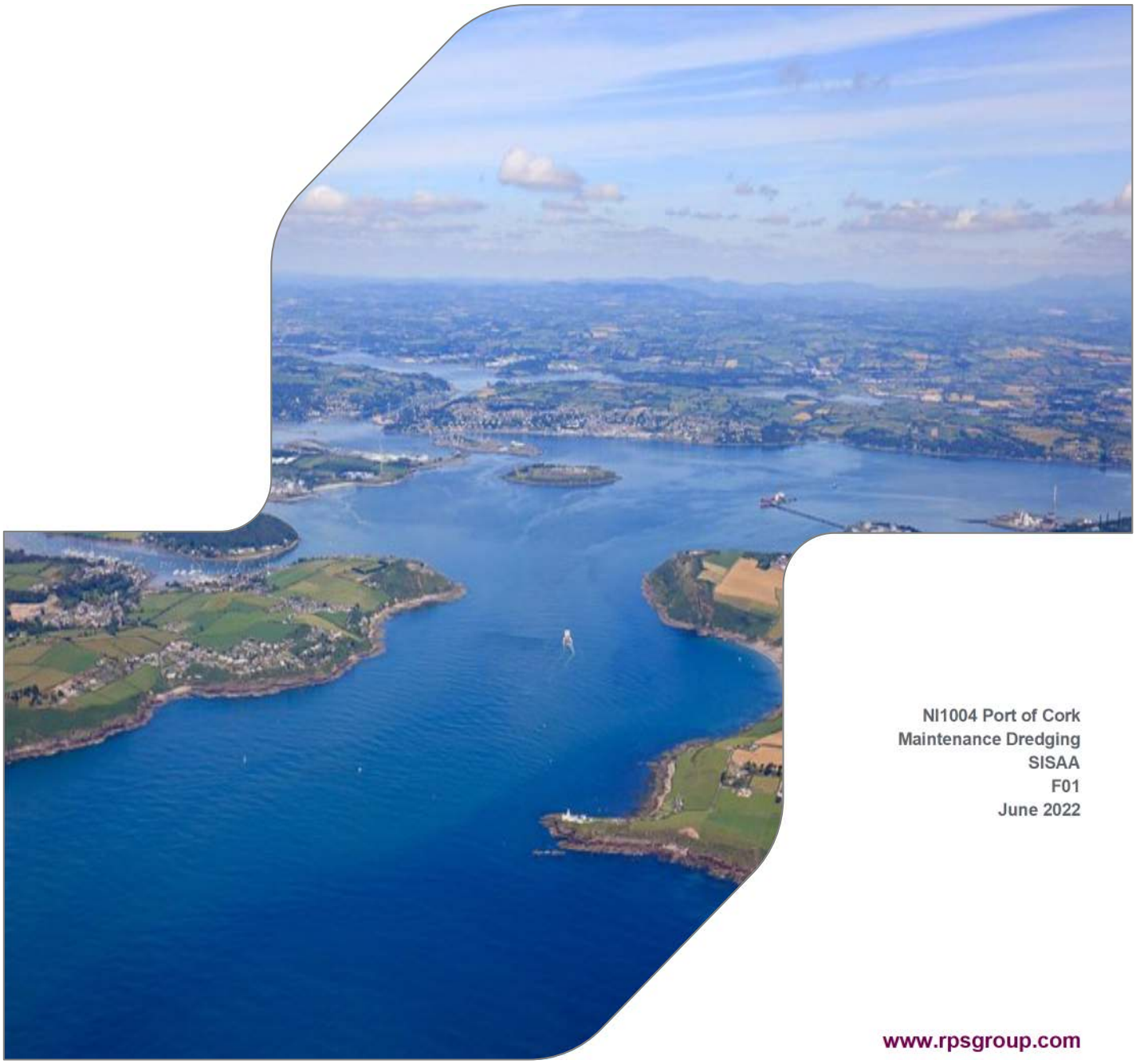
SUPPORTING INFORMATION FOR SCREENING FOR APPROPRIATE ASSESSMENT

Cork Harbour Maintenance Dredging Campaign 2022-2029



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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 2011 Regulations').

1.1 Appropriate Assessment

1.1.1 A Step-wise Process

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 for 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/public authority determines that an appropriate assessment is required, in which case it must then carry out that appropriate assessment.

According to European Commission guidance documents 'Assessment of plans and projects significantly affecting Natura 2000 sites' (EC, 2001) and the 'Managing Natura 2000 sites: The

Provisions of Article 6 of the 'Habitats' Directive 92/43/EEC' (EC, 2019), the obligations arising under Article 6 establish a step-wise procedure for Appropriate Assessment as follows, and as illustrated in Box 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 the first sentence of Article 6(3).

The second part of the procedure, governed by the second sentence of Article 6(3), 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 a negative assessment, 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) apply 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 Stage 1 screening appraisal is that significant effects on European sites can be excluded, there is no requirement to proceed to the next step.

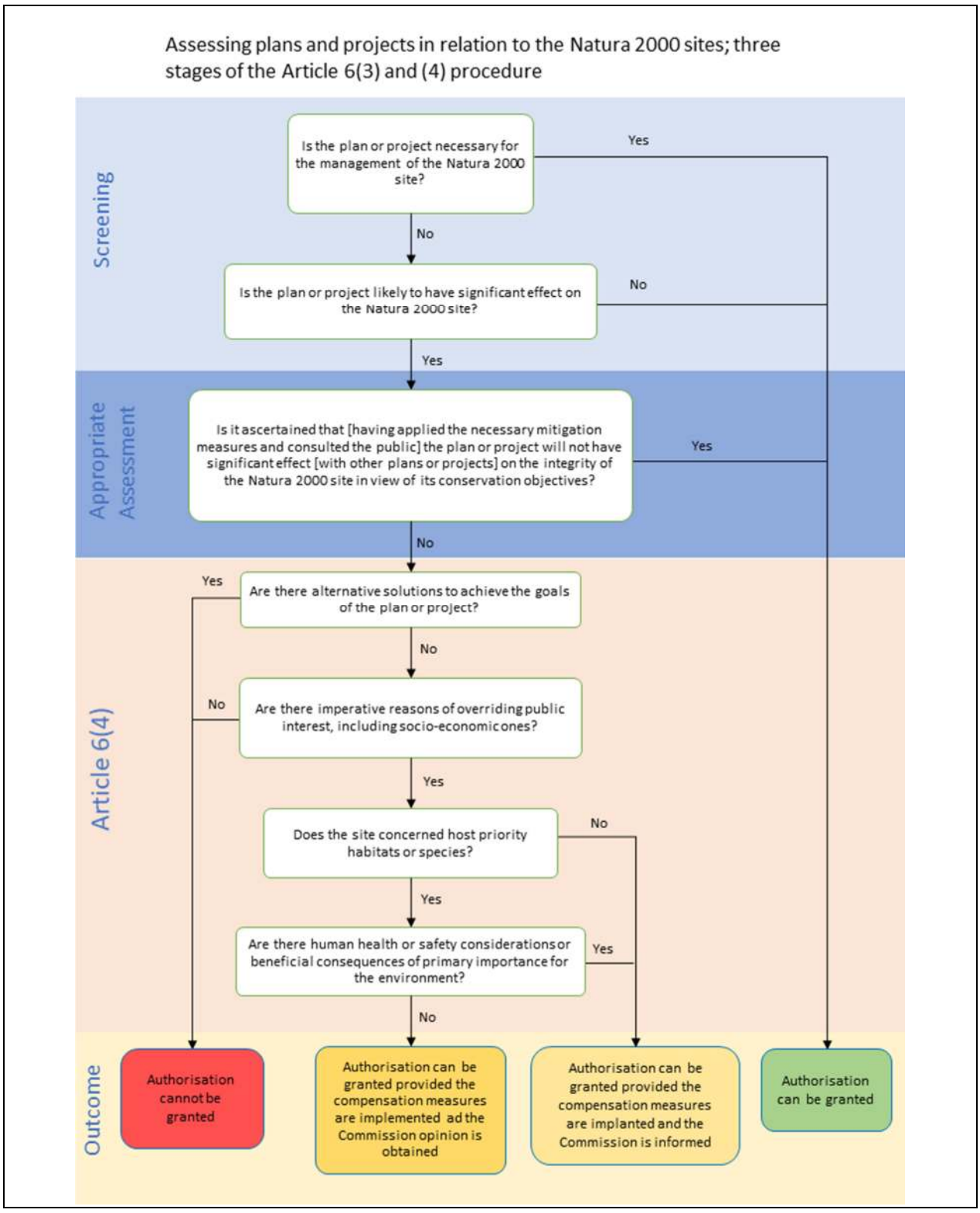

Figure 1.1: Step-wise procedure of Appropriate Assessment (from EC, 2021)

1.1.2 Domestic Transposition

1.1.2.1 Screening

Section 177U of the 2000 Act requires *inter alia* that a 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 a European site.

