredging, which are considered low down the spectrum of impacts of coastal activities on marine mammals. OSPAR (2008) suggested that the dumping of dredge materials are largely irrelevant with respect to environmental impact and the issue are confined to disturbance due to underwater noise emission during the dumping process and during the transport (ship noise).

Leatherback turtle

Hopper dredges have been shown to have a significant impact on turtles at breeding sites (Goldberg *et al.* 2015) but there has been no work assessing risk at high latitude feeding areas such as Ireland. Leatherback turtles hear in the very low frequency range (50-1,200Hz) (Southall *et al.* 2007 and cited in NPWS, 2014). With this low frequency range leatherback turtle are only susceptible to the noise from shipping.

Otter

Otter also hear in the low frequency range but are less sensitive than other marine mammals. Otters would need to be in the marine waters to be exposed to noise from dredging activity.

5.2.2 Turbidity

A review of the turbidity generated in open water dredge spoil disposal sites (Truitt 1988) showed that significantly elevated turbidity levels are generally confined to the lower 15-20% of the water column depth, declining by orders of magnitude toward the surface. Turbidity levels at all depths decline rapidly, approaching background levels within a matter of minutes to tens of minutes, with the bottom levels declining slowest.

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 Newby *et al.* (1970) reported apparent blindness in three harbour seals on Gertrude Island, Puget Sound, Washington and found them to appear healthy suggesting their ability to forage was unaffected by blindness. McConnell *et al.* (1999) tracked grey seals in the North Sea and included one blind seal in their

study. No significant difference in foraging behaviour was found indicating vision is not essential to pinnipeds' survival or ability to forage.

5.3 | Risk Assessment

The total volume to be dredged is 423,217 cubic metres, with a maximum of c.29,376 dry tonnes per day. No dumping will occur in either November or February as this coincides with the herring spawning seasons off Cork Harbour. The dump site is off Roches Point and has been used for decades by the Port of Cork. There are no Special Areas of Conservation which include marine mammals as qualifying interests adjacent to the dredging sites or disposal site but given the highly mobile nature of marine mammals we have considered relevant SACs within 150 km of the dredging and dumping activities. The dumpsite will be divided into subsections with each used sequentially to ensure uniform spread of the dredged sediments.

5.3.1 Acoustic disturbance

Noise associated with dredging

The potential for disturbance to marine mammals is greatest when elevated levels of underwater noise are considered. Marine mammals, especially cetaceans, have well developed acoustic capabilities and are sensitive to sound at much higher frequencies than humans (Richardson *et al.* 1995). They are less sensitive to the lower frequencies but there is still great uncertainty over the effects of sound pressure levels on marine mammals and thus the assessment of its impact. Sources of noise include that generated 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). Hopper dredges produced broadband sound between 20-1000 Hz and the highest levels occurred during loading. 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). They found that if the Sound Exposure Level was kept constant significant shifts were induced by longer duration exposures but not for shorter exposures. Otters are sensitive to low frequencies ranges would need to be in the marine waters to be exposed to noise associated with dredging activity.

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. Dredging is thus defined as "*the excavation of sand, gravel, loose rock and other material from the seabed*". Dredging is considered to include both the excavation and dumping of the material as the same operation.

McKeown (2016) carried out underwater noise measurements during a 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 has 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 SPLRMS and 140 dB re 1µPa² s SEL. Noise levels were below the NOAA general behavioural threshold for marine mammals of 160 dB re 1 µPa SPLRMS (McKeown 2016).

5.3.2 Noise associated with shipping

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.

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. A similar exposure level solicited minor changes in orientation behaviour and locomotion changes in minke whales (Palka and Hammond 2001). Harbour porpoise are frequently observed near vessels but tend to change behaviour and move away and this avoidance may occur up to 1-1.5km from a ship but is stronger with 400m (cited from Richardson *et al.* 1995). Seals show considerable tolerance to vessel activity but this does not exclude the possibility that it has an effect. Leatherback turtles would not be considered tolerant to vessels of any size and typically avoid vessels if approached but could be effected by shipping noise if close to the vessel.

5.3.3 Disturbance during transit

The presence of a dredger in the harbour will lead to increased vessel traffic and associated noise. Large vessels produce low frequency sounds and TSHD vessels and split hopper barges are large vessels. However given the busy nature of Cork Harbour and shipping lane and the level ambient noise already experienced at this site (Sutton *et al.* 2014) the presence of an additional vessel and associated noise, is extremely unlikely to be significant. The increased noise above ambient levels generated by the dump vessel will be of relatively short duration (maximum of 3-4 weeks per annum).

5.3.4 Disturbance during disposal of dredged material

The disposal site has been routinely used for the dumping of dredged material, with approximately eight million tonnes of material dumped at this site between 1997 and 2012 at an average rate of around 550,000 m^3 per annum. The total volume to be dredged is 423,217 cubic meters, with a maximum of c.29,376 dry tonnes per day. No dumping will occur in either November or February. Increased noise is restricted to <100m from dredging operations during disposal (McKeown 2016), thus increased sound pressure associated with spoil disposal will be above ambient noise levels off Roches Point within a very small area (radius <100m).

Marine mammals are tolerant of shipping noise, being repeatedly exposed to many vessels, small and large. Pinnipeds also exhibit much tolerance and often haul out on man-made structures where there is considerable human activity. 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). Thus dredging seems to have less effect on marine mammals than moving sound sources although avoidance behaviour of whales exposed to high levels of activity have been documented. Reactions, when measured have only occurred when received sound levels are well above ambient levels. Leatherback turtles are likely to be disturbed by disposal activities if in the vicinity and are not accommodated to vessel traffic. The likelihood of marine turtles being in the area during disposal at sea is extremely low.

5.3.5 Physical Disturbance

The risk of injury or mortality is considered extremely low as marine mammals are exposed to considerable vessel traffic on a daily basis and would be aware of their presence. The dredge vessel is slow moving and not able to turn quickly thus any animals 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 a marine mammal is extremely unlikely. The duration of the release of dredged material last around 1-2 minutes and the vessel slows down during spoil release. The risk of injury or mortality to marine turtles is considered extremely low as unlikely to be in the area during disposal.

5.3.6 Collision Risk

Collisions are unlikely due to the slow speed of the TSHD/barge. Dredging is unlikely to cause damage to marine mammal auditory systems, but masking and behavioural changes are possible (Todd *et al.* 2015). Sediment disturbance and any increases in turbidity are unlikely to affect marine mammals that use echolocation, or pinnipeds since research indicates that vision is not essential to pinnipeds' survival or ability to forage (McConnell *et al.* 1999). Grey seals approached the TSHD after commencement of loading operations during previous dredging campaigns by the POCC which did not appear to cause any disturbance to them (Russell and Levesque, 2014). The seals came very close to the TSHD to investigate on a number of occasions, possibly using it as a feeding opportunity. Leatherback turtles could be a collision risk but the likelihood of marine turtles being in the area during disposal at sea is extremely low.

5.3.7 Indirect impacts on preferred prey

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

5.3.8 Potential disturbance to life-cycle

The dumping of dredged material will not cause any adverse effects on cetaceans or seals in the area providing mitigation measures are in place but may affect prey availability. Small shoaling fish that occur regularly in the diet of seals and small cetaceans and are likely to be affected during operations. Any displacement resulting from indirect impacts on available prey will be short-term and local, with fish returning to the area at the completion of dumping activity.

Increased turbidity will result from dumping spoil within the dump site. Increased turbidity is unlikely to have a direct effect of marine mammals but may have an indirect effect through impacts on prey (Todd *et al.* 2015). There is limited evidence for an effect of increased turbidity on marine mammals. Harbour porpoise use echolocation to navigate and locate prey and thus would not be affected by increased turbidity. Even when increased turbidity has been shown to substantially reduce visual acuity in seals, which are not known to use sonar for prey detection, there is no evidence of reduced foraging efficiency (Todd *et al.* 2015).

5.3.9 Cumulative Effects

There is no significant dredging planned or already licensed in and around Cork Harbour other than that presented in this Annex IV assessment. No dumping will occur at the same time as the Port of Cork's maintenance dredging permitted under DAS Permit S0013-03. Other pressures likely to contribution to cumulative impacts include shipping.

Shipping

Most identified potential impacts relate to disturbance from increased noise associated with dredging and additional vessels working in the harbour. Cork Harbour is a busy shipping area Port of Cork reported an increase of over 21% in 2022 as a result of growth in port traffic. This will contribute to increased ambient

noise levels in the harbour. In this context the activities of an additional dredger will not significantly impact on ambient noise.

Aquaculture

Aquaculture operations in Cork Harbour are largely restricted to oyster farming, with no mussel dredging currently under operation (MI 2020). There are a total of seven aquaculture sites considered, covering a total area of 314 ha, within Cork Harbour (Figure 14). Five of the sites are small oyster trestle sites (combined area of 19 ha). The small scale of the oyster trestle cultivation activity and the location of three of the five sites in areas of the harbour mean that no significant displacement impacts on birds, including waders, waterfowl and seabirds are likely to occur.

Birds are far more sensitive to above water disturbance than marine mammals and other Annex IV species and thus current aquaculture operations within Cork Harbour will contribute very little to potential cumulative effects.

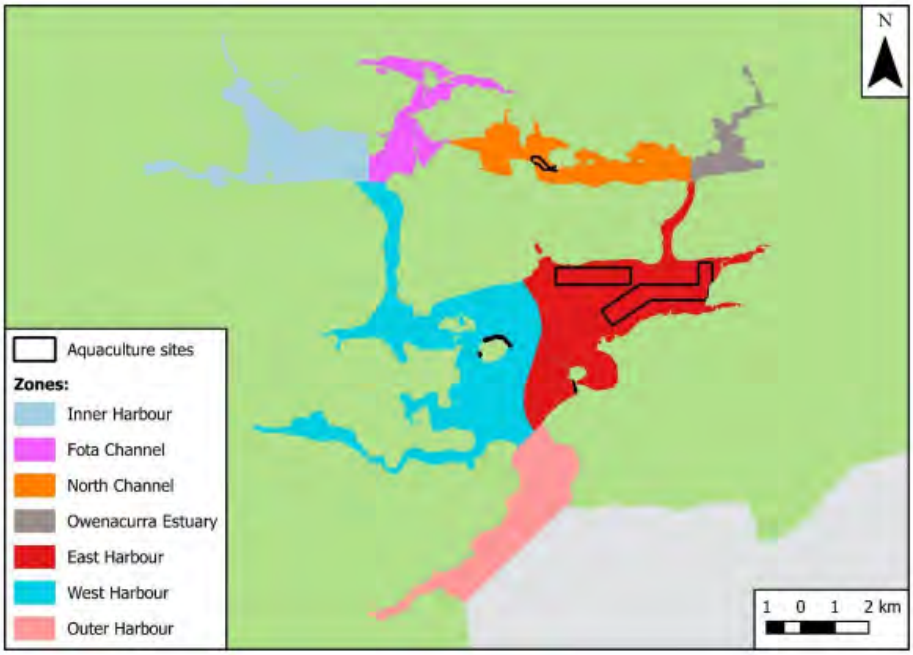

Figure 14: Aquaculture sites in Cork Harbour (from MI (2020)

5.3.10 Identification of Relevant Natura 2000 sites with marine mammals as a qualifying interest

Marine mammals are highly mobile and range far outside those sites designated to protect them. There are three SAC with marine mammals as qualifying interests along the south coast (Table 3).

Table 3. SACs which list marine mammals as a Qualifying Interest, with foraging range of Cork Harbour

Site	Qualifying Interest			Closest distance to Loading or Dumping Site	
	Grey seal	Harbour seal	Harbour porpoise	nmls	km
Roaringwater Bay and Islands SAC (Site Code 000101)	X		X	50	90

Saltee Islands SAC (Site Code 000707)	X			58	107
Slaney River Valley SAC (Site Code 000781)		X		90	166

Three SACs with marine mammals as qualifying interests are presented in Table 3. None occur within 50nmls of Ringaskiddy Basin or the proposed Dump Site and the Slaney River Valley SAC is >150km from the site. This site list harbour seals as a qualifying interest and as this species feeding range is typically a maximum of 20km (Cronin *et al.* 2009) this site will not be affected and is excluded.

The Saltees Islands SAC off Co Wexford and Roaringwater Bay and Islands SAC are an important breeding site for grey seals and seals from this site could forage as far west as Cork Harbour during the pup rearing period. Roaringwater Bay and Islands SAC is also designated for harbour porpoise and certainly porpoise using this SAC are part of a wider population that also occur off Cork Harbour. The Conservation Objectives of these two SACs in relation to grey seals (NPWs 2011a; 2011b) are to maintain their favourable conservation condition which is defined by a number of attributes and targets:

Access to suitable habitat:

i) Species range within the site should not be restricted by artificial barriers to site use.

Breeding behaviour

ii) The breeding sites should be maintained in a natural condition.

Moulting behaviour

iii) The moult haul-out sites should be maintained in a natural condition.

Resting behaviour

iv) The resting haul-out sites should be maintained in a natural condition.

Population composition

v) The grey seal population occurring within this site should contain adult, juvenile and pup cohorts annually

Disturbance Level of impact

vi) Human activities should occur at levels that do not adversely affect the grey seal population

The only attribute which could potentially be impacted is attribute vi) disturbance. It is extremely unlikely that any disturbance associated with dredging or disposal of spoil would lead to any likely significant effects and thus this conservation objective will not be not compromised.

Regarding the conservation objectives for harbour porpoise within the Roaringwater Bay and Islands SAC only attributes i) and vi) apply (NPWS 2011b). No artificial barriers will be created and disturbance, if it occurs at all will be temporary and very local and have no significant effect on harbour porpoise or the conservation objectives of the Roaringwater Bay and Islands SAC.

5.3.11 NPWS Assessment Criteria

1. Do individuals or populations of marine mammal species occur within the proposed area?

Grey seals are the most frequently observed marine mammal species at the dredging sites followed by Harbour porpoise and common dolphin at the disposal site. Bottlenose dolphins also in and at the mouth of Cork Harbour and minke and fin whale in the wider area. No moulting sites for grey or harbor seals occur in Cork Harbour. All marine mammals are part of a larger population and are very mobile. Otters are likely to occur adjacent to the site while marine turtles are extremely rare.

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

The project will not cause injury or death but could lead to very local, temporary disturbance, from noise associated with the project.

Noise Impact

The activities proposed during this project consist of dredging and dumping operations. It is extremely unlikely any noise generated will be capable of causing permanent or temporary hearing injury to a marine mammal. Localised disturbance to marine mammals in the works area may occur during operations, but current evidence from recent dredging operations suggests no disturbance occurs and indeed dredging may provide increased foraging opportunities for grey seals.

Physical Impact

The risk of injury or mortality is considered low as marine mammals in the in the immediate vicinity of the site are exposed to human activity on a daily basis and would be accommodated. The dump vessel is slow moving and thus any animals in the area would have sufficient time to avoid any collisions and thus injury or mortality.

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

No abundance estimates for marine mammals exposed to the proposed activity are available but the numbers in the harbour are generally low. Seals occur in low numbers within the harbour and counts at breeding and moulting sites are available at sites >50km from Cork Harbour. Cetaceans occur in small numbers in the harbour but in greater numbers at the disposal site but no robust density estimates for the site are available. The numbers of all marine mammals present at the disposal site and exposed to elevated noise levels are likely to be in the low 10s. Otters are likely to be only single individuals or in the very unlikely event dredging occurs near an active holt a family (<5 individuals).