Regulation 42 of the 2011 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

Section 177V of the 2000 Act requires *inter alia* that an appropriate assessment carried out by the competent authority shall include a determination under Article 6(3) of the Habitats Directive as to whether or not a proposed development would adversely affect the integrity of a European site and an appropriate assessment shall be carried out by the competent authority where it has made a determination under section 177U(4) that an appropriate assessment is required, before consent is given for the proposed development.

Regulation 42 of the 2011 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.

1.2 Objective of the Document

The purpose of the Stage 1 screening appraisal to inform a screening for appropriate assessment is to provide an appraisal for the competent authorities to enable each respective competent authority to carry out a screening for appropriate assessment of the proposed maintenance dredging loading and dumping at sea activities across an eight year campaign in Cork Harbour by the Port of Cork Company (“POCC”), on European sites in view of their conservation objectives.

The Stage 1 screening appraisal to inform a screening for appropriate assessment has 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 Permit and an application to the Department of Housing, Local Government and Heritage (“DHLGH”) for a Foreshore Licence.

This report seeks to assist the EPA and the DHLGH as public authorities under the 2011 Regulations in fulfilling their obligations to conduct a screening for 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 Stage 1 screening appraisal to inform a screening 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.

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) and more recently by the Office of the Planning Regulator Practice Note (PN01) (OPR, 2021). In addition to the advice available from the Department, the European Commission has published a number of documents which provide significant guidance on the requirements of Appropriate Assessment, most notably including, '*Assessment of Plans and Projects in relation to Natura 2000 Sites – Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC'* (EC, 2021), 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 of this document. 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, Brussels (EC, 2001);
- 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. European Commission (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 (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. European Commission (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. European Commission (EC, 2013a);
- Guidelines on Climate Change and Natura 2000. European Commission (EC, 2013b);
- 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)' (IAQM, 2020);

- Office of the Planning Regulator Practice Note (PN01) 'Appropriate Assessment Screening for Development Management' (OPR, 2021); and
- 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).

EC (2000) notes that the implementation of an approach based on the precautionary principle should start with a scientific evaluation, as complete as possible, and where possible, identifying at each stage the degree of scientific uncertainty, and also that decisions taken based on the precautionary principle should be maintained so long as scientific information is incomplete or inconclusive. EC (2001) notes also that predicting the response of a receptor to a disturbance effect can be difficult and, in the absence of firm scientific information, requires a precautionary approach.

2.2 Likely Significant Effect

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 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* threshold. Plans or projects that have no appreciable effect on a European site are thereby excluded. If all plans or projects capable of having any effect whatsoever on the site were to be caught by Article 6(3), activities on or near the site would risk being impossible by reason of legislative overkill.

2.3 Mitigation Measures

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 up-to-date EU guidance (EC, 2019; EC, 2021) and the case law of the 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) and EC (2021) which refers to CJEU Case C-323/17.

2.4 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 Habitats Directive appraisal 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.

2.5 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*".

EC (2021) additionally advises that –

- an in-combination assessment is often less detailed at the screening stage than in the appropriate assessment;
- there is still a need to identify all other plans or projects that could give rise to cumulative impacts with the plan or project in question and
- if this analysis cannot reach definitive conclusions, it should at least identify any other relevant plans and projects that should be scrutinised in more detail during the appropriate assessment.

2.6 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.

2.6.1 Site-Specific Conservation Objectives

NPWS began preparing detailed Site-Specific Conservation Objectives ("SSCOs") for European sites in 2011. The European sites within Dublin Bay 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 June 2022.

2.7 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 an 8-year permit to dredge and dump at sea, a maximum dredge volume of 4,700,145m^3 (including contingency volumes). This consists of both primary and secondary dredging campaigns. Historically, the primary dredging campaigns are normally undertaken every 2 to 3 years.

Table 3.1 below summarises the maintenance dredging requirements within Cork Harbour.

The volume to be dredged in any specific year is not fixed, as an alternative it is proposed to set a maximum annual disposal limit based on the historical permitted tonnage for a primary campaign. Furthermore, primary campaigns will not occur in sequential years. This will replicate the historical practice and provide the Port with flexibility. Secondary dredge campaigns may occur in intervening years.

The location and extent of the proposed dredge areas within Cork Harbour are illustrated in **Figure 3.2** below. This figure indicates that the proposed dredge areas extend from the Port of Cork at Cork City, to beyond Roches Point at the entrance to the harbour. As illustrated in **Figure 3.1** the licensed disposal site is located approximately 8km south of Roches Point.

As summarised in

Table 3.1 the proposed method of dredging includes:

- Trailer Suction Hopper Dredger (“TSHD”)
- Water Injection Dredger (“WID”)
- Mechanical Dredger
- Plough Dredger

The method of dredging in each area has been determined based on bed level conditions, dredging volumes and hydrodynamic conditions. The primary method of dredging for the Cork Harbour operations will involve the use of a TSHD technique. This method involves lowering a drag head to the seabed and using powerful onboard pumps to suck sand, silt and clay material from the seabed. Dredged material will be stored in an onboard hopper before being brought to the licensed disposal site to dump the dredged material.

3.1 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, Aquatic Services Unit commissioned Socotec to analyse 13 discrete sediment samples collected from throughout Cork Harbour.

Although the material testing did not include a full Particle Size Analyse, the material was examined to quantify the percentage of sand and silt material. The results of this assessment are presented in

Table 3.2 below. As demonstrated by this information, approximately 87.2% of the material to be dredged was identified as silt whilst the remaining 12.8% 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 below.

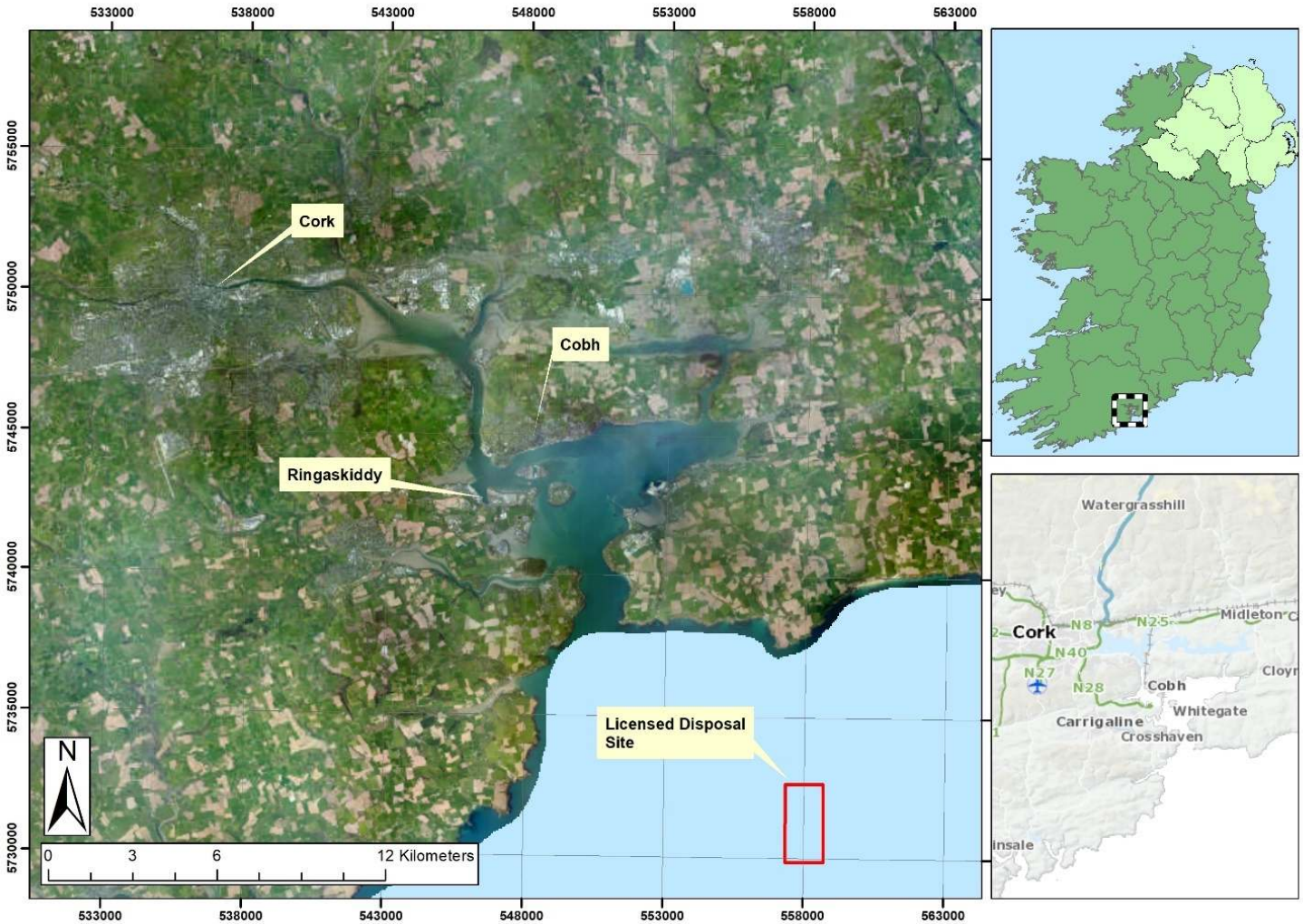

Figure 3.1: Location of Cork Harbour in relation to the existing licensed disposal site

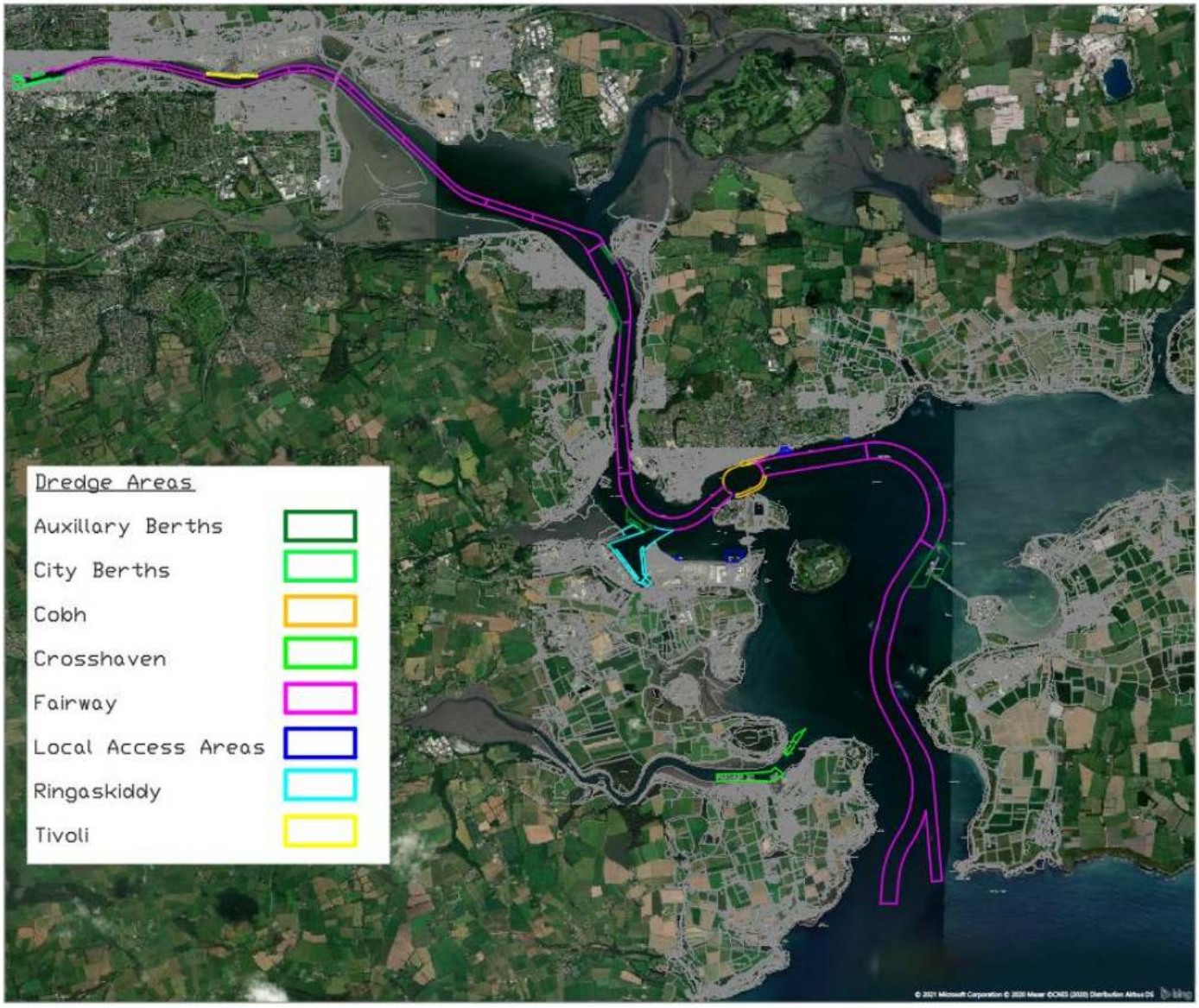

Figure 3.2: Location of the proposed dredging locations within Cork Harbour

Table 3.1: Summary of proposed maintenance dredging requirements at Cork Harbour

Area Priority	Area Names	Method of Dredging	Secondary Year Years 1,3,4,6,7	Primary Year Year 2,5,8
			Dry Tonnes	
Primary Areas	Approach Channel/Fairways	TSHD supported by WID/bed-leveller		195,000
		TSHD /Mechanical	97,500	
		WID/Plough	15,000	
	Cork City Berths	TSHD supported by WID/bed-leveller		20,000
		TSHD /Mechanical	10,000	
		WID/Plough	2,500	
	Ringaskiddy Basin and Berths	TSHD supported by WID/bed-leveller		140,000
		TSHD /Mechanical	70,000	
		WID/Plough	32,500	
Secondary Areas	Tivoli Berths	TSHD supported by WID/bed-leveller		10,000
		TSHD /Mechanical	5,000	
		WID/Plough	1,250	
	Cobh Turning Circle and Berth	TSHD supported by WID/bed-leveller		7,200
		TSHD /Mechanical	3,600	
		WID/Plough	900	
	Auxiliary Berths	TSHD supported by WID/bed-leveller		10,000
		TSHD /Mechanical	5,000	

		WID/Plough	1,250	
Other Areas	Local Access Dredging Areas	WID/Plough	15,000	15,000
		Mechanical	5,000	
	Crosshaven	WID/Plough	21,000	

Table 3.2: Summary the Dumping at Sea material analyses report from Cork Harbour

Sample ID code	Position Latitude (dd mm.mmm)	Position Longitude (dd mm.mmm)	Particle size >2mm %	Particle size <2mm >63um %	Particle size <63um %
CQ1	N 51.899309	W -8.457703	0.0	8.5	91.5
CQ2	N 51.900180	W -8.457756	0.0	9.2	90.8
CQ3	N 51.902084	W -8.446370	0.0	4.3	95.7
T4	N 51.900383	W -8.420232	0.0	0.9	99.1
BB5	N 51.901119	W -8.397153	0.0	0.6	99.4
LM6	N 51.893669	W -8.380717	0.0	7.9	92.1
LM7	N 51.883644	W -8.360465	0.2	59.4	40.4
H1	N 51.868510	W -8.331579	0.1	31.8	68.1
R1	N 51.837750	W -8.323635	5.3	4.6	90.1
R2	N 51.836445	W -8.327514	0.0	10.0	90.0
R3	N 51.835076	W -8.328577	0.0	6.2	93.8
R4	N 51.832540	W -8.326194	0.0	2.7	97.3
R5	N 51.831872	W -8.323912	0.3	15	84.7
		Average [%]	0.5	12.4	87.2

3.2 Summary of works

The proposed maintenance 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.