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

The proposed work will be carried out in months excluding November and February. This includes the peak pupping and moulting periods for both grey and harbour seals. As there are no known pupping or moulting sites within or adjacent to Cork Harbour seals it will have no effect. Cetaceans occurring within Cork Harbour can be sporadic but some species such as bottlenose dolphins may occur more during summer months. Other species such as harbour porpoise and common dolphin occur throughout the year at the site though abundance may peak during autumn. Harbour porpoise and common dolphin adults with calves have been recorded at the disposal site during summer and autumn months. Potentially if otters occur near the dredge site or in the very unlikely event dredging occurs near an active holt.

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 particular gender or age group for seals or cetaceans predominates in the area suggesting dredging and dumping site are likely to expose all age groups and both gender. Similarly for harbour porpoise and common dolphin both adults and juveniles have been recorded at the disposal site and adults with calves during summer months.

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

As a small number of grey seals regularly occur at the dredging sites there may be temporary disturbance to some individuals. However, they are accommodated to human activities and are likely to not be affected, indeed there is some evidence dredging may provide foraging opportunities for seals. At the disposal sites, while a range of cetacean species may occur throughout the year and during important feeding times (e.g. autumn for fin whales), the disposal of spoil at the spoil ground is extremely unlikely to lead to any significant disturbance. Potentially in the very unlikely event dredging occurs near an active holt or with foraging occurring offshore.

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

While there may be temporary disturbance of marine mammals in the area, they are accommodated to human activities and are likely to recover from any temporary disturbance within hours or days.

6 | MITIGATION MEASURES

Potential mitigation measures during the dumping operation are limited. Similar activities 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. However, this mitigation measure will only be effective during daylight hours and in favorable weather conditions. Mitigation measures proposed by POCC in the DAS application include:

- A full record of loading and dumping tracks and record of the material being dumped will be maintained for each trip;
- No over-spilling (overflowing) from the dredger(s) will be permitted;
- Dumping will be carried out through the vessel's hull;
- No dumping will occur in either November or February;
- Dumping will be limited to c.29,376 dry tonnes per day;
- No dumping will occur at the same time as the Port of Cork's maintenance dredging;
- The dumpsite will be divided into subsections with each used sequentially to ensure uniform spread of the dredged sediments;
- A Marine Mammal Observer will witness all the work in line with the Annex IV Species Risk Assessment;
- Water Quality monitoring of the loading areas will be undertaken at locations to be agreed with the EPA;
- A documented Accident Prevention Procedure will be put in place prior to commencement; and
- A documented Emergency Response Procedure will be put in place prior to commencement

The National Parks and Wildlife Service recommend a distance of 500m radial distance of the dredging sound source in water depths of <200m (NPWS 2014) on commencement. Noise measurements by McKeown (2016) suggests an exclusion zone of 100m from dredging and disposal activities is sufficient, beyond which marine mammals are unlikely to detect the activity over ambient noise. If a significant negative change in behaviour is recorded such as rapid movement away from vessel or distress then the MMO should have the authority to cease operations. This mitigation should also be used to ensure no otters are present at the dredging sites prior to start-up.

It is expected that animals would habituate to vessels during dredging and dumping, and would return to foraging in the affected areas when operations area completed. However, given the volumes of material to be dumped, and the long time-scale of these operations, mitigation measures to reduce and avoid the potential

impact of dredging and dumping on harbour porpoise (and other marine mammals) are recommended. Whittock *et al.* (2017) showed implementation of mitigation zones through the use of MMOs was effective at minimising impacts on marine turtles.

6.1 Disturbance

The most effective way of mitigating the potential effects of disturbance is through the provision of an MMO ensuring no marine mammals, otters or marine turtles are present within an agreed buffer zone.

6.2 Collision, injury and mortality

The most effective way of mitigating the potential effects of collision, injury and mortality is through the provision of an MMO ensuring no marine mammals are present within an agreed mitigation zone.

6.3 Disruption of normal behaviour

Dredging activity is of short duration and displacement will be short term. Provision of MMOs during dredging will provide opportunities to record sightings of marine mammal during dredging, on transit and while disposing at the spoil ground. While sound exposure levels from such operations are below that able to cause injury to a marine mammal, disturbance, from the noise generated by dredging, from the physical presence of the dredger, and possibly have the potential to cause low level disturbance, masking or behavioural impacts. The presence of an additional vessel and the associated noise produced, is very unlikely to have any significant impact on marine mammals, though it may lead to short term displacement of seals from the dump site.

6.4 Proposed Measures

Timing of Dredging and Disposal at Sea

Dredging is planned to occur throughout the year, excluding November and February. Grey seals can potentially be affected by the proposed dredging operations and are listed on Annex II of the EU Habitats Directive. Cetacean species such as harbour porpoise and bottlenose dolphins, which are also listed on Annex II of the EU Habitats Directive occur within and adjacent to Cork Harbour and all cetacean species are listed on Annex IV and entitled to strict protection. These could potentially be affected by the proposed disposal of dredged spoil during proposed operations

Dredging during summer months will expose grey and harbour seal and harbour porpoise which at worse may lead to temporary disturbance. The breeding and pupping season for harbour seals occurs from June to July but given that the nearest known pupping site is >15km from the dredging operation it is unlikely to have any effect. Harbour porpoise occur throughout the year with calves present from July to December but as they are highly mobile and are likely to forage over a wide area any impacts from disturbance are not confined to the proposed dredging period. To minimise any disturbance effects on seals and harbour porpoise we recommend adoption of the NPWS Guidelines for minimising impacts of man –made sounds in Irish waters.

Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters

The mitigation measures recommended by the NPWS are for the presence of a trained and experienced Marine Observer (MMO) and the use of “ramp up” procedures for noise and vibration emitting operations. The proposed mitigation measures (Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters) recommended by the Department of Arts, Heritage and the Gaeltacht in 2014 are designed to mitigate any possible effects.

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

1. A dedicated, qualified and experienced Marine Mammal Observer will conduct a 30 minute watch for marine mammals within 200m prior to start up. If a seal or cetacean (or otter) is sighted within 200m of the TSHD/barge, start-up must be delayed until the animal(s) is observed to move outside the mitigation zone or the 30 minutes has passed without the animal being sighted within the mitigation zone.
2. Dredging activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.
3. Once normal dredging operations commence, there is no requirement to halt or discontinue the activity 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 MZ.

6.5 Residual Effects

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.

Seals using the areas to be dredged are likely to be tolerant of vessel noise and any animals which might be displaced from operations can be expected to quickly re-establish use of the area following cessation of the works.

7 | CONCLUSION

Cork Harbour and its approaches are important for some Annex IV species in the area including marine mammals at sites to be dredged and at the dredge disposal site. Previous dredging campaigns and recent IWDG marine mammal observers onboard dredge vessels, have provided a good understanding of the Annex IV species community potentially exposed to dredging and dumping and the likely effects.

We recommend the NPWS Guidelines to minimise the acoustic impacts of dredging be implemented to enable dredging campaigns to be carried out which will result in no significant impacts to Annex IV species.

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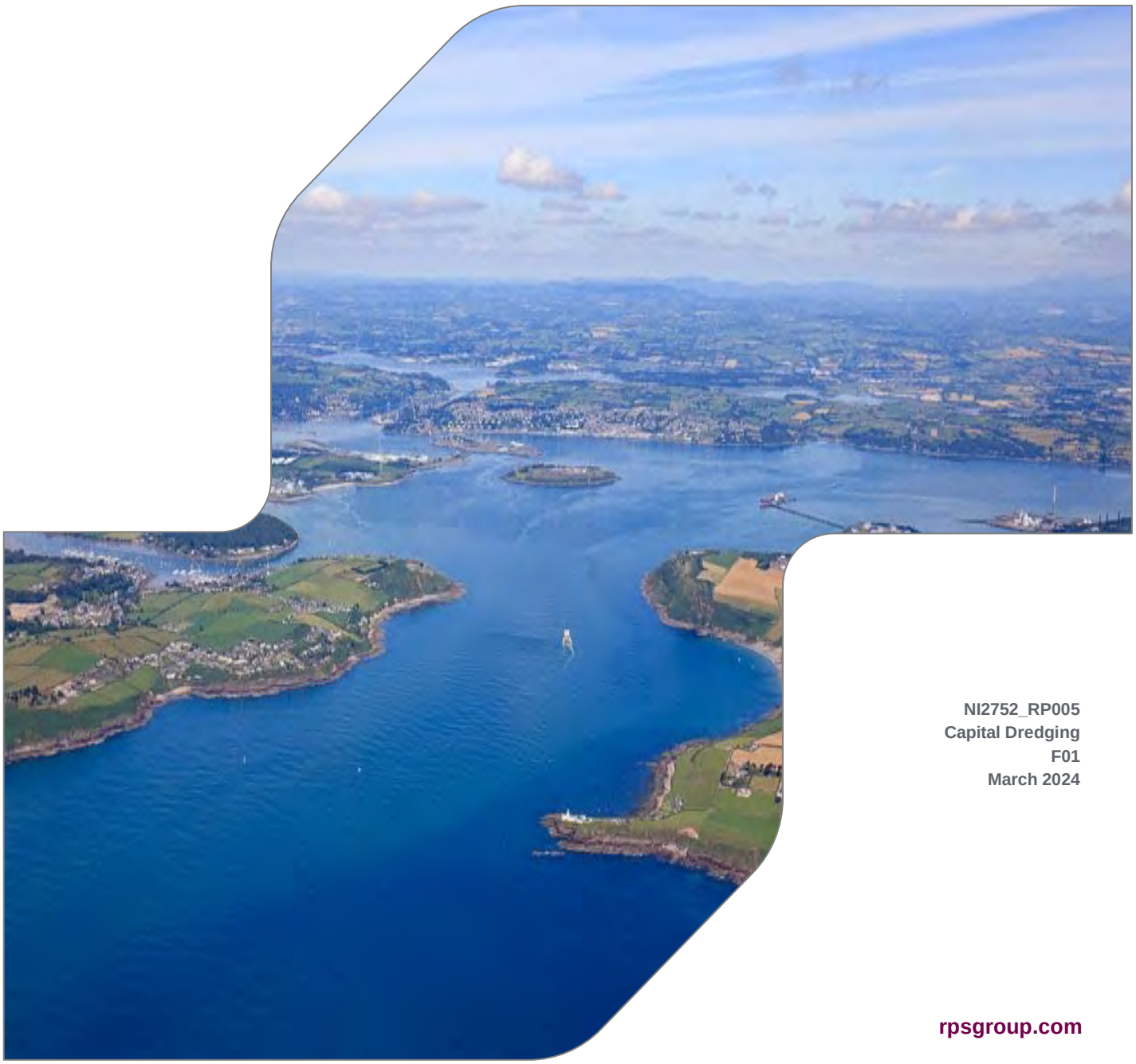
Appendix B: Sediment Plume Dispersion Assessment

RINGASKIDDY CAPITAL DREDGING

Sediment Plume Dispersion Assessment



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1 INTRODUCTION

Port of Cork Company (POCC) engaged the services of RPS for the provision of plume dispersion information relating to proposed capital dredging at Ringaskiddy Deepwater Port. As part of the permitting requirements for dredging and disposal operations, modelling was required to determine the fate of the suspended fraction of the dredged material. This was undertaken using numerical modelling techniques which provided information on tides and sediment transport.

This technical report presents the findings of the numerical modelling programme and describes the dispersion of dredge material suspended during the dredging operations and the fate of dredge material as it is dumped at the licensed disposal site.

The location of the licensed disposal site in relation to Ringaskiddy is illustrated in Figure 1.1 below.

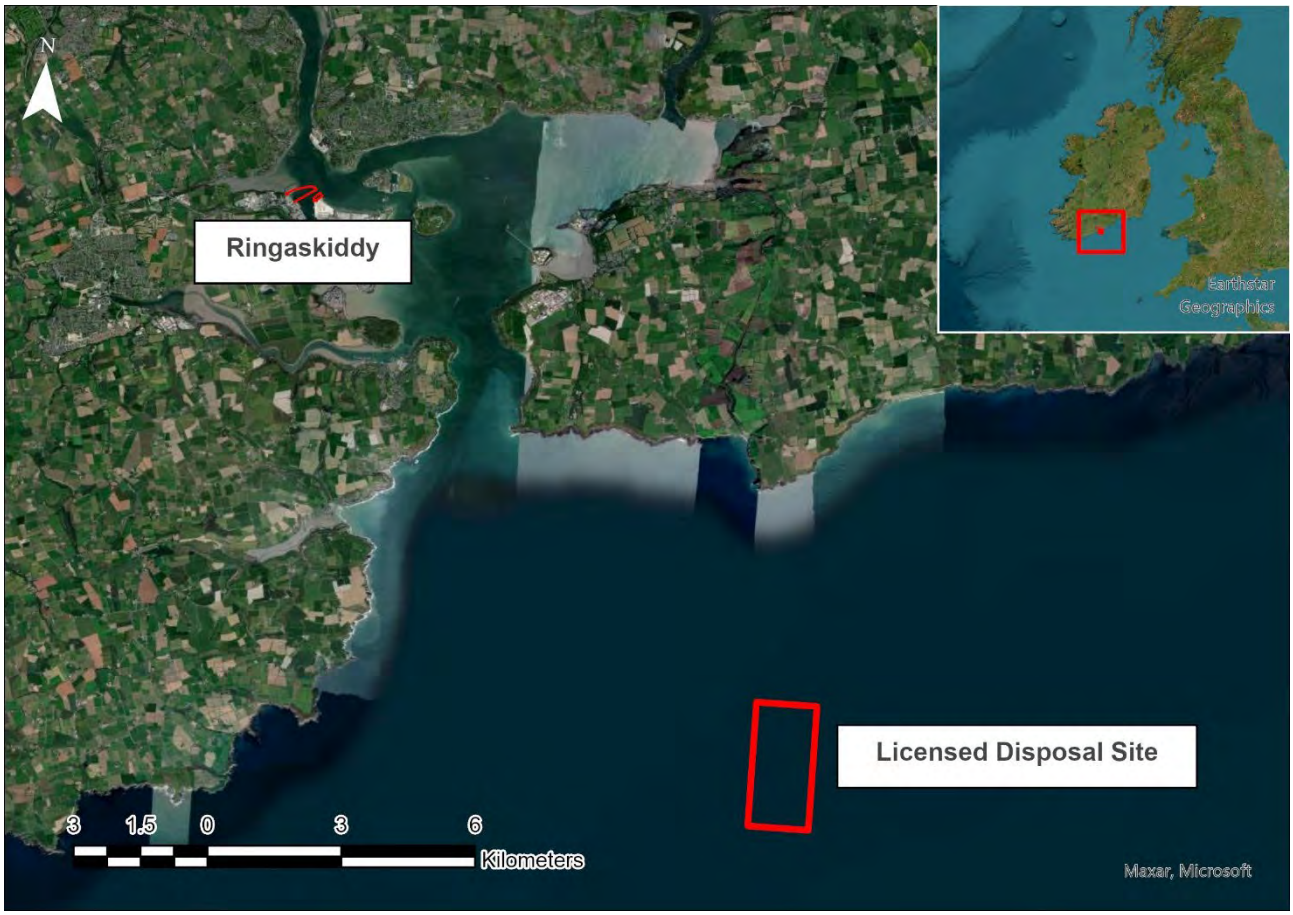

Figure 1.1: Location of Ringaskiddy in relation to the existing licensed disposal site

2 DESCRIPTION OF DREDGING WORKS

POCC have requested a permit be granted for a maximum dredge volume of 375,355m^3 and 47,862m^3 to be dredged from sites A and B respectively. Figure 2.1 shows the locations of Area A and Area B in relation to Ringaskiddy. It is envisaged that all dredging works will be undertaken using a backhoe dredger and/or a Trailing Suction Hopper Dredger (TSHD) with a capacity of not exceeding c. 8,000m^3 with the load per day being not greater than c.29,376 dry tonnes. As illustrated in Figure 1.1 the licensed disposal site is located approximately 8km south of Roches Point.