3.3 Sediment plumes generated from the dredging activity

3.3.1 Characterisation of dredging activity

Given the extensive nature of the proposed dredging works it was necessary to model the dispersion of sediment plumes arising from dredging operations.

As detailed in

Table **3.1**, the total volume of material to be dredged during the primary dredging years equates to c. 669,855m3 (inclusive of max contingency) compared to a total dredge volume of 356,667m3 (inclusive of max contingency) during the secondary dredge years. In the primary maintenance dredging years, approximately 95% of the 669,855m3 of material is to be dredged using TSHD. The primary year dredging activities modelled represent those campaigns where the greatest amounts of dredge material are removed from the seabed and provide a worst case scenario for an assessment of effects of loading and disposal at sea in relation to suspended sediments and deposition and potential effects upon European sites.

Taking a “worst case scenario” (highest production) approach, modelling assumed that the TSHD operations would be undertaken on a 24/7 basis. Based on this assumption, it was anticipated that the TSHD operations during the primary maintenance dredging year would be completed over the course of 16 days and *c.*123 individual dredging cycles. Longer campaigns with lower production rates are likely to occur. A typical dredging cycle which has been used for plume modelling and the Habitats Directive appraisals is presented in

Table **3.3** below. These times can vary between areas due to manoeuvring/access issues as well as tidal currents and propulsion power of the dredger engaged.

Table 3.3: 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	65	
Dumping	10	
Sailing from Dump	55	

The path that was used to define the location and movement of the dredging source term in the model is presented in Figure 3.2. This dredge path is reflective of the dredging operations summarised in Figure 2.1 excluding any areas that would be dredging used a Water Injection Dredging (WID) approach (i.e. in the area of Crosshaven Pier).

The composition of material to be dredged was determined via a series of historical sediment samples that were analysed for previous maintenance dredging applications (see Section 2.1 of Plume Dispersion Repot at Appendix A). The results of these samples indicated that approximately 87.2% of material to be dredged was comprised of silt. Given the lack of detailed sediment grading curves for these samples, 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 3.4** below.

The actual loss from the TSHD draghead during any loading cannot be practically measured in real-time. However, for assessment the percentage of fines lost at the TSHD head was assumed to be 3%, this equated to a loss of *c.*45.3kg/s during active dredging times (i.e. 30min of every 3hr dredging cycle). This loss was introduced as a source term that traversed the dredger path illustrated in Figure 3.2.

It should be noted that the remaining 12.8% 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 3.4: 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 STAGE 1 SCREENING APPRAISAL FOR APPROPRIATE ASSESSMENT

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

The proposed POCC maintenance dredging programme for the next 8 year relates to the ongoing maintenance of the Inner Lee Channel and the Approach Channel to the Port's various berthing facilities from Roches Point over seabed which has been subject to previous and historical dredging. The purpose of the proposed development is to ensure that the channel depths supported are maintained at the existing dredged depths to continue to enable the safe passage of vessels.

On this basis, the proposed development is not directly connected with or necessary to the management of any site as a European Site.

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 2011 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 June 2022.

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

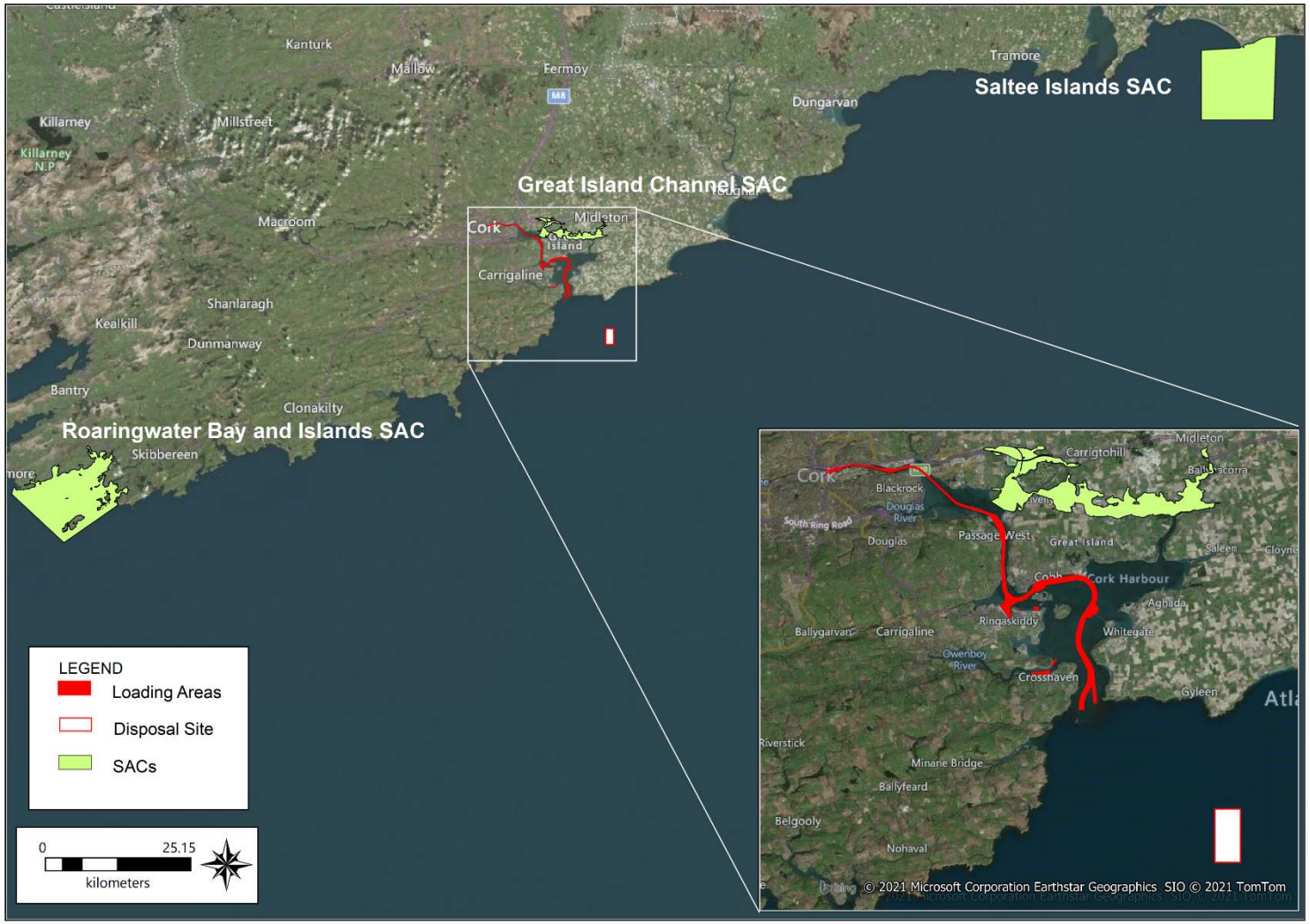

Figure 4.1: SACs considered in the Habitats Directive Appraisals

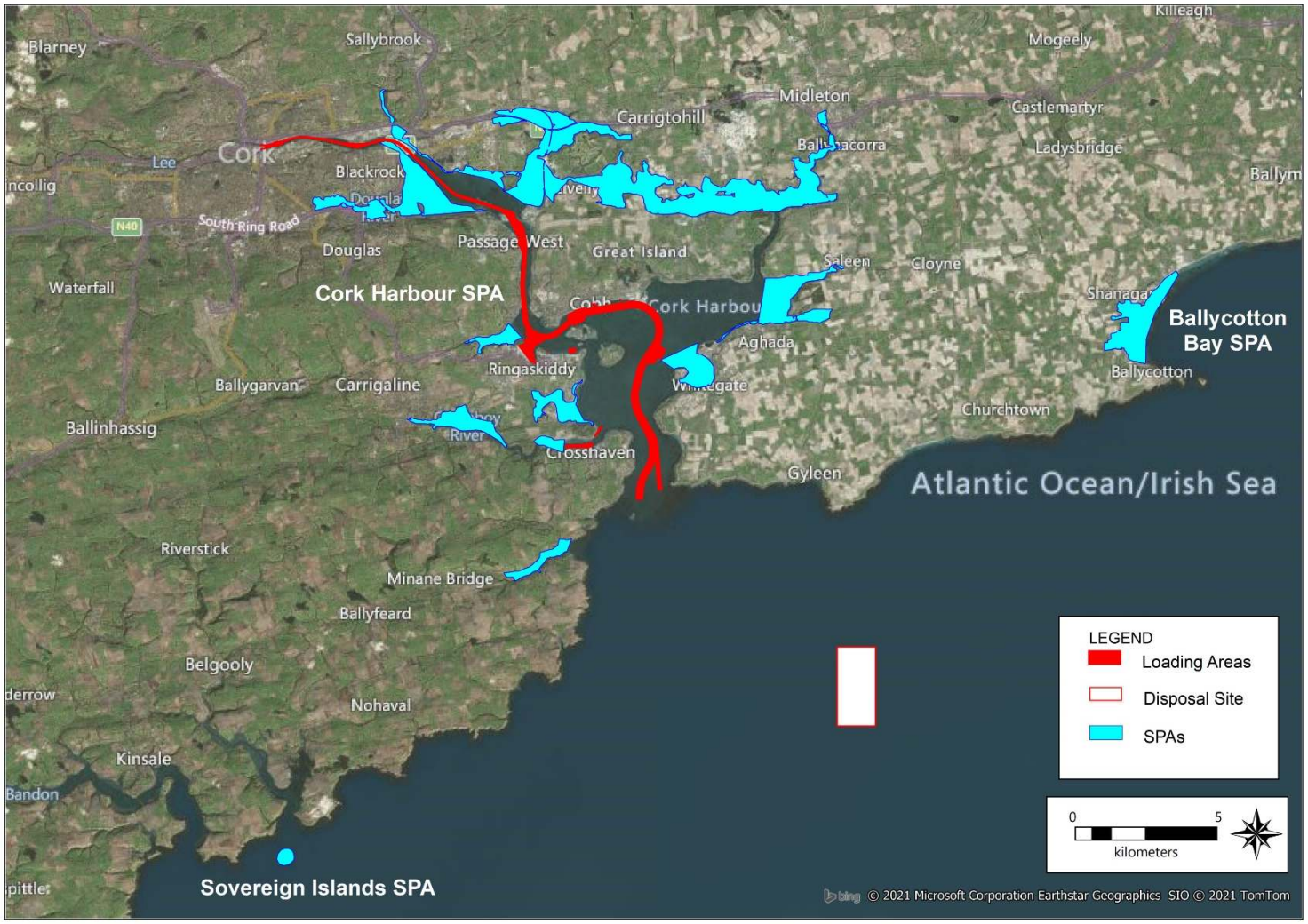

Figure 4.2: SPAs considered in the Habitats Directive Appraisals

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:			c.500m from proposed loading activities 34km by sea from dump site
		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	

Site Code	Site Name	Qualifying Interests & Conservation Objectives			Distance from proposed development
		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)	
		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 (16/12/15)** 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]			Adjacent to the proposed loading activities 16.25km by sea from dump site
		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	

Site Code	Site Name	Qualifying Interests & Conservation Objectives			Distance from proposed development
		• 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**	
		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	

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 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]			
		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	

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 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	
		• 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	

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 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 breeding pair	Mean number	No significant decline	
		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**			36km by sea from proposed loading activities 26.5km by sea from proposed dump site

		• Teal *Anas creca* [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	
		• 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	
		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	
		• 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 281 hectares, other than that occurring from natural patterns of variation.	
IE004124	Sovereign Islands SPA	**Conservation Objectives Specific Version 1.0 (26/08/14)** To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA: • Cormorant *Phalacrocorax carbo* [A017]			29.8km by sea from proposed loading area 31.27km by sea from proposed dump 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 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 area is in close proximity to two European sites, those being Great Island Channel SAC (within 500m) and Cork Harbour SPA (adjacent). Dredging is not proposed within these European sites. There will be no direct habitat loss and there will be no LSEs as a result of direct habitat loss.

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 a number of areas shown in Figure 3.2 over time, and on each occasion will result in temporary suspension and release of sediments at the loading sites. 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. Temporary suspension and release of sediments will also occur at the dump site on each dredge/dump run cycle.

Suspended sediments and sedimentation presents a potential pathway for likely significant water quality and habitat deterioration effects. The suspended sediment, including silts and mud is the single main pollutant to the aquatic environment generated by the proposed maintenance 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 will involve the dredging of sediments within 500m of Great Island Channel SAC and 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, Target 1 requires that the permanent habitat area is stable or increasing, subject to natural processes; and Target 2 requires that the 'Mixed sediment to sandy mud with polychaetes and oligochaetes community complex' is conserved in a natural condition.

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, whilst the permanent area of the habitat (Target 1) will not be undermined, it is not possible to exclude the possibility of LSEs as a result of elevated sediment loading on the marine community complex (Target 2) of Great Island Channel SAC in the absence of mitigation measures.

4.4.2.3.2 Cork Harbour SPA

The proposed works which will involve the dredging of sediments within close proximity to 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 discount 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 discount 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 a LSE cannot be discounted.

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 construction or operation of landside elements of the proposed project 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 maintenance dredging project, 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 26km from the proposed dump site and more than 23km from the proposed Maintenance dredging Project, 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, some aspects of the proposed works will require activities producing underwater noise, including:

- Dredging of approximately 4,700,145 m^3 material from Cork Harbour over the next 8 years to maintain the prior depth of the Navigation Channels.
- Dispose of the dredged material at the proposed licensed 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.

A review of pinniped and cetacean marine mammals in Cork Harbour and the western Celtic Sea including records from the IWDG Sightings dataset from 2010 to 2020 was undertaken.

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 and River Lee 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 50nmls of Cork Harbour 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 Saltee 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:

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 over 90km by sea from this SAC. LSEs upon the grey seal population in Roaringwater Bay and 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 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 localised to the loading areas or dump site, far 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 a MMRA is broader than this narrow objective. The MMRA 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 2.3 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 maintenance dredging project, whereas other sites considered occur at much greater distances where the prospect of noise or visual disturbance caused by the proposed maintenance dredging is not likely.

The proposed maintenance 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 maintenance 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 4.3.2.2. 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 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 maintenance 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 maintenance 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 maintenance 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.

There are no other dredging activities planned or already licenced within Cork Harbour, other than those presented here.

On this basis, a range of other projects were considered in terms of their potential to have in-combination effects with the proposed maintenance 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. Results are presented in Table 4.2 below.

Table 4.2: Other Dredging Projects Considered for In-combination Effects

Reg No.	DAFF Ref.	Applicant
S005-01	E3/2/64 Vol 2	Department of Defence (Haulbowline Naval Base)
S005-02	N/A	Department of Defence (Haulbowline Naval Base)
S0013-02	393	Port of Cork Company
S0021-01	N/A	Port of Cork Company
S0021-02	N/A	Port of Cork Company
S0032-01		Cork County Council
S0034-01		PSE Kinsale Energy Limited
S0035-01		PSE Seven Heads Limited

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.**

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

4.5.3 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.**

4.5.4 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.**

4.5.5 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**.