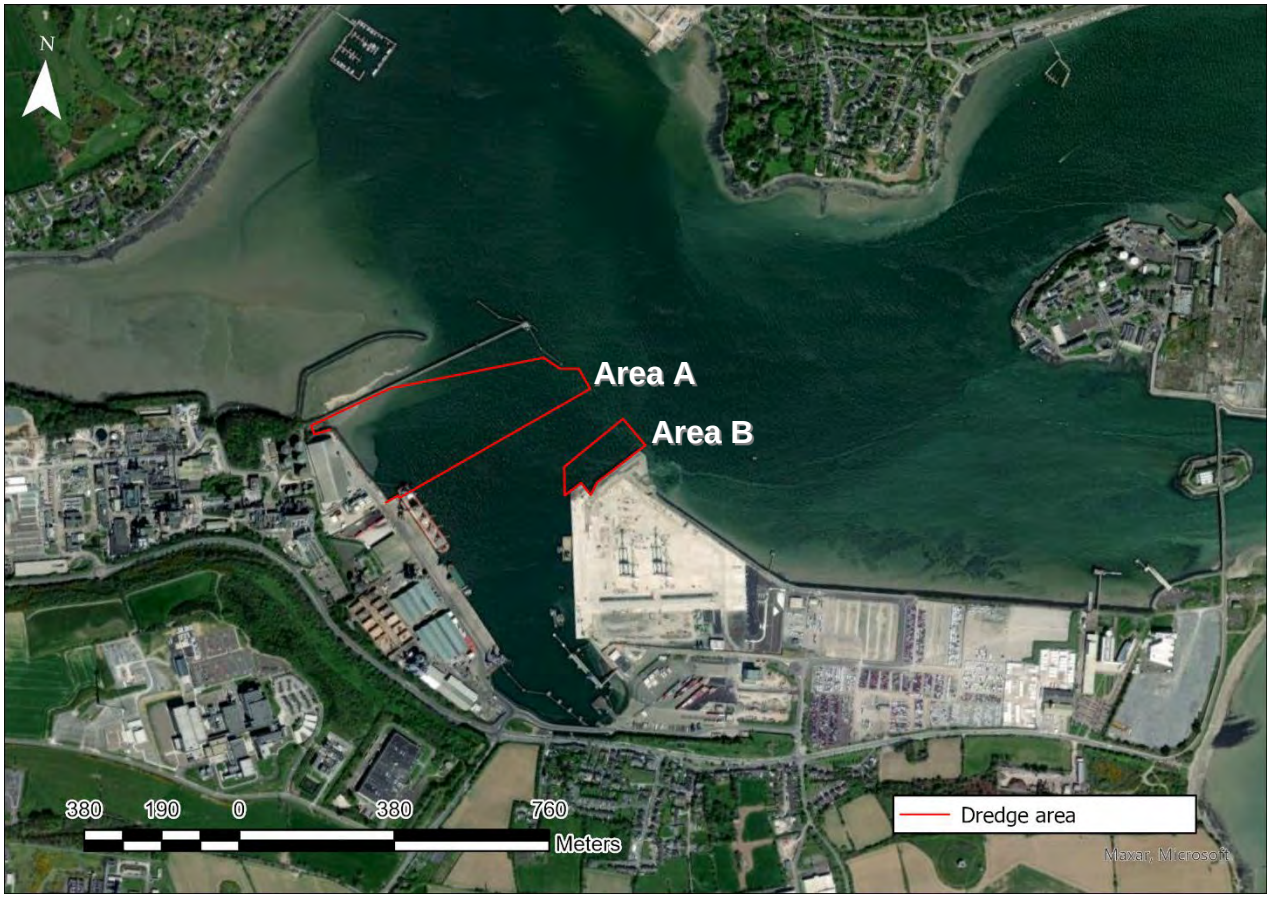

Figure 2.1: Location of the proposed dredging location within Cork Harbour

To reduce sediment dispersion, dredging operations will be undertaken with no overspill from the hopper. A number of mitigation measures will be applied during the operation, which are outlined below:

- A full record of loading and dumping tracks and record of the material being dumped will be maintained for each trip;
- No over-spilling (overflowing) from the dredger(s) will be permitted;
- Dumping will be carried out through the vessel's hull;
- Dumping will be limited to 29,376 dry tonnes per day;
- No dumping will occur in either November or February;
- No dumping will occur at the same time as the Port of Cork's maintenance dredging permit;

- The dumpsite will be divided into subsections with each used sequentially to ensure uniform spread of the dredged sediments;
- A 250m radius exclusion zone will be implemented around an archaeological anomaly at location 188723.5, 54463.1 (ITM coordinates);
- An Archaeologist will witness all the work in line with the Underwater Archaeology Impact Assessment;
- A Marine Mammal Observer will witness all the work in line with the Annex IV Species Risk Assessment;
- Water Quality monitoring of the loading areas will be undertaken at locations to be agreed with the EPA;
- A documented Accident Prevention Procedure will be put in place prior to commencement; and
- A documented Emergency Response Procedure will be put in place prior to commencement.

2.1 Sediment Characteristics

As part of the Dumping at Sea application process, it was necessary to collect and analyse sediment samples to determine potential contamination and the physical nature of the sediment to be dredged. To this end, Socotec was commissioned to analyse 20 discrete sediment samples collected from Ringaskiddy.

In addition to examining the potential for contaminates, the material was also examined to quantify the percentage of sand and silt material. The results of this assessment are presented in Table 2.1 below. As demonstrated by this information, approximately 78.8% of the material to be dredged was identified as silt whilst the remaining 21.19% of material had a grain size equivalent to or greater than that of sand material.

This information was subsequently used to inform the numerical modelling described in Section 4 of this report.

Table 2.1: Summary of the Dumping at Sea material analyses report from Ringaskiddy

Sample ID code	Particle size >2mm %	Particle size <2mm >63um %	Particle size <63um %
MAR02152.001	0	13.87	86.13
MAR02152.002	8.16	22.49	69.35
MAR02152.003	5.02	25.56	69.42
MAR02152.004	0	17.08	82.92
MAR02152.005	1.28	9.69	89.02
MAR02152.006	2.42	7.68	89.9
MAR02152.007	3.25	19.61	77.14
MAR02152.008	0.63	16.1	83.27
MAR02152.009	0	12.58	87.42
MAR02152.010	0	15.04	84.96
MAR02152.011	1.91	15.83	82.26
MAR02152.012	0	13.42	86.58
MAR02152.013	0	14.45	85.55
MAR02152.014	0	64.31	35.69
MAR02152.015	0	28.69	71.31
MAR02152.016	0	17.84	82.16
MAR02152.017	0	16.53	83.47
MAR02152.018	0	20.58	79.42
MAR02152.019	0	18.54	81.46
MAR02152.020	8.17	23.19	68.65
AVERAGE [%]	**1.54**	**19.65**	**78.80**

3 MODELLING METHODOLOGY

3.1 Overview

To inform an Appropriate Assessment of the proposed dredging works it was necessary to develop a suitable numerical modelling programme to assess and quantify the sediment plumes generated as a result of the proposed dredging operations.

The computational modelling was undertaken using RPS' in house suite of MIKE coastal process modelling software developed by the Danish Hydraulic Institute. A description of the modelling software used in this study is presented in the following Section.

Existing data was collected and reviewed by the study team. The relevant data on bathymetry, current flows, sediment grading etc., including the results of the new field studies, were analysed and prepared for use in the modelling study. For the purposes of this assessment, RPS utilised an existing hydraulic model of the Port of Cork area. As described in Appendix A, this model has been fully calibrated and is considered fit for purpose.

3.2 Modelling Software

The sediment plume dispersion simulations were undertaken using the coupled MIKE 21 Flow Model (FM) model. The FM model is a state-of-the-art modelling system based on a flexible mesh approach. The modelling system was developed by the Danish Hydraulics Institute (DHI) for applications within oceanographic, coastal and estuarine environments. The MIKE modelling software package has been approved by numerous leading institutions and authorities including the US Federal Emergency Management Agency (FEMA).

The Hydrodynamic Module is the basic computational component of the entire MIKE 21 Flow Model FM modelling system providing the hydrodynamic basis for the advection/dispersion Module, ECO Lab Module, Mud Transport Module and Sand Transport Module. For this study RPS utilised the following modules within the MIKE software package:

- Hydrodynamic module
- Mud Transport module

A more comprehensive description of these modules and the key parameters governing the coastal processes within the simulations are described in the following sections.

3.2.1 Hydrodynamic Module

The Hydrodynamic Module simulates water level variations and flows in response to a variety of forcing functions in lakes, estuaries and coastal regions. The effects and facilities include:

- Flooding and drying;
- Momentum dispersion;
- Bottom shear stress;
- Coriolis force;
- Wind shear stress;
- Barometric pressure gradients;
- Ice coverage;
- Tidal potential;
- Precipitation/evaporation;
- Wave radiation stresses; and
- Sources and sinks.

The Hydrodynamic Module can be used to solve both three-dimensional (3D) and two-dimensional (2D) problems. In 2D the model is based on the shallow water equations - the depth-integrated incompressible Reynolds averaged Navier-Stokes equations.

3.2.2 Mud Transport (MT) Module

The Mud Transport (MT) module of the MIKE 21/3 Flow Model FM describes erosion, transport and deposition of mud or sand/mud mixtures under the action of currents and (if appropriate) waves. The hydrodynamic basis for the MT Module is calculated using the Hydrodynamic Module of the MIKE 21/3 Flow Model FM modelling system and the MT is implemented as a couple model with the two running concurrently. The MT module is applicable for mud fractions and sand/mud mixtures.

The following processes may be included in the simulation.

- Forcing by waves;
- Salt-flocculation;
- Detailed description of the settling process;
- Layered description of the bed; and
- Morphological update of the bed.

In the MT-module, the settling velocity varies, according to the salinity, if included, and the concentration considering flocculation in the water column. Bed erosion can be either non-uniform, i.e. the erosion of soft and partly consolidated bed, or uniform, i.e. the erosion of a dense and consolidated bed. The bed is described as layered and is characterised by the density and shear strength.

3.3 Model Domain

As the proposed capital dredging operations included dredging within Ringaskiddy and the dumping of dredge material at the license site *c.* 8km south of Roches Point it was necessary to develop two individual numerical models.

The outer Cork Harbour model developed to simulate the dispersion of dumped material at the licensed disposal site is illustrated in Figure 3.1 below. This model extended approximately 40km offshore and from Ballycotton at the east boundary to the Old Head of Kinsale at the west boundary. As the model was developed using flexible mesh technology, it was possible to define the disposal site using a high-resolution mesh with an effective cell size of 50m^2. The model resolution was decreased to *c.* 1,500m^2 at the offshore boundary to increase computational efficiency.

The inner Cork Harbour model developed to simulate the dispersion of spilled material during dredging is illustrated in Figure 3.2. This high-resolution model had a mesh size ranging from 30m^2 at Ringaskiddy and within the fairway approach channels to *c.*70m^2 across the wider flat areas, with a smaller mesh size of 14m^2 in the harbour itself. The mesh structure and resolution of this model is illustrated in Figure 3.3 and Figure 3.4.

Bathymetry data for both models was based on data from the Irish National Seabed Survey (INSS), INFOMAR, and other local bathymetry surveys undertaken within Cork Harbour in support of previous studies.

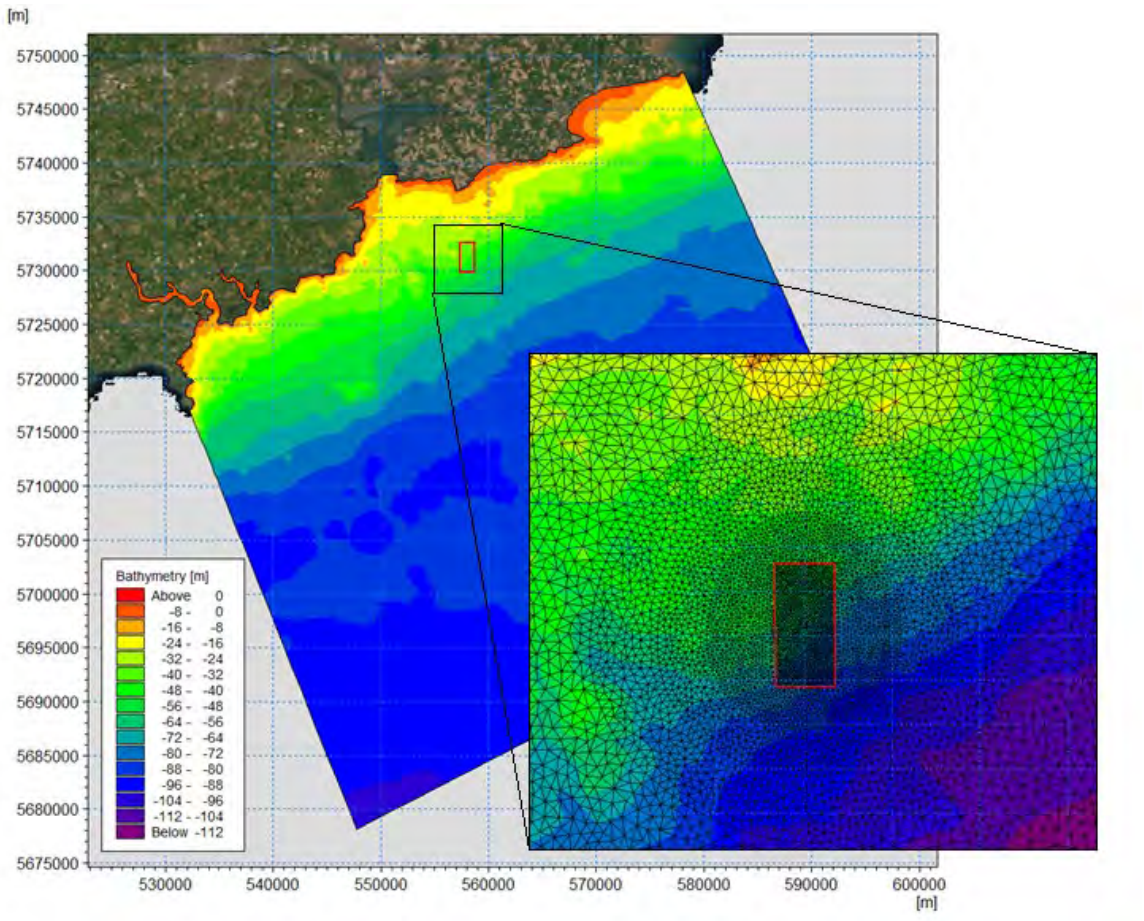

Figure 3.1: Extent and bathymetry of the Outer Cork model with high resolution around the disposal shown in the inset