4.5.6 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.

4.5.7 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 maintenance 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 or 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 or 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 maintenance 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	✓	✓	✓	✓

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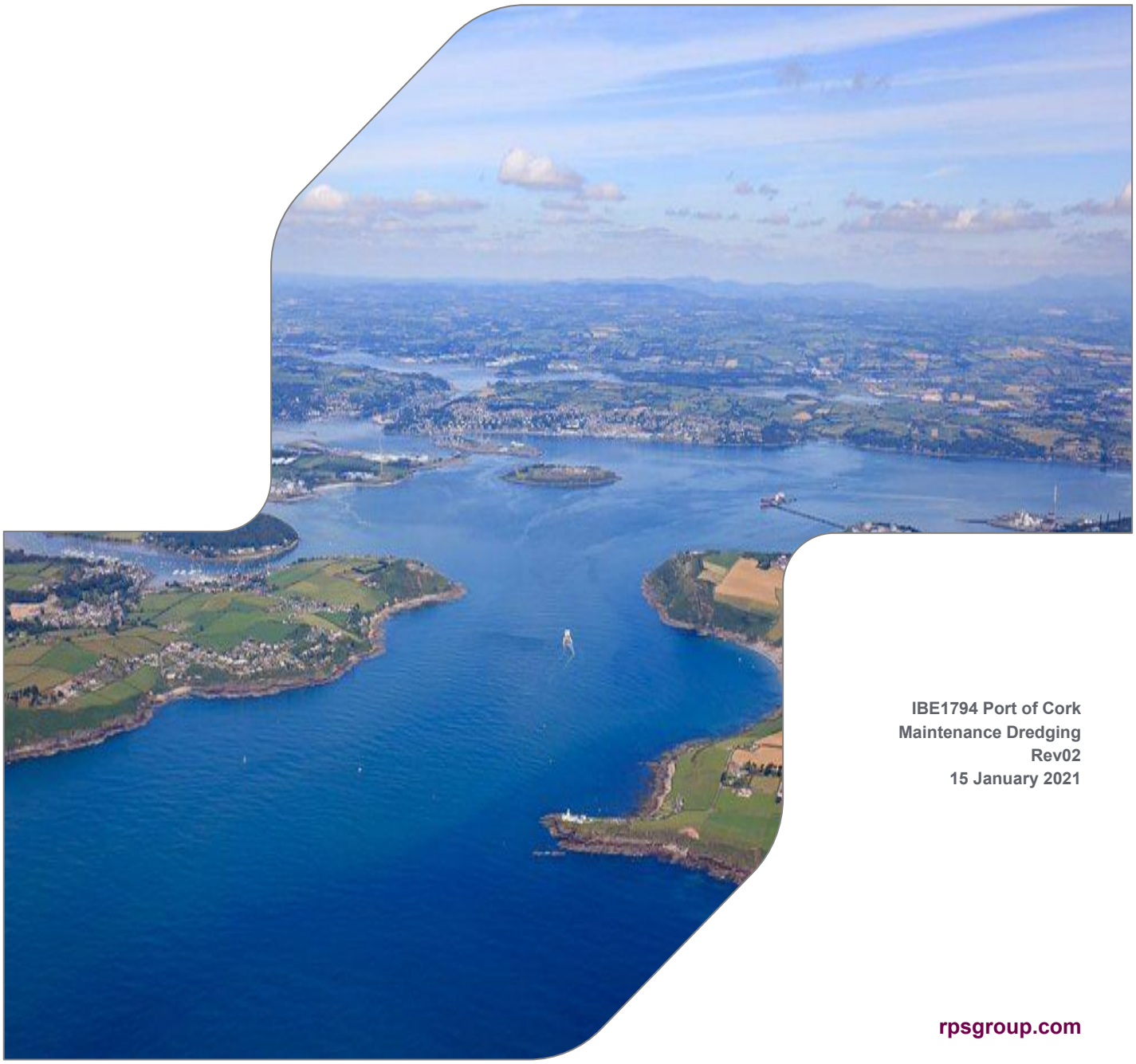
Appendices

Appendix A: Sediment Plume Dispersion Assessment

PORT OF CORK MAINTENANCE DREDGING

Sediment Plume Dispersion Assessment



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1 INTRODUCTION

Port of Cork engaged the services of RPS for the provision of plume dispersion information relating to maintenance dredging throughout Cork Harbour. As part of the licensing for future dredging 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 Cork Harbour is illustrated in Figure 1.1 below.

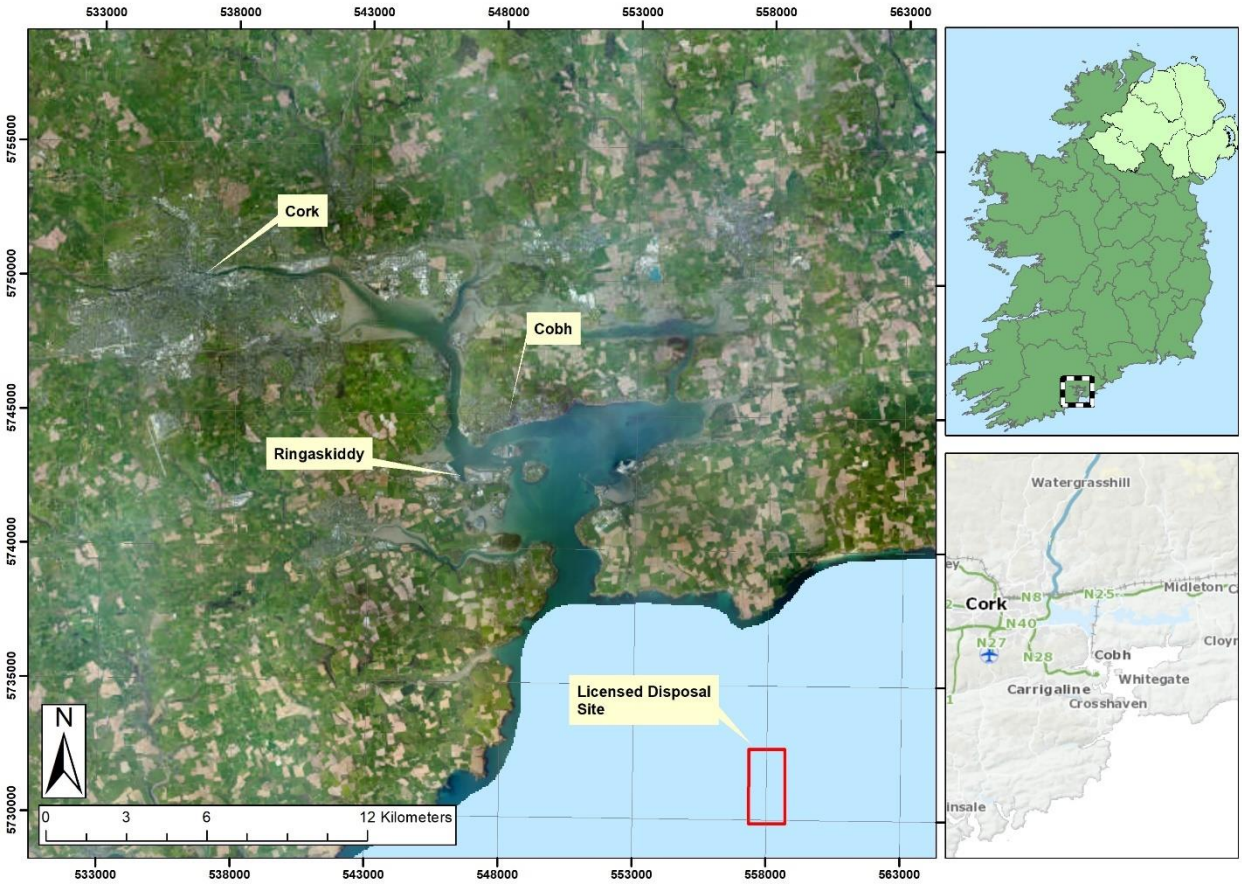

Figure 1.1: Location of Cork Harbour in relation to the existing licensed disposal site

2 DESCRIPTION OF DREDGING WORKS

Cork Port Authority have requested an 8-year permit be granted for a maximum dredge volume of 4,700,145m^3 (including contingency volumes). This consists of both primary and secondary dredging campaigns. Historically, the primary dredging campaigns are normally undertaken every 2 to 3 years. Table 2.1 below summarises the maintenance dredging requirements within Cork Harbour.

The volume to be dredged in any specific year is not fixed, as an alternative it is proposed to set a maximum annual disposal limit based on the historical permitted tonnage for a primary campaign. Furthermore, primary campaigns will not occur in sequential years. This will replicate the historical practice and provide the Port with flexibility. Secondary dredge campaigns may occur in intervening years.

Table 2.1: Summary of proposed maintenance dredging requirements at Cork Harbour

Area Priority	Area Names	Method of Dredging	Secondary Year Years 1,3,4,6,7	Primary Year Year 2,5,8
			Dry Tonnes	
Primary Areas	Approach Channel/Fairways	TSHD supported by WID/bed-leveller		195,000
		TSHD /Mechanical	97,500	
		WID/Plough	15,000	
	Cork City Berths	TSHD supported by WID/bed-leveller		20,000
		TSHD /Mechanical	10,000	
		WID/Plough	2,500	
	Ringaskiddy Basin and Berths	TSHD supported by WID/bed-leveller		140,000
		TSHD /Mechanical	70,000	
		WID/Plough	32,500	
Secondary Areas	Tivoli Berths	TSHD supported by WID/bed-leveller		10,000
		TSHD /Mechanical	5,000	
		WID/Plough	1,250	
	Cobh Turning Circle and Berth	TSHD supported by WID/bed-leveller		7,200
		TSHD /Mechanical	3,600	
		WID/Plough	900	
	Auxiliary Berths	TSHD supported by WID/bed-leveller		10,000
		TSHD /Mechanical	5,000	
		WID/Plough	1,250	
Other Areas	Local Access Dredging Areas	WID/Plough	15,000	15,000
		Mechanical	5,000	
	Crosshaven	WID/Plough	21,000	

The location and extent of the proposed dredge areas within Cork Harbour are illustrated in Figure 2.1 below. This figure indicates that the proposed dredge areas extend from the Port of Cork at Cork City, to beyond Roches Point at the entrance to the harbour. As illustrated in Figure 1.1 the licensed disposal site is located approximately 8km south of Roches Point.

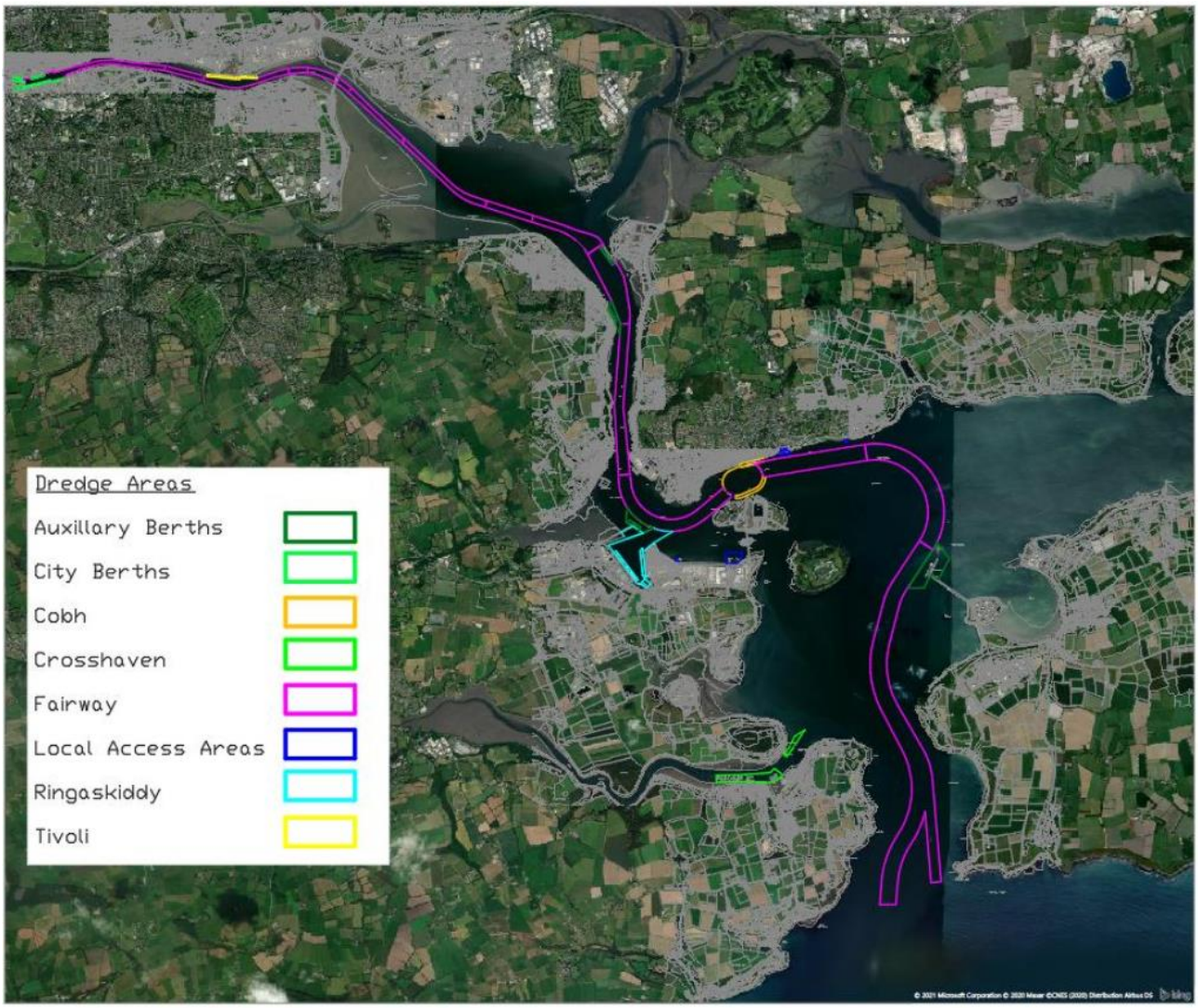

Figure 2.1: Location of the proposed dredging locations within Cork Harbour

As summarised in Table 2.1 the proposed method of dredging includes:

- Trailer Suction Hopper Dredger (TSHD)
- Water Injection Dredger (WID)
- Mechanical Dredger
- Plough Dredger

The method of dredging in each area has been determined based on bed level conditions, dredging volumes and hydrodynamic conditions. The primary method of dredging for the Cork Harbour operations will involve the use of a TSHD. This method involves lowering a drag head to the seabed and using powerful onboard pumps to suck sand, silt and clay material from the seabed. Dredged material will be stored in an onboard

hopper before it navigates to the licensed disposal site to dump the dredged material. To reduce sediment dispersion, the TSHD operations will be undertaken with no overspill from the hopper.

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, Aquatic Services Unit commissioned Socotec to analyse 13 discrete sediment samples collected from throughout Cork Harbour.