Figure 3.2: Extent and bathymetry of the inner Cork Harbour model

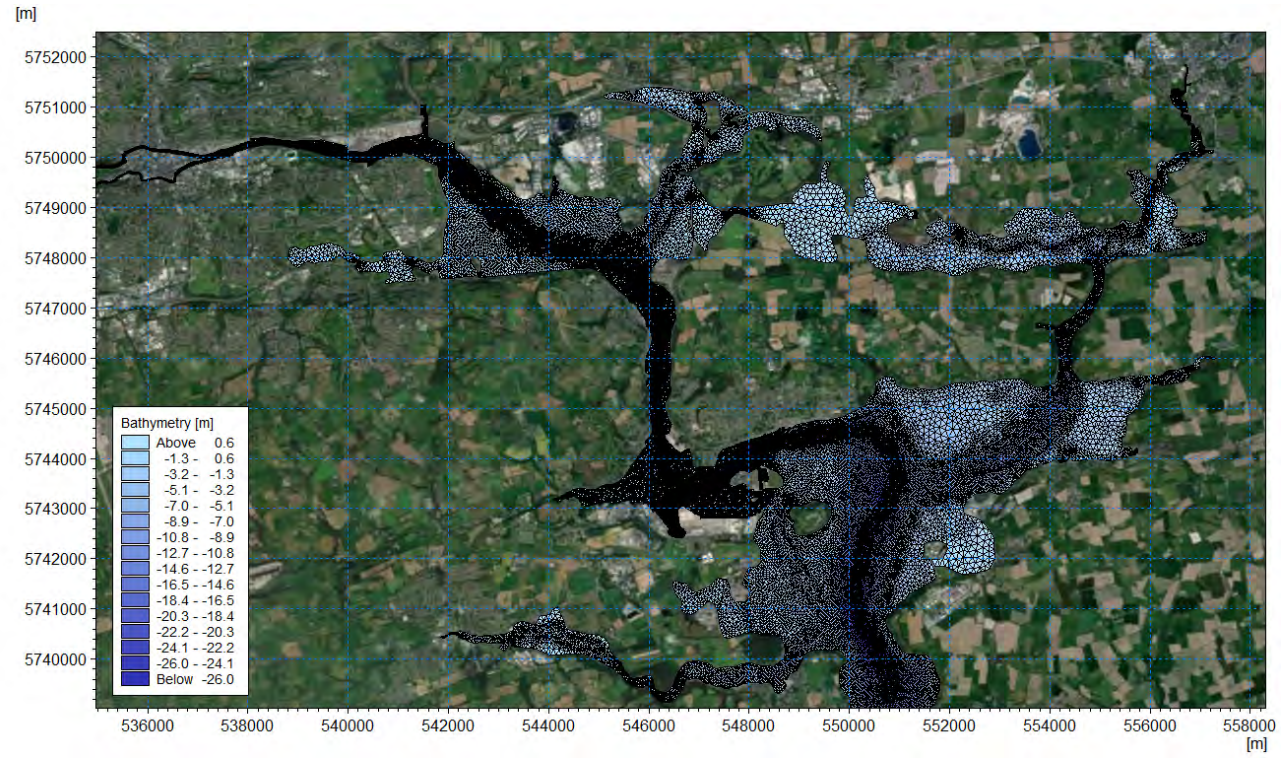

Figure 3.3: Mesh resolution and structure of the inner Cork Harbour model

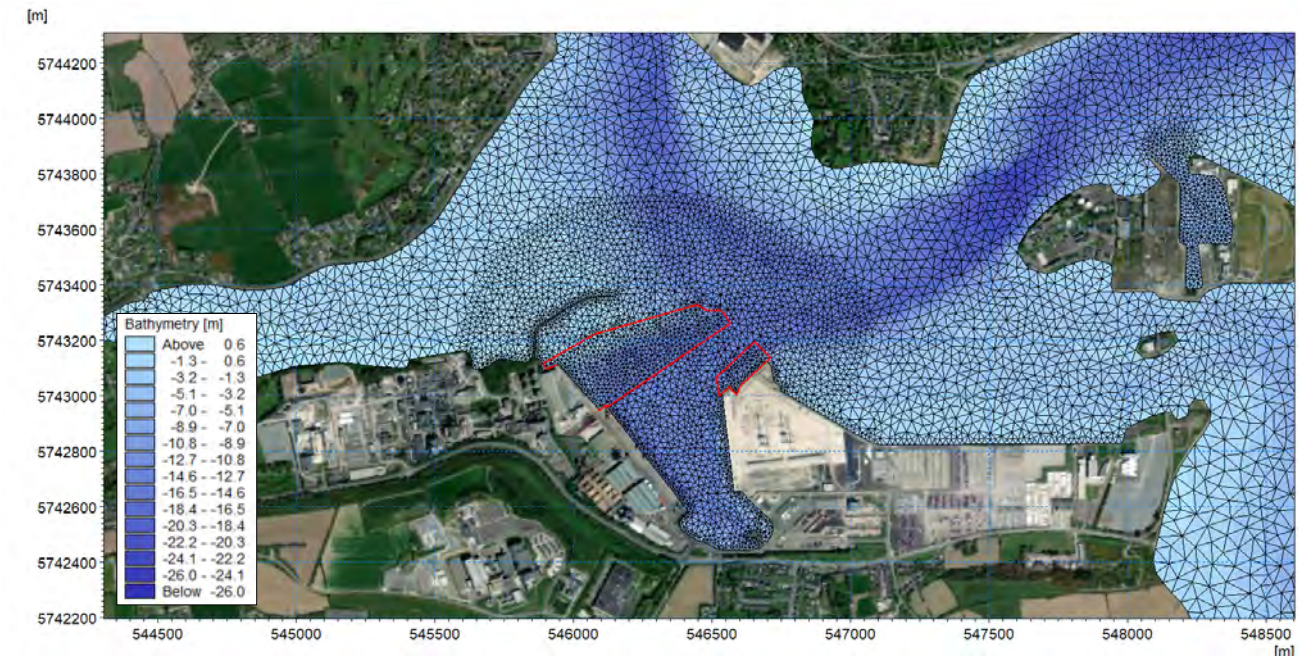

Figure 3.4: Mesh resolution and structure of the model in the Ringaskiddy area

3.4 Boundary Conditions

The tidal boundary data used for the Cork Harbour models was generated using RPS' Irish Sea Tidal and Storm Surge model. This model stretches from the North-western end of France, including the English Channel as far as Dover, out into the Atlantic to 16° west, including the Porcupine Bank and Rockall. In the other direction it stretches from the Northern part of the Bay of Biscay to just south of the Faeroes Bank. Overall, the model covers the Northern Atlantic Ocean and UK continental shelf up to 600km from the Irish Coast as illustrated in Figure 3.5.

This model was also constructed using flexible mesh technology; along the Atlantic boundary the model features a mesh size of 13.125' (24km). The Irish Atlantic coast has been described using cells of on average 3km size while in the Irish Sea the maximum cell size is limited to 3.5 km decreasing to 200m along the Irish coastline. The bathymetry of this model was generated from several different sources including digital chart data and surveys of several banks and coastal areas. This model is driven by astronomic tides generated using a global tidal model designed by a team at the Danish National Survey and Cadastre Department (KMS) and include pressure wave fields based on forecast data from the ECMWF.

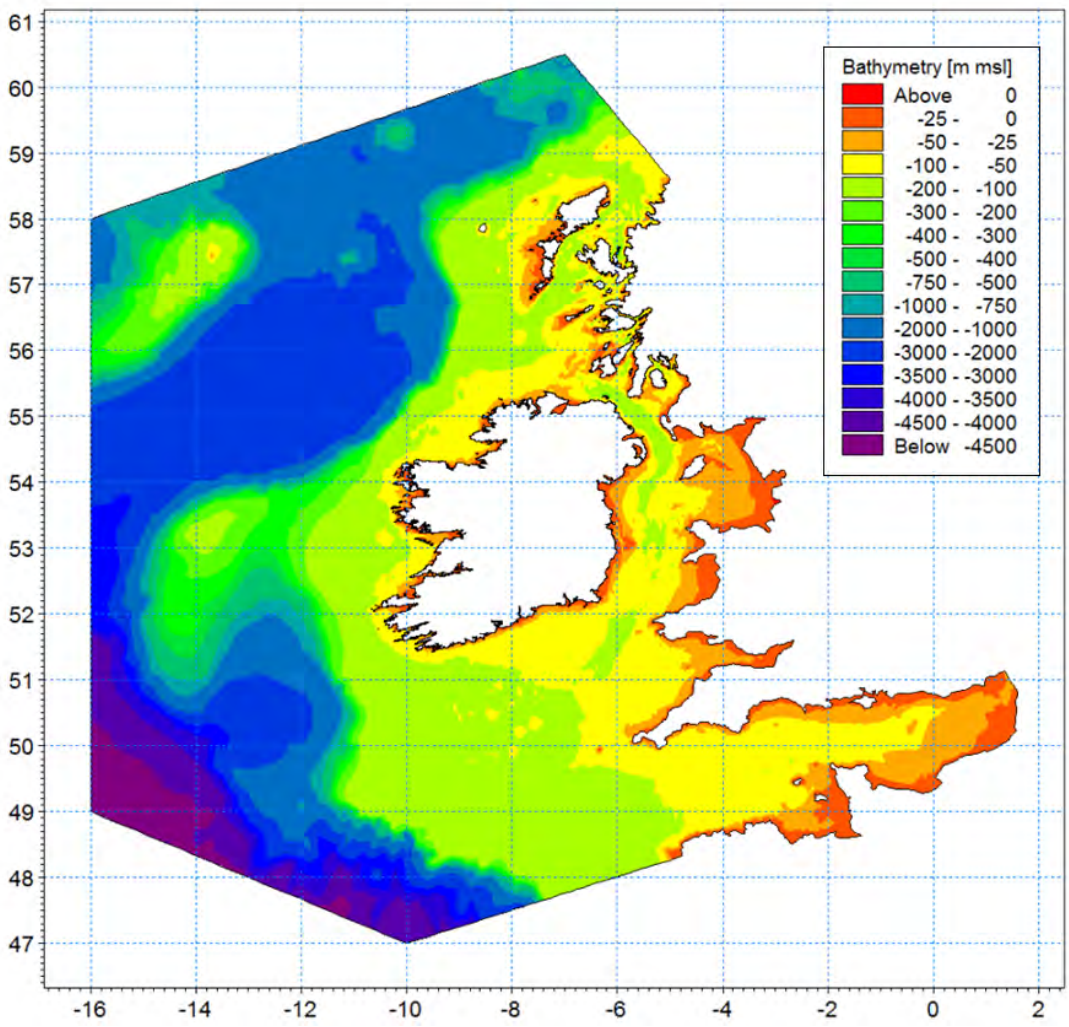

Figure 3.5: Extent and bathymetry of RPS' Irish Sea Tidal and Storm Surge model

4 SEDIMENT DISPERSION MODELLING

4.1 Summary of works

The proposed capital dredging works are comprised of two distinct activities in respect to the generation of sediment plumes, these are:

- The dredging activities. During this phase of the works, sediment will be released into the water column due to the turbulent interaction of the dredger and the material comprising the seabed.
- The dumping of dredged material at the licensed disposal site. During this phase of the works, a fraction of the sediment will become suspended in the water column as the bulk load of dredge material is released from the dredge hopper.

As the dredging and dumping activities occur inside and outside of Cork Harbour, it was necessary to an individual simulation for each activity. More information on the model setups and results from the numerical modelling is presented in the following Sections of this report.

4.2 Sediment plumes generated from the dredging activity

4.2.1 Characterisation of dredging activity

The total volume of material to be dredged equates to 375,355m^3 and 47,862m^3 from sites A and B respectively. Taking a “worst case scenario” approach, RPS assumed that the dredging operations would be undertaken on a 24/7 basis. A typical dredging cycle which has been used for this modelling study is presented in Table 4.1 below. The path that was used to define the location and movement of the dredging source term in the numerical model is presented in Figure 4.1.

Table 4.1: Typical dredging cycle commensurate with historical operations

Cycle Phase	Duration [min]	Comment
Loading time	50	Consists of 20mins of manoeuvring and 30 mins of dredging
Sailing to Dump	90	
Dumping	10	
Sailing from Dump	90	

Figure 4.1: The path used to define the location and movement of the dredging source term

The composition of material to be dredged was determined via a series of sediment samples. The results of these samples indicated that approximately 78% of material to be dredged was comprised of silt. RPS characterised this silt fraction in the numerical modelling using a distinct coarse silt and fine silt fraction. Key parameters including the mean grain diameter and fall velocities associated with these fractions are summarised in Table 4.2 below.

In the interest of presenting a conservative assessment taking into account a worst case scenario, modelling simulations were based on dredging operations being undertaken using a TSHD as opposed to a backhoe dredger. The percentage of fines lost at the dredger head was assumed to be 3%, this equated to a loss of *c.*45.3kg/s during active dredging times (i.e. 30 minutes of every 4hr dredging cycle). This loss was introduced as a source term that traversed the dredger path illustrated in Figure 4.1.

It should be noted that the remaining 21.2% of material which comprised of sand material was not included in the modelling simulations. This is because sand fractions have a much higher fall velocity and would therefore quickly re-settle onto the seabed before being removed by the dredger.

Table 4.2: Specification of silt material used in the dredging simulations

Representative material	Fraction	Class	Mean Diameter [mm]	Fall Velocity [m/s]	Proportion of source [%]
Silt	3	Coarse Silt	0.0467	0.001054	50
	4	Fine Silt	0.0023	0.000265	50

4.2.2 Typical Plume Simulations – Ringaskiddy

The total suspended sediment concentrations (SSCs) during typical dredging operations within Area A of the Ringaskiddy Ferry Port are presented in Figure 4.2 to Figure 4.5. Figure 4.6 to Figure 4.9 represent total suspended concentrations within Area B. A summary description of these plots has been presented in Table 4.3 below.

Table 4.3: Summary description of the sediment plumes for the Ringaskiddy Ferry Port

Figure	Tidal Phase
Figure 4.2 and Figure 4.6	Low water
Figure 4.3 and Figure 4.7	Mid-flood
Figure 4.4 and Figure 4.8	High water
Figure 4.5 and Figure 4.9	Mid-ebb

Based on the output of the modelling results it was found that:

- Sediment plumes did not *generally* extend for more than *c*.400m along a north – south axis during period of flood or ebb tidal flows. The SSC of these plumes were generally less than 100mg/L.
- Sediment plumes did not *generally* extend for more than *c*.1,000m along an east – west axis during period of high or low water phases. Again, the SSC of these plumes were generally less than 100mg/L.
- Material that became suspended as a result of dredging operations typically settled back onto the seabed or was fully dispersed within 75 minutes.
- The spatial dispersion of suspended material generated by operations within the inner regions of Areas A and B was generally limited given the sheltered nature of the Ringaskiddy harbour, whilst material suspended by operations further east tended to disperse further given the stronger tidal flows.

Sediment deposition in the Ringaskiddy area upon completion of the dredging operations is illustrated in Figure 4.10. As demonstrated by this figure, deposition levels within the study area were generally less than 0.016m. it should be noted that most of this sediment within Areas A and B would actually be removed given that dredging operations continue until the target depth is achieved.

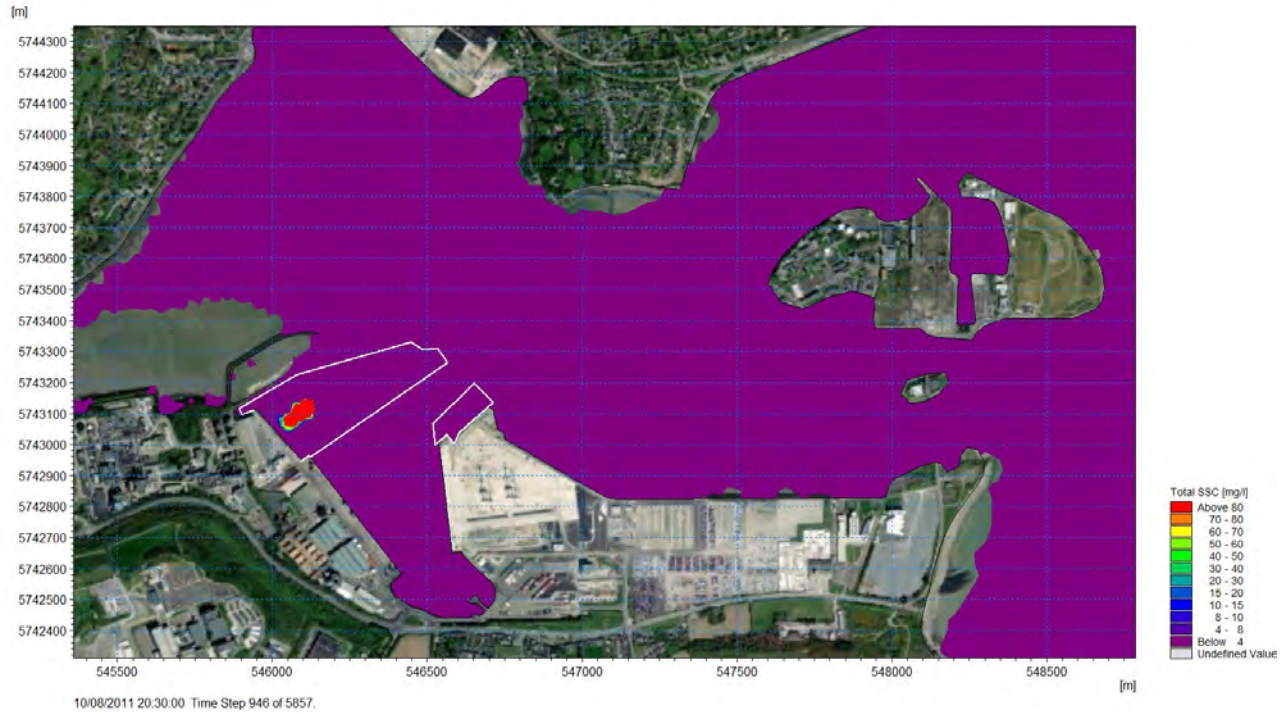

Figure 4.2: Sediment plume envelope created at Low Water from dredging operations in Ringaskiddy Ferry Port

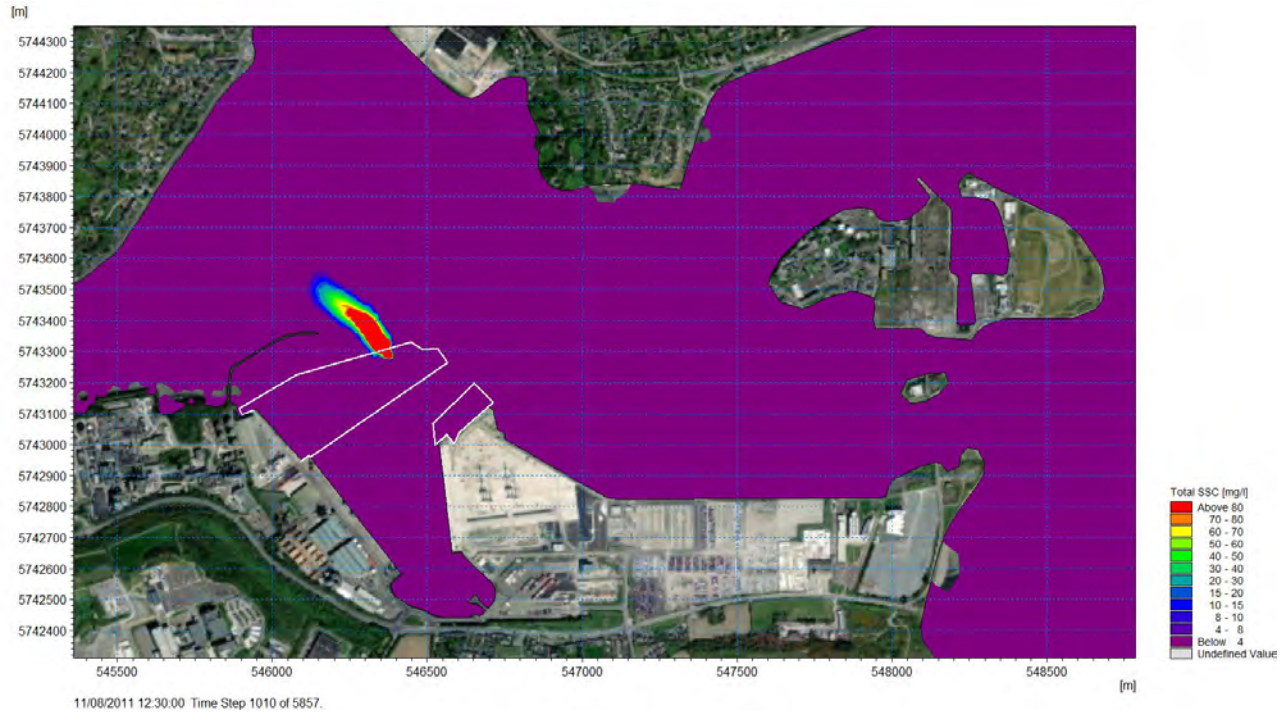

Figure 4.3: Sediment plume envelope created at Mid Flood from dredging operations in Ringaskiddy Ferry Port

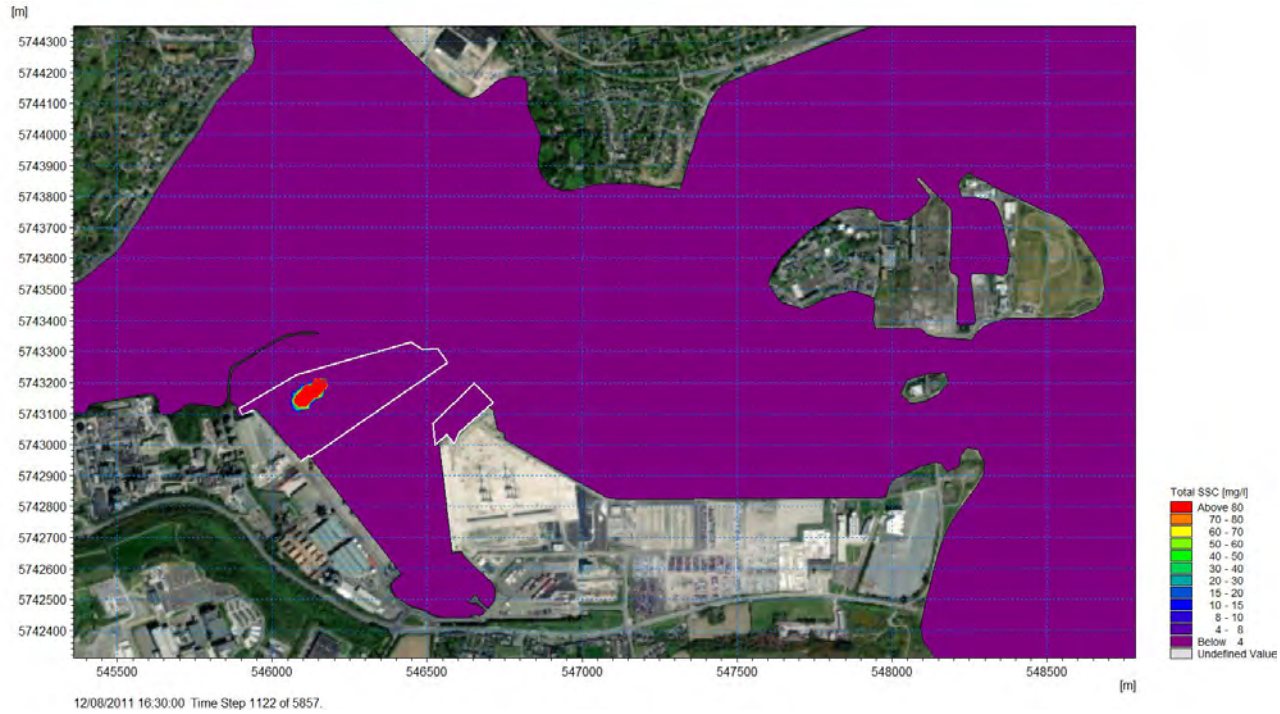

Figure 4.4: Sediment plume envelope created at High Water from dredging operations in Ringaskiddy Ferry Port

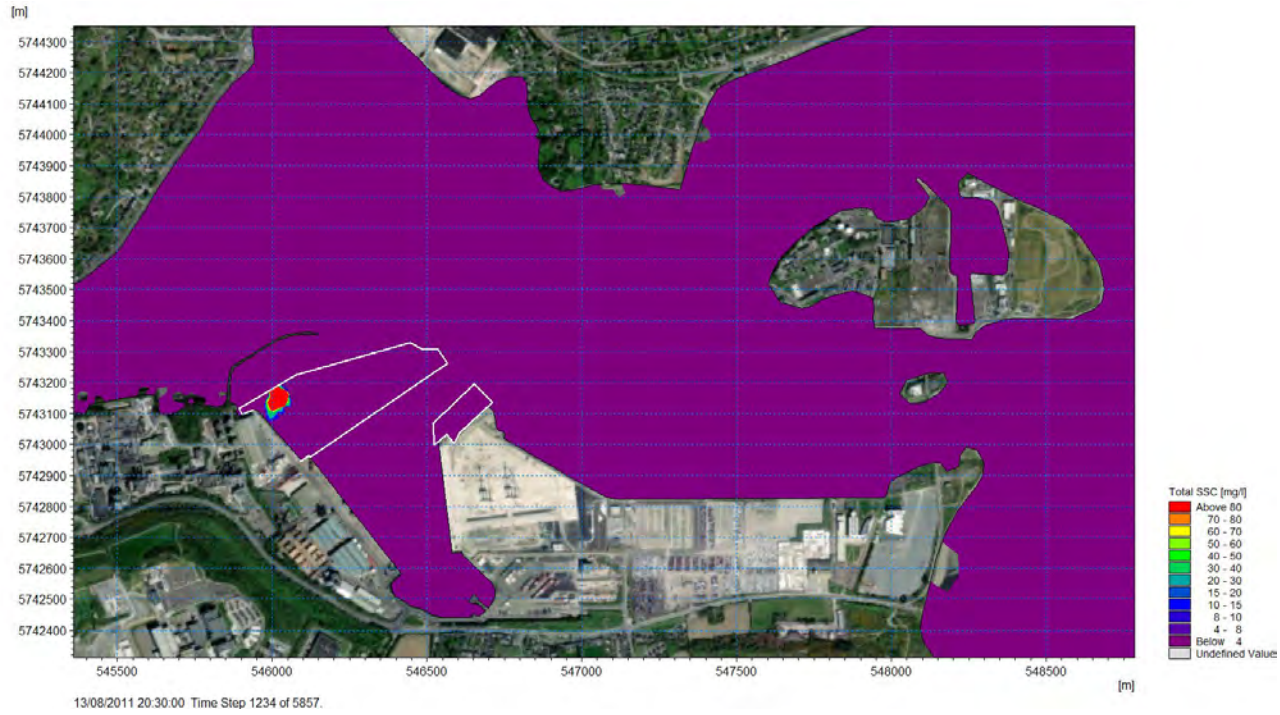

Figure 4.5: Sediment plume envelope created at Mid Ebb from dredging operations in Ringaskiddy Ferry Port

Figure 4.6: Sediment plume envelope created at Low Water from dredging operations in Ringaskiddy Ferry Port

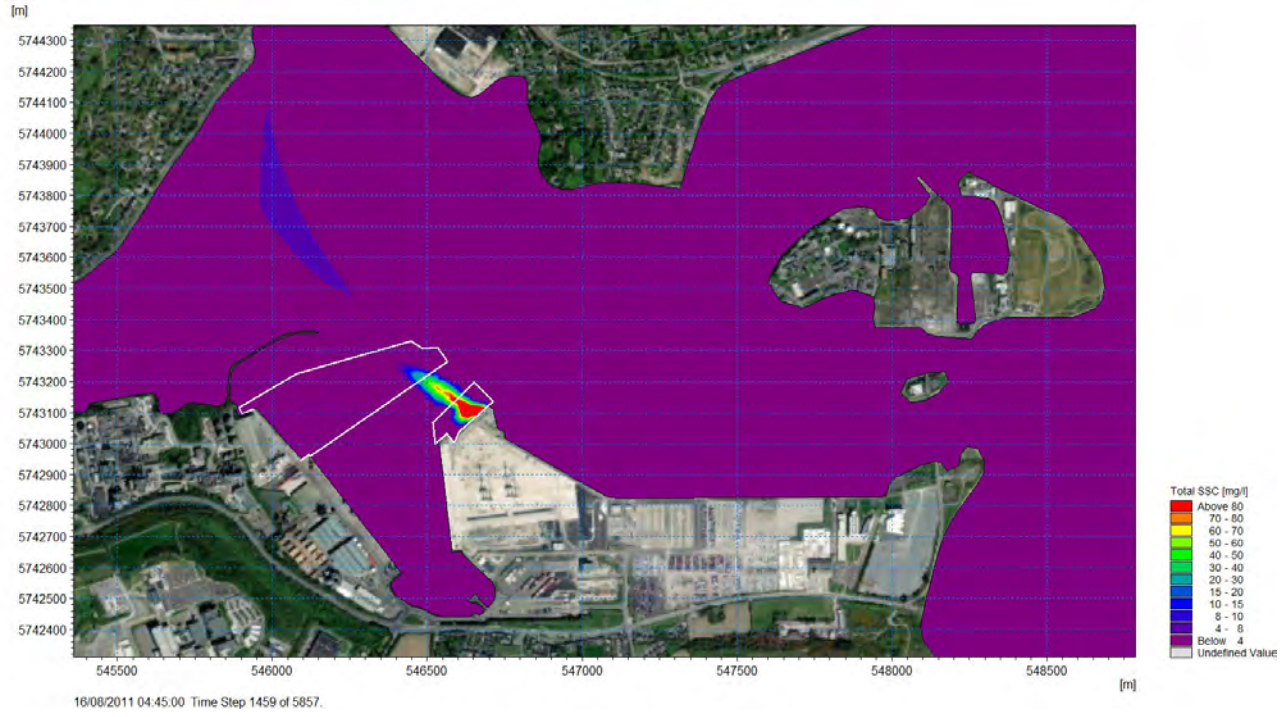

Figure 4.7: Sediment plume envelope created at Mid Flood from dredging operations in Ringaskiddy Ferry Port

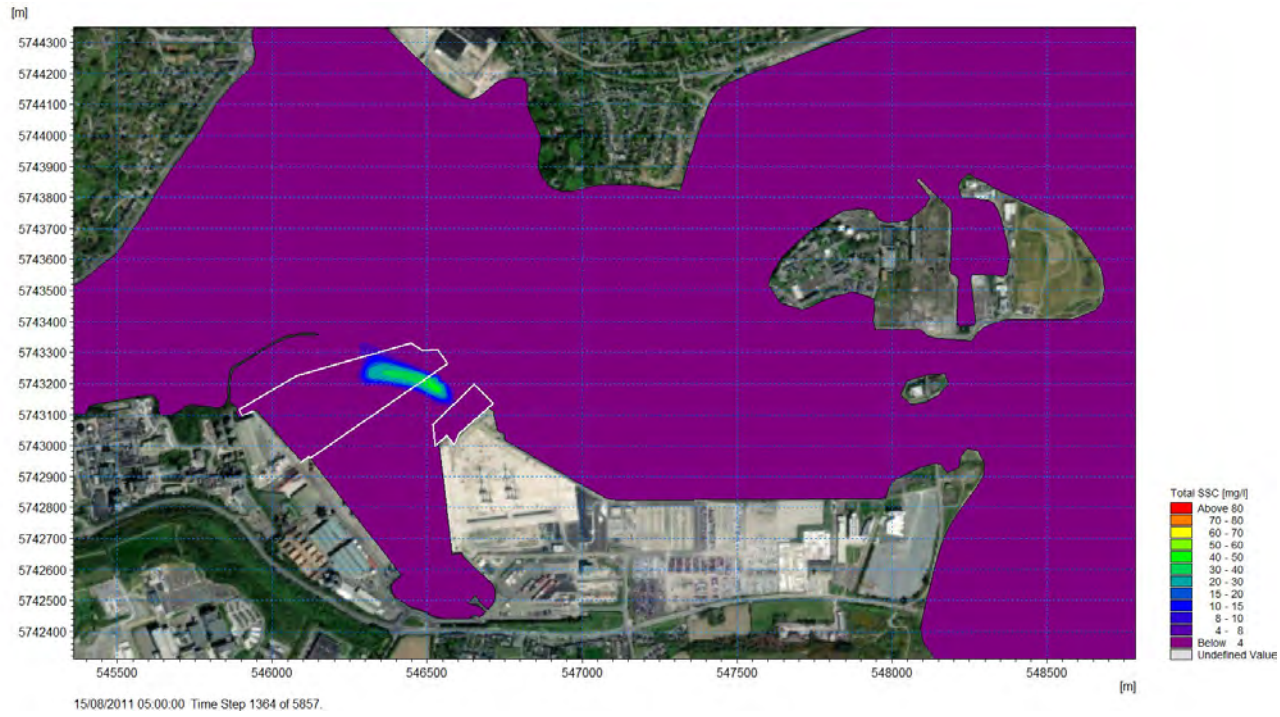

Figure 4.8: Sediment plume envelope created at High Water from dredging operations in Ringaskiddy Ferry Port

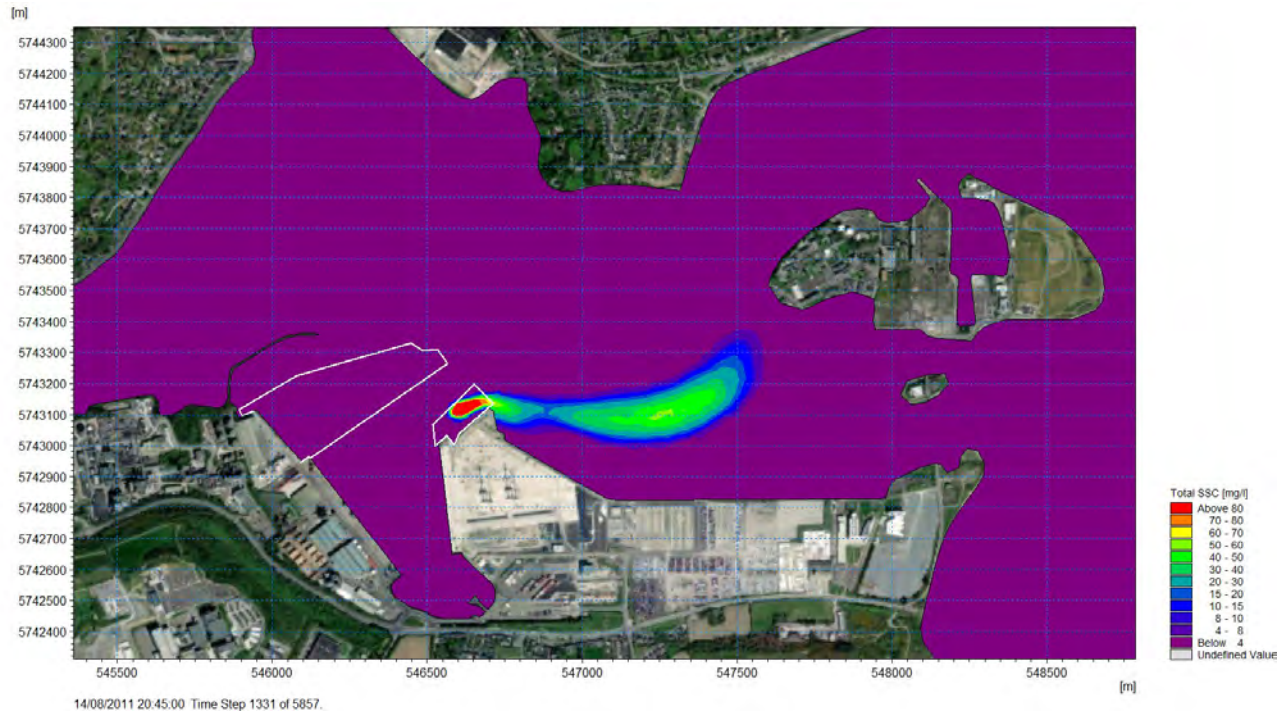

Figure 4.9: Sediment plume envelope created at Mid Ebb from dredging operations in Ringaskiddy Ferry Port

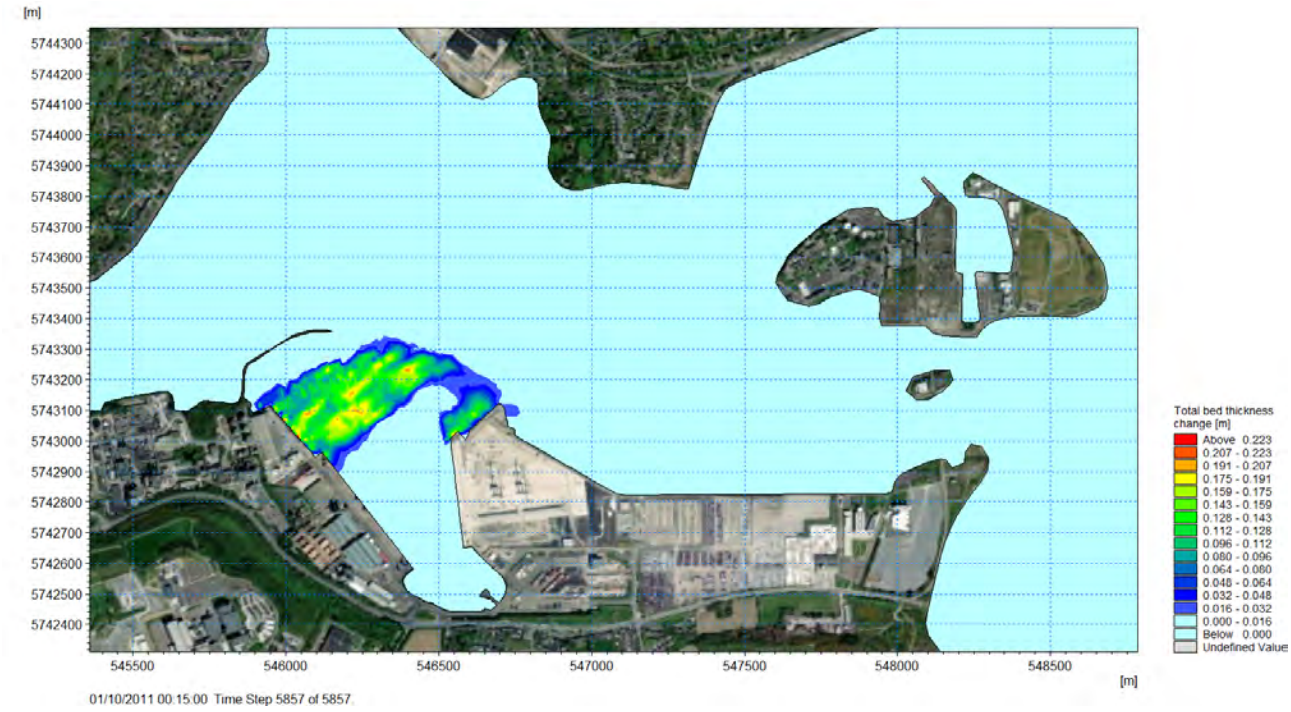

Figure 4.10: Total bed thickness change within Ringaskiddy Ferry Port following the proposed dredging operations

4.2.3 Average and Maximum Sediment Plumes

Having presented actual total suspended sediment plume envelopes for the dredging activities at Ringaskiddy during specific phases of the tide, this Section of the report presents the statistical mean and maximum total suspended sediment plumes for the capital dredging works.

Figure 4.11 which illustrates the statistical mean total suspended sediment plume envelope demonstrates that the average total SSC throughout Cork harbour does not generally exceed 0.2mg/L during the course of the dredging operations. This is true for most of the harbour except at Ringaskiddy Ferry Port whereby the constrained nature of the tidal currents restricts initial mixing and results in a marginally higher average total SSC of up to 6mg/L.

The maximum total SSC plume envelope observed from the dredging simulations is presented in Figure 4.12 overleaf. This Figure should be assessed with caution as it represents the maximum suspended sediment concentration experienced in each mesh element over the course of the simulation. These values may therefore not have occurred simultaneously nor have persisted for any significant period. It will be seen from this figure that beyond Areas A and B the maximum total SSCs do not generally exceed 150mg/L. Within the active dredge areas, the maximum SSC can on occasions exceed 1,000mg/L. It should be noted that these maximum total SSCs almost always related to times when the dredger was active and therefore represented the sediment source before any mixing or dispersion had occurred.

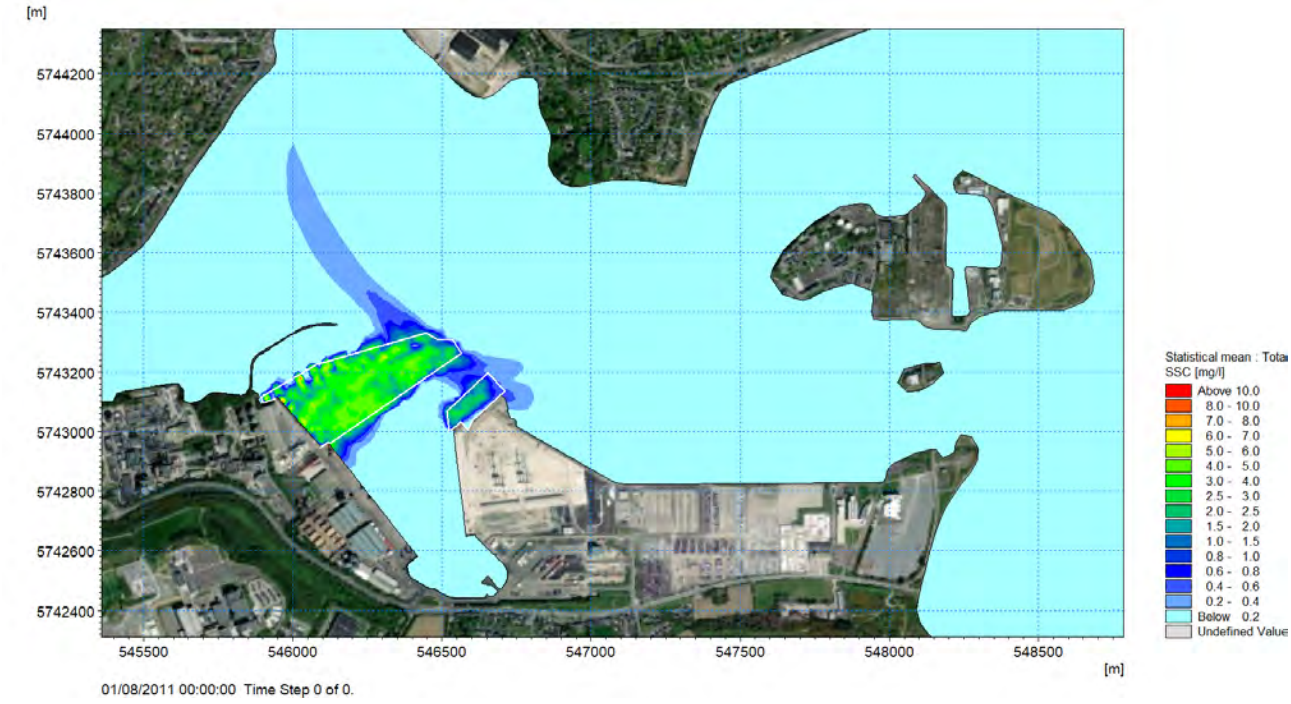

Figure 4.11: Average total suspended sediment concentration within Ringaskiddy Ferry Port during the course of the proposed dredging operations

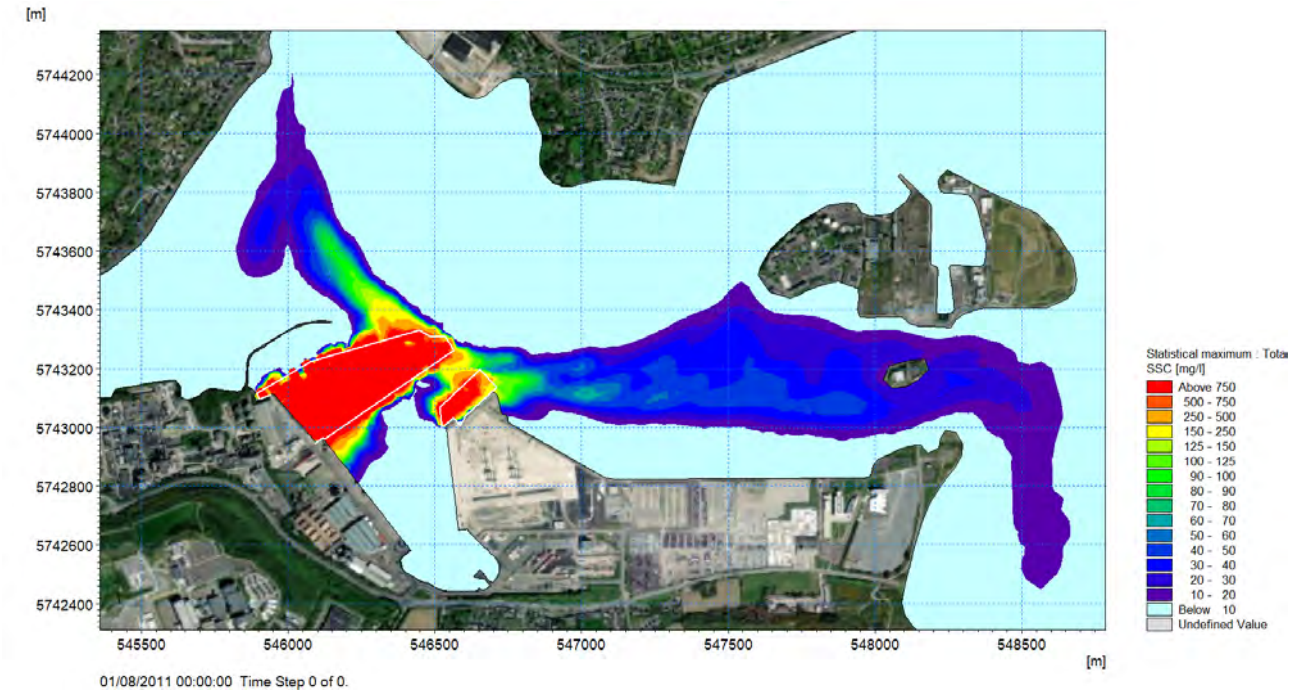

Figure 4.12: Maximum total suspended sediment concentration within Ringaskiddy Ferry Port during the course of the proposed dredging operations

4.3 Sediment plumes generated from the dumping activity

4.3.1 Characterisation of dumping activity

In addition to assessing sediment plumes generated from the dredging operation within Ringaskiddy Ferry Port, RPS also assessed the dispersion and settlement of material released from dumping dredged material at the licensed disposal site approximately 8km south of Roches Point.

Dumping activities would last for approximately 10min in every 4-hour dredging cycle. Given that the proposed dredger has a hopper capacity of 8,000m^3, a suitable spill rate was determined for the model. As described in Section 2.1 of this report, analysis of sediment samples taken throughout Cork Harbour demonstrated that the material to be dredged comprised 78% of silt material, with the remaining 21% being sand material. These sediment fractions where therefore defined in the numerical model as per the specifications presented in Table 4.4 below. This dumped material was introduced as a source term that traversed the disposal site illustrated in Figure 4.13.

Table 4.4: Specification of the silt and sand material used in the dredging simulations

Representative material	Fraction	Class	Mean Diameter [mm]	Fall Velocity[m/s]	Proportion [%]
Sand	1	Medium Sand	0.250	0.021870	6.40
	2	Fine Sand	0.125	0.006920	6.40
Silt	3	Coarse Silt	0.0467	0.001054	43.60
	4	Fine Silt	0.0023	0.000265	43.60

As before, RPS took a worst-case scenario and assumed that the dredging operations would be undertaken on a 24/7 basis. As such, the findings presented in the following Section of this report represent approximately 423,217m^3 of sediment material being dumped at the licensed disposal site over the course of the dredging operations.

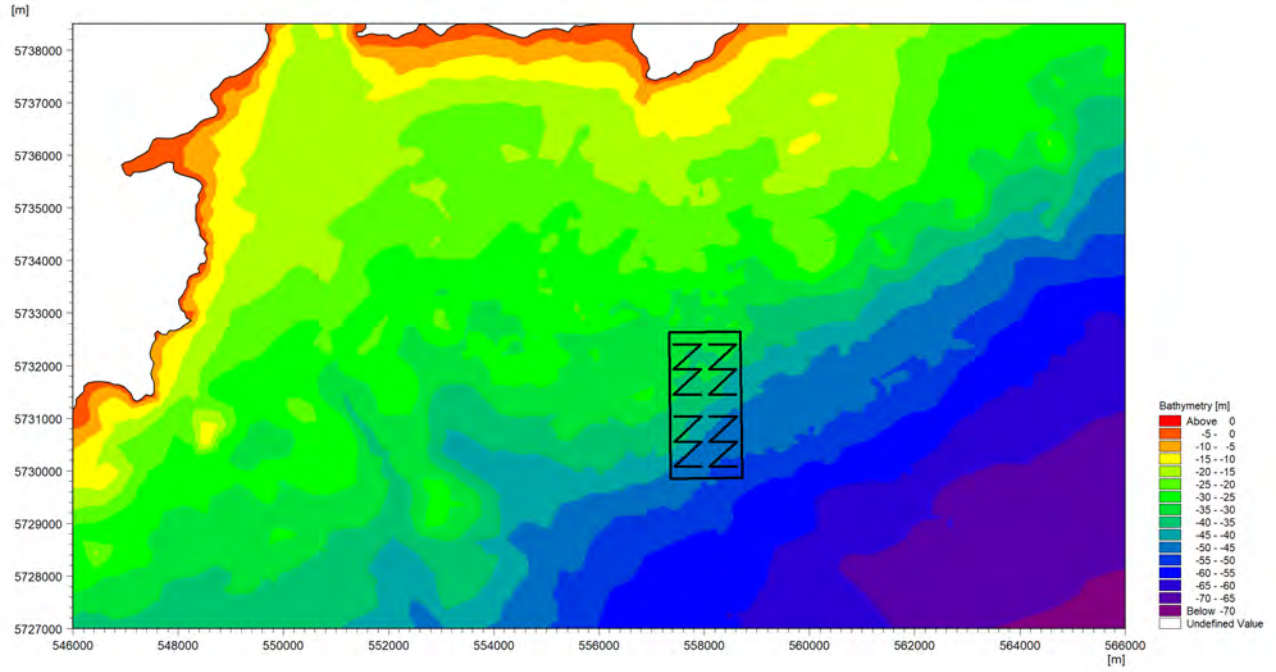

Figure 4.13: The path used to define the location and movement of the dumping source term

4.3.2 Sediment plume envelopes and deposition levels

The average total suspended sediment concentration across at the disposal site as a result of the dredging operation is presented in Figure 4.14 overleaf. As demonstrated by this Figure, the highest total SSC are observed within the confines of the licensed disposal site. The average total SSC beyond the immediate vicinity of the licensed disposal site does not generally exceed 3mg/L and is quickly dispersed to less than 1mg/L approximately 2km from the disposal site boundary.

Sediment deposition at the licensed disposal site at the end of the dredging operation is illustrated in Figure 4.15 overleaf. It will be seen from this figure that almost all the sediment dumped during the primary dredging operation remains within the confines of the licensed disposal site. Beyond the immediate vicinity of the licensed disposal site, change in bed levels do not generally exceed 5mm.

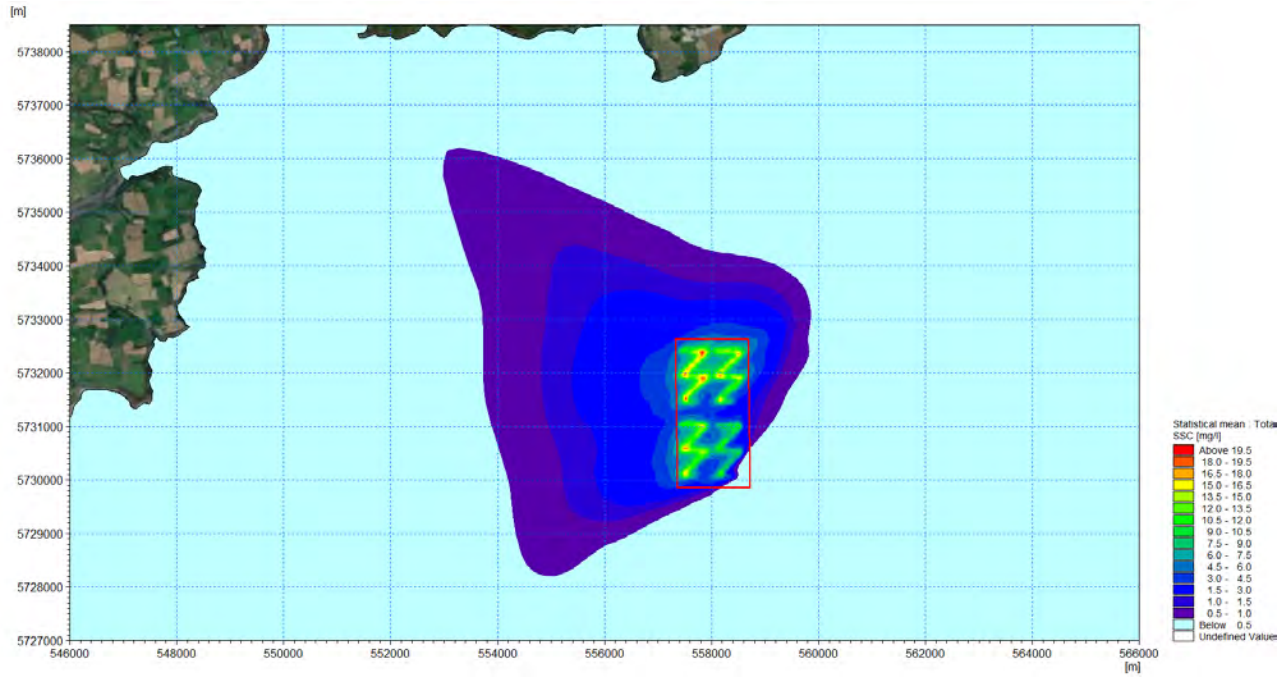

Figure 4.14: Average total suspended sediment concentration at the licensed disposal site during the course of the capital dredging operations

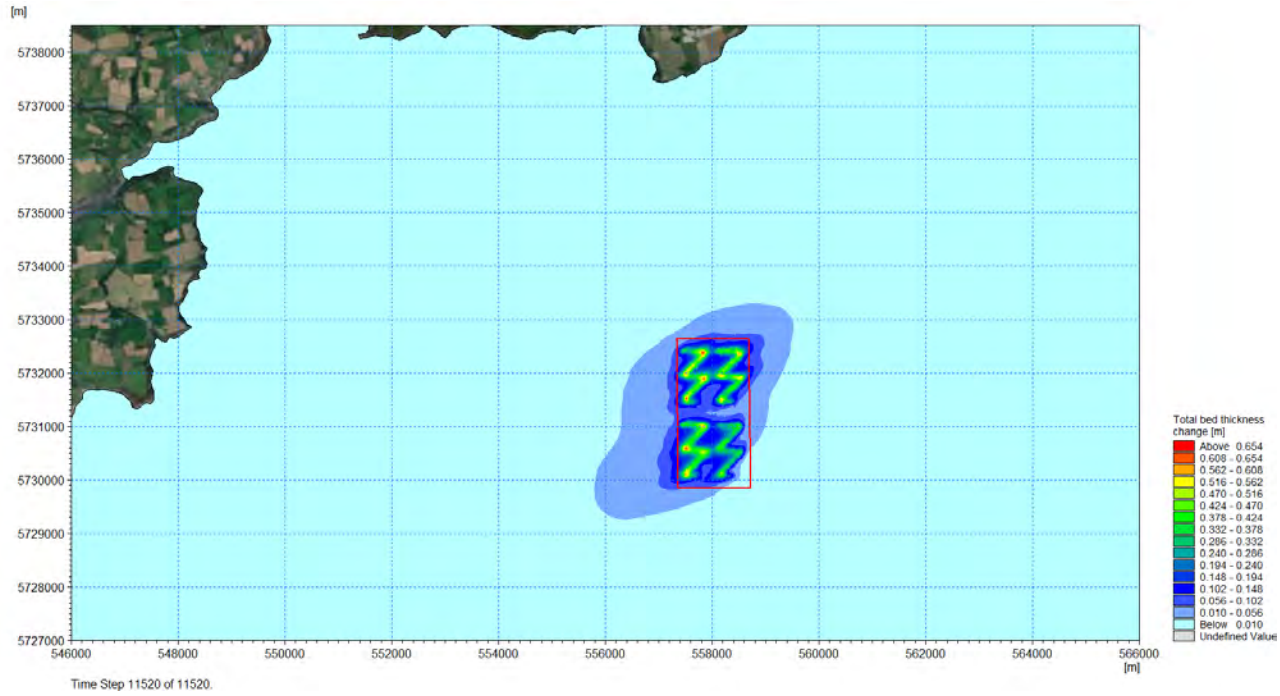

Figure 4.15: Total bed thickness change at the licensed disposal site following the capital dredging operations

5 CONCLUSION

A modelling programme was undertaken to evaluate both the dredging and disposal phases of the proposed capital dredging operations within Ringaskiddy Ferry Port; this included extensive tide and sediment dispersion modelling. The computational modelling was undertaken using RPS' in house suite of MIKE coastal process modelling software by the Danish Hydraulic Institute (DHI).

An assessment of the capital dredging operations which included the dredging and disposal of 423,217m^3 material found that the average total SSC throughout Ringaskiddy Ferry Port did not generally exceed 0.2mg/L during the dredging operations. This was true for most of the harbour except at Ringaskiddy Ferry Port whereby the constrained nature of the tidal currents restricts initial mixing and results in a higher average total SSC of up to 6mg/L.

The maximum total SSC plume envelope observed during the dredging simulations did not generally exceed 500mg/L outside of Ringaskiddy Ferry Port. However, these maximum total SSCs were almost always related to times when the dredger was active and therefore represented the sediment source before any mixing or dispersion had occurred.

Sediment deposition outside Ringaskiddy Ferry Port as a result of the dredging operations was minimal as deposition levels within the Port were generally less than 1.6cm. Most of the sediment accumulation in Areas A and B would be removed by the passing dredger once it had settled.

An assessment of the dumping phase of the capital dredging operations found that the average total suspended sediment concentration beyond the immediate vicinity of the licensed disposal site did not generally exceed 3mg/L. The average suspended sediment concentration quickly dispersed to less than 1mg/L approximately 2km to the west from the disposal site boundary, and within c.0.5km to the east.

Almost all the sediment dumped during the capital dredging operation was found to remain within the confines of the licensed disposal site. Beyond the immediate vicinity of the licensed disposal site, change in bed levels did not generally exceed 5mm.

Appendix A – Model Calibration

A.1 Calibration using measured data

The model was verified by comparison with tidal heights across the domain and published Admiralty tidal stream data. The two most relevant gauge locations are Cobh and Ringaskiddy, the locations of which are indicated in Figure 5.1. In addition, some limited hydrographic data was available at four locations near Paddy's Point. The model showed good agreement with the current speed during mid tide which was recorded to be 0.6m/s.

Figure 5.1: Calibration locations for data presented

The inner Cork Harbour model was used to simulate the full range of tidal excursion and was therefore calibrated over this range.

Figure 5.2 and Figure 5.3 show the comparison between the predicted astronomic tide from the tide gauge at Cobh with the model data for the spring and neap tides respectively. Figure 5.4 and Figure 5.5 shows the same data for Ringaskiddy. Both locations indicate that the model simulates the tidal flows well.

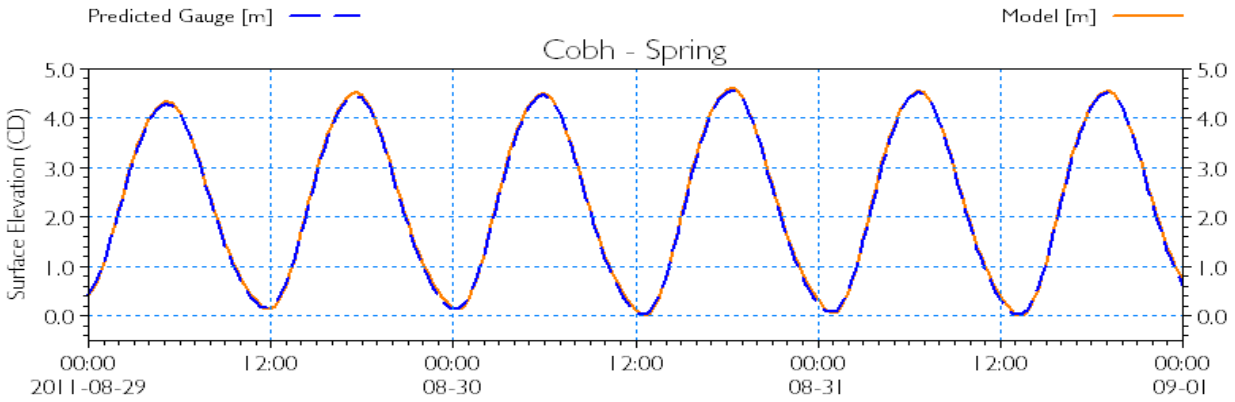

Figure 5.2: Tidal Elevation from Gauge and Model Data - Cobh Spring tide

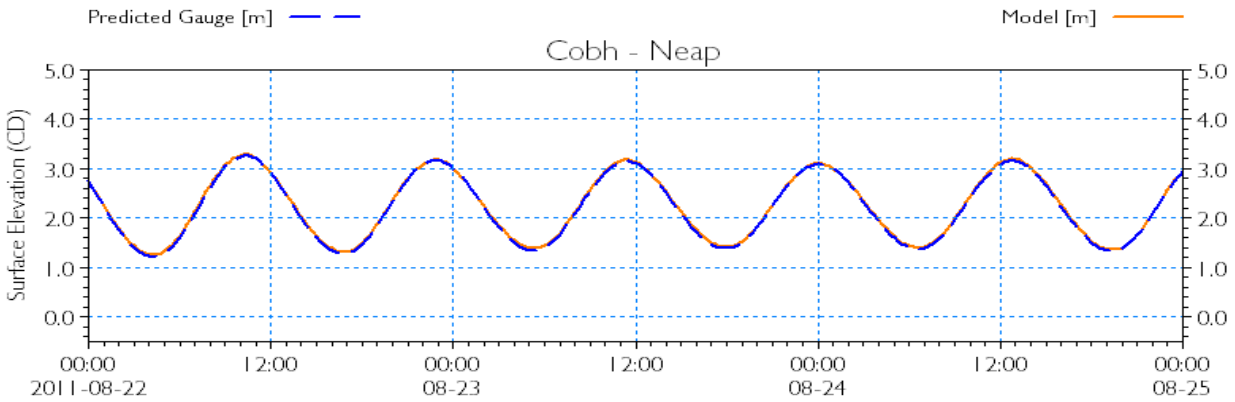

Figure 5.3: Tidal Elevation from Gauge and Model Data - Cobh Neap tide

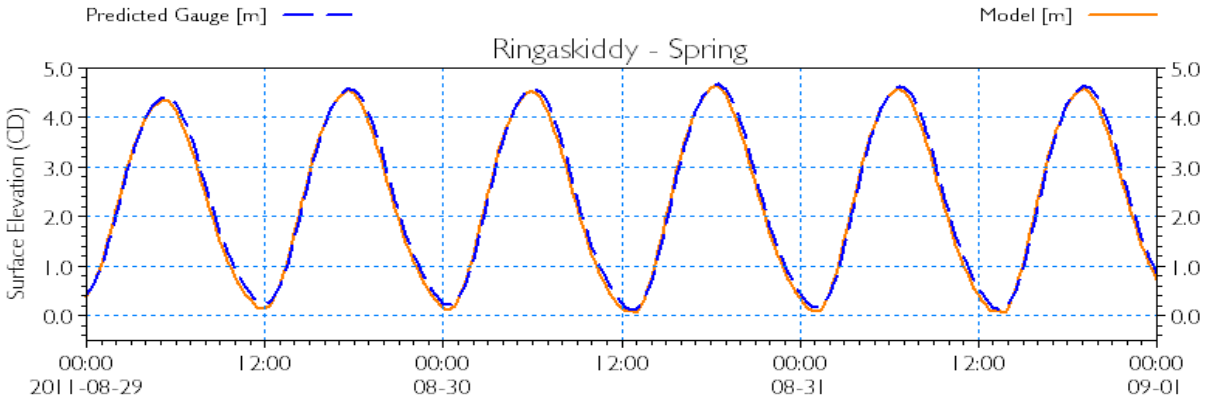

Figure 5.4: Tidal Elevation from Gauge and Model Data - Ringaskiddy Spring tide

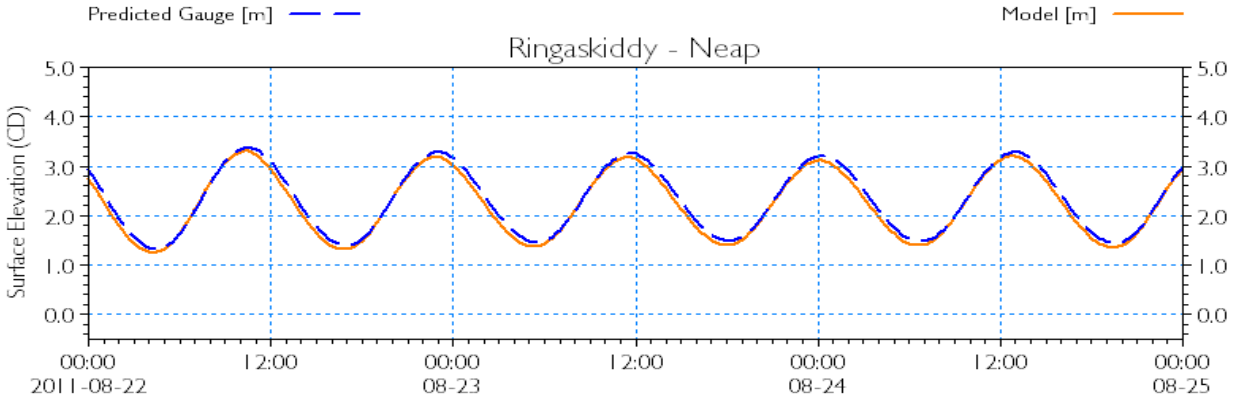

Figure 5.5: Tidal Elevation from Gauge and Model Data - Ringaskiddy Neap tide

A.2 Calibration using Admiralty Tide data

In addition to calibrating the inner Cork Harbour model using recorded gauge data, RPS also verified the model using tidal harmonics and published high and low water times/levels taken from the Admiralty Tide Tables.

The locations at which the model was calibrated are shown on Figure 5.6, with the comparison between the model and verification data shown in Figure 5.7 to Figure 5.11.

It can be seen from these figures that that the model is well calibrated in terms of water level across the dredged extent and is therefore considered fit for purpose.

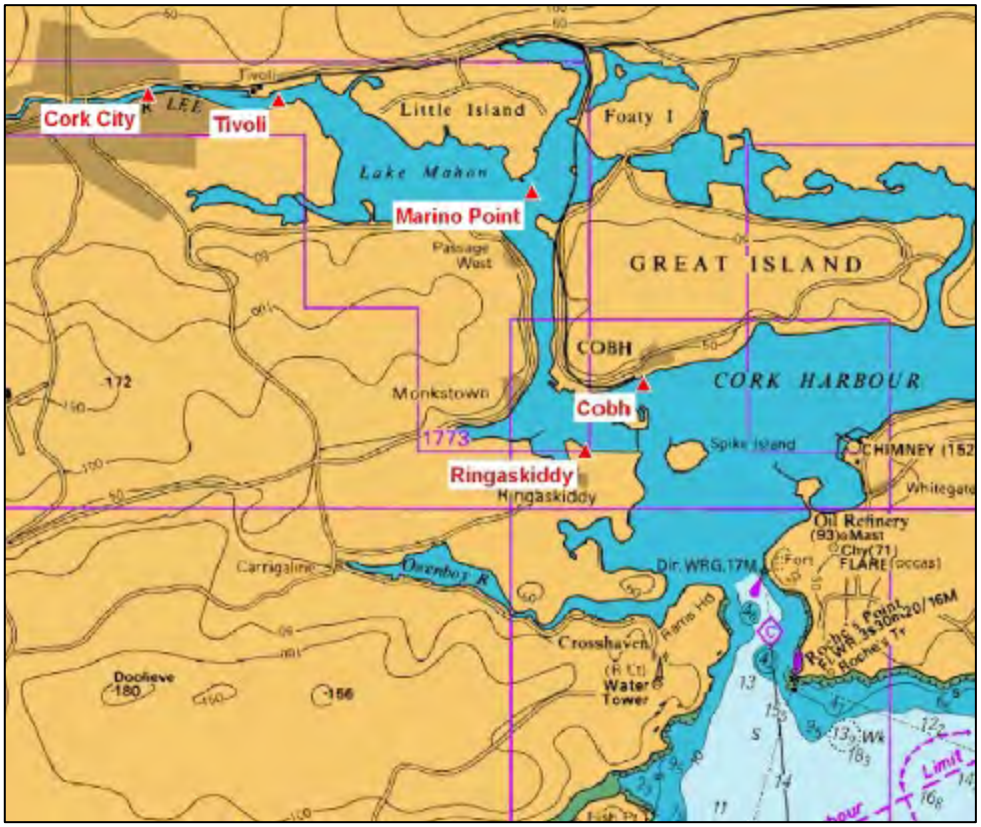

Figure 5.6: Calibration locations for data presented

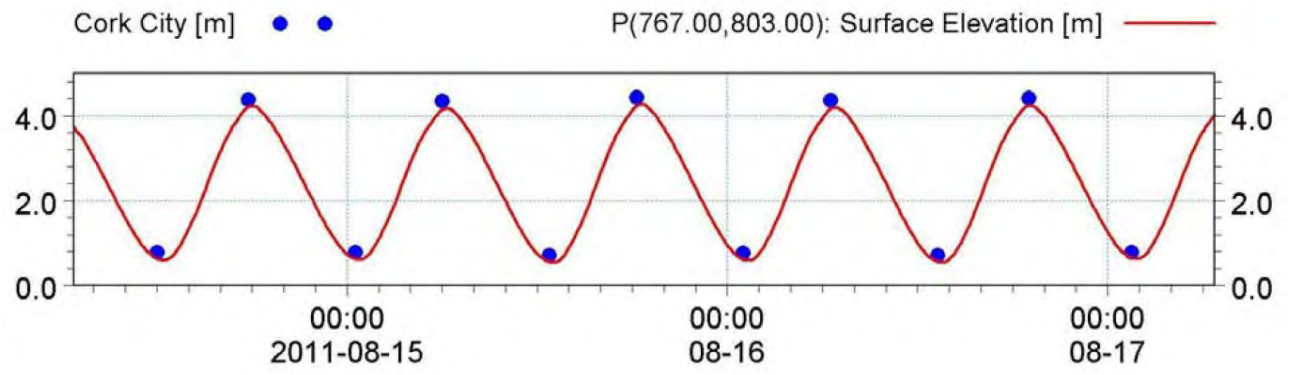

Figure 5.7: Simulated and predicted tidal elevation Cork City

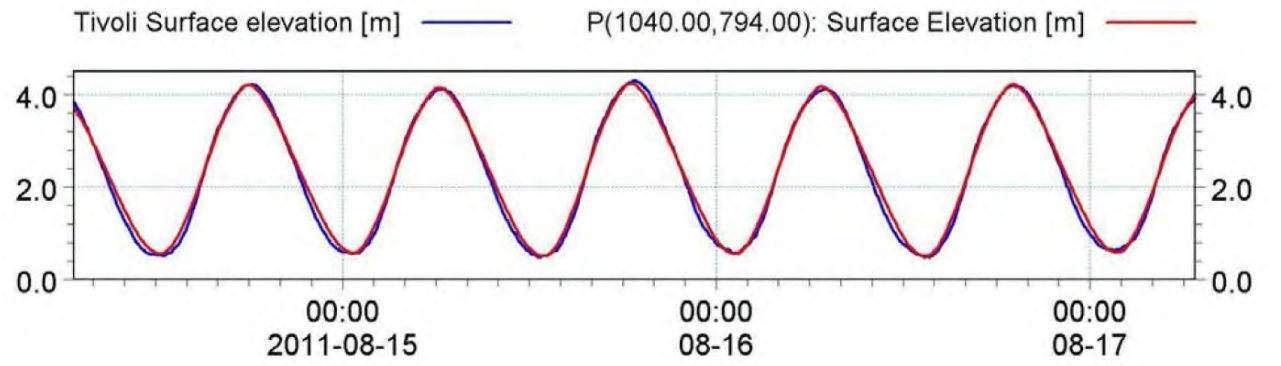

Figure 5.8: Simulated and measured tidal elevation Tivoli

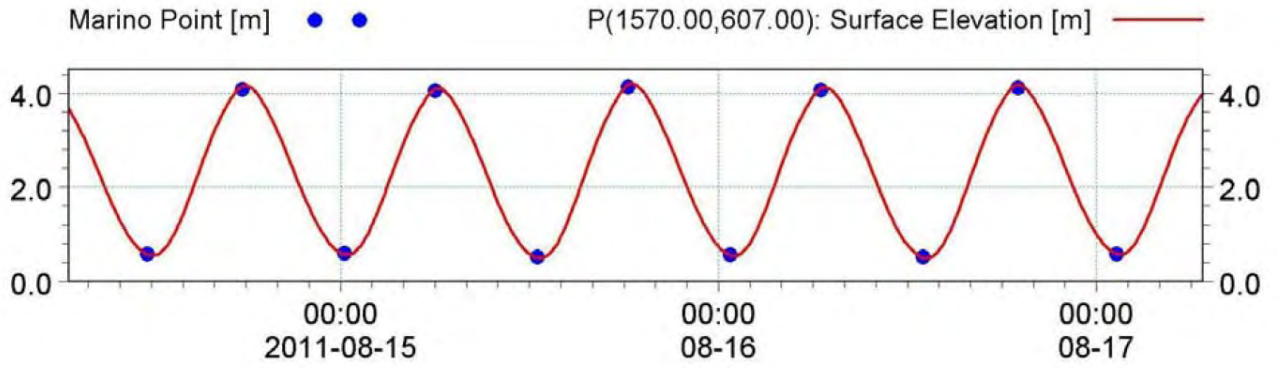

Figure 5.9: Simulated and predicted tidal elevation Marino Point

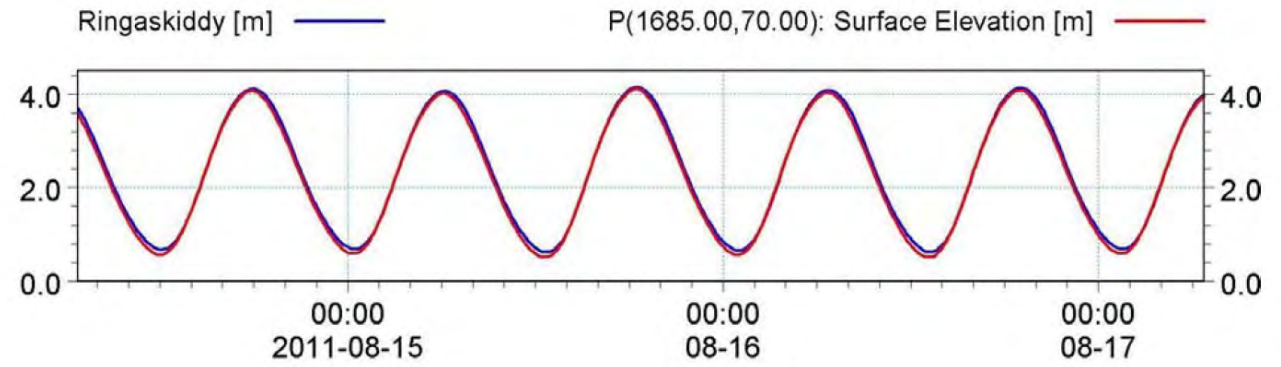

Figure 5.10: Simulated and predicted tidal elevation Ringaskiddy

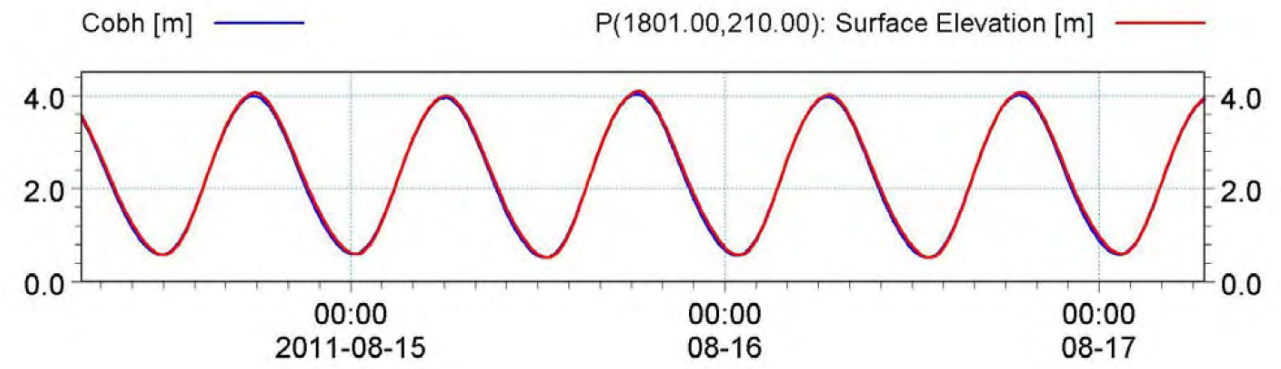

Figure 5.11: Simulated and measured tidal elevation Cobh