Although the material testing did not include a full Particle Size Analyse, the material was examined to quantify the percentage of sand and silt material. The results of this assessment are presented in Table 2.2 below. As demonstrated by this information, approximately 87.2% of the material to be dredged was identified as silt whilst the remaining 12.8% 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 2.2: Summary the Dumping at Sea material analyses report from Cork Harbour

Sample ID code	Position Latitude (dd mm.mmm)	Position Longitude (dd mm.mmm)	Particle size >2mm %	Particle size <2mm >63um %	Particle size <63um %
CQ1	N 51.899309	W -8.457703	0.0	8.5	91.5
CQ2	N 51.900180	W -8.457756	0.0	9.2	90.8
CQ3	N 51.902084	W -8.446370	0.0	4.3	95.7
T4	N 51.900383	W -8.420232	0.0	0.9	99.1
BB5	N 51.901119	W -8.397153	0.0	0.6	99.4
LM6	N 51.893669	W -8.380717	0.0	7.9	92.1
LM7	N 51.883644	W -8.360465	0.2	59.4	40.4
H1	N 51.868510	W -8.331579	0.1	31.8	68.1
R1	N 51.837750	W -8.323635	5.3	4.6	90.1
R2	N 51.836445	W -8.327514	0.0	10.0	90.0
R3	N 51.835076	W -8.328577	0.0	6.2	93.8
R4	N 51.832540	W -8.326194	0.0	2.7	97.3
R5	N 51.831872	W -8.323912	0.3	15	84.7
		Average [%]	0.5	12.4	87.2

3 MODELLING METHODOLOGY

3.1 Overview

In order 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. Initially, hydrodynamic modelling was undertaken and calibrated for RPS' Cork Harbour model, details of the model calibration process are presented in Appendix A.

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 fuller 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
- 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 maintenance dredging operations included dredging within Cork Harbour 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 within the fairway approach channels to *c.*70m^2 across the wider flat areas. The mesh structure and resolution of this model is illustrated in Figure 3.3.

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.

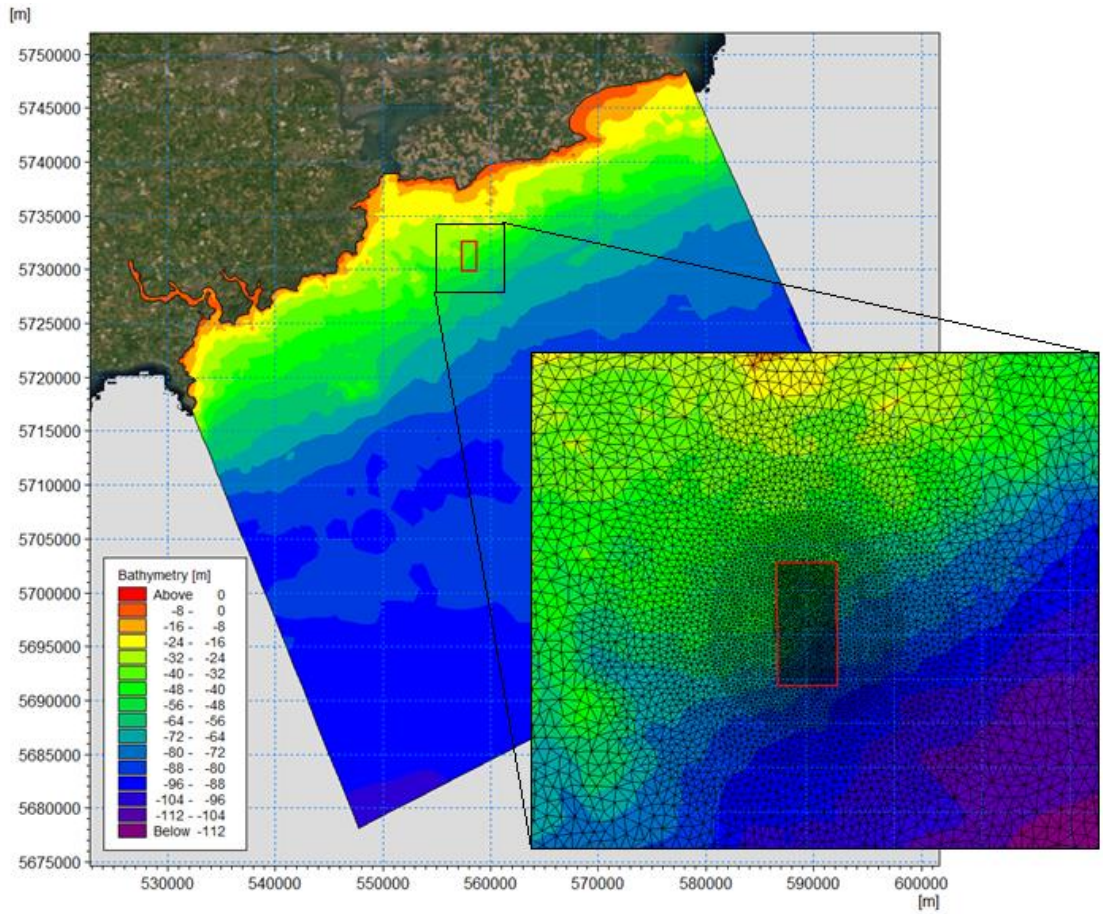

Figure 3.1: Extent and bathymetry of the Outer Cork model with high resolution around the disposal shown in the inset

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

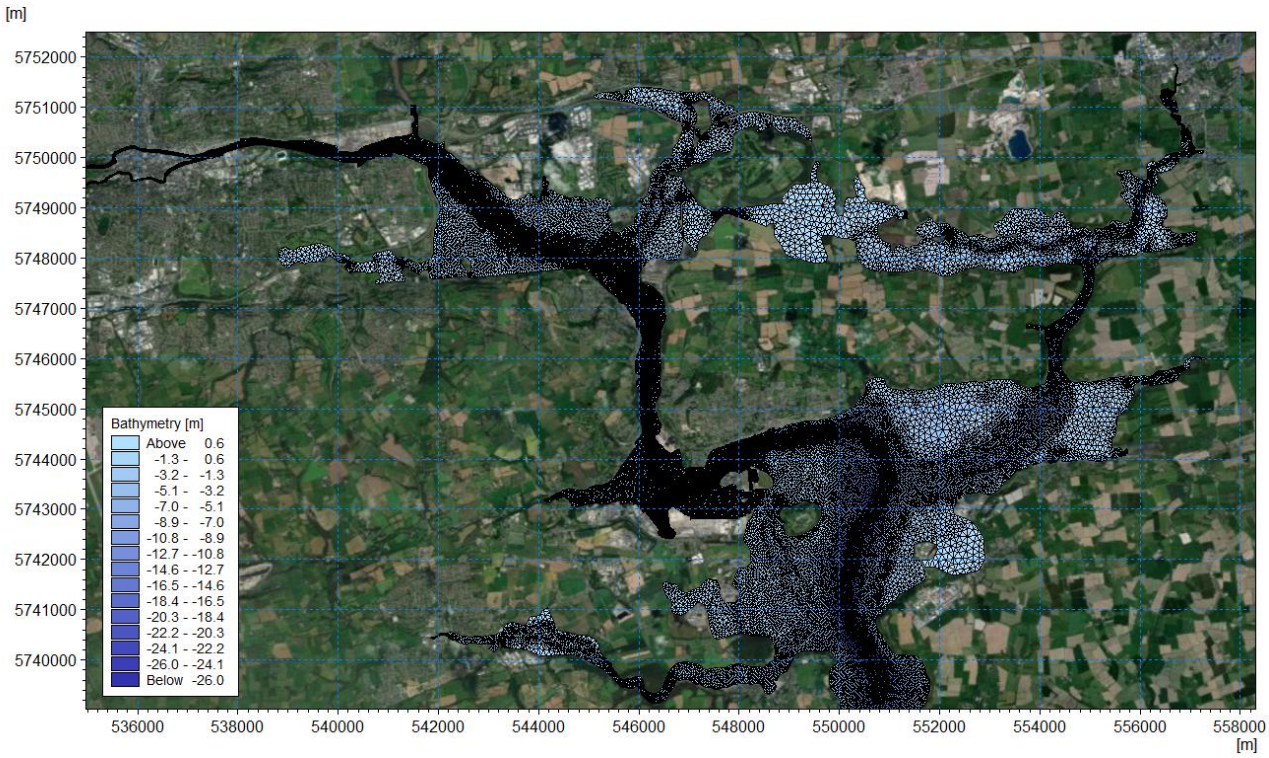

Figure 3.3: Mesh resolution and structure of the inner Cork Harbour model

3.4 Boundary Conditions

The tidal boundary data used for the Cork Harbour models was generated by 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 3.4.

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.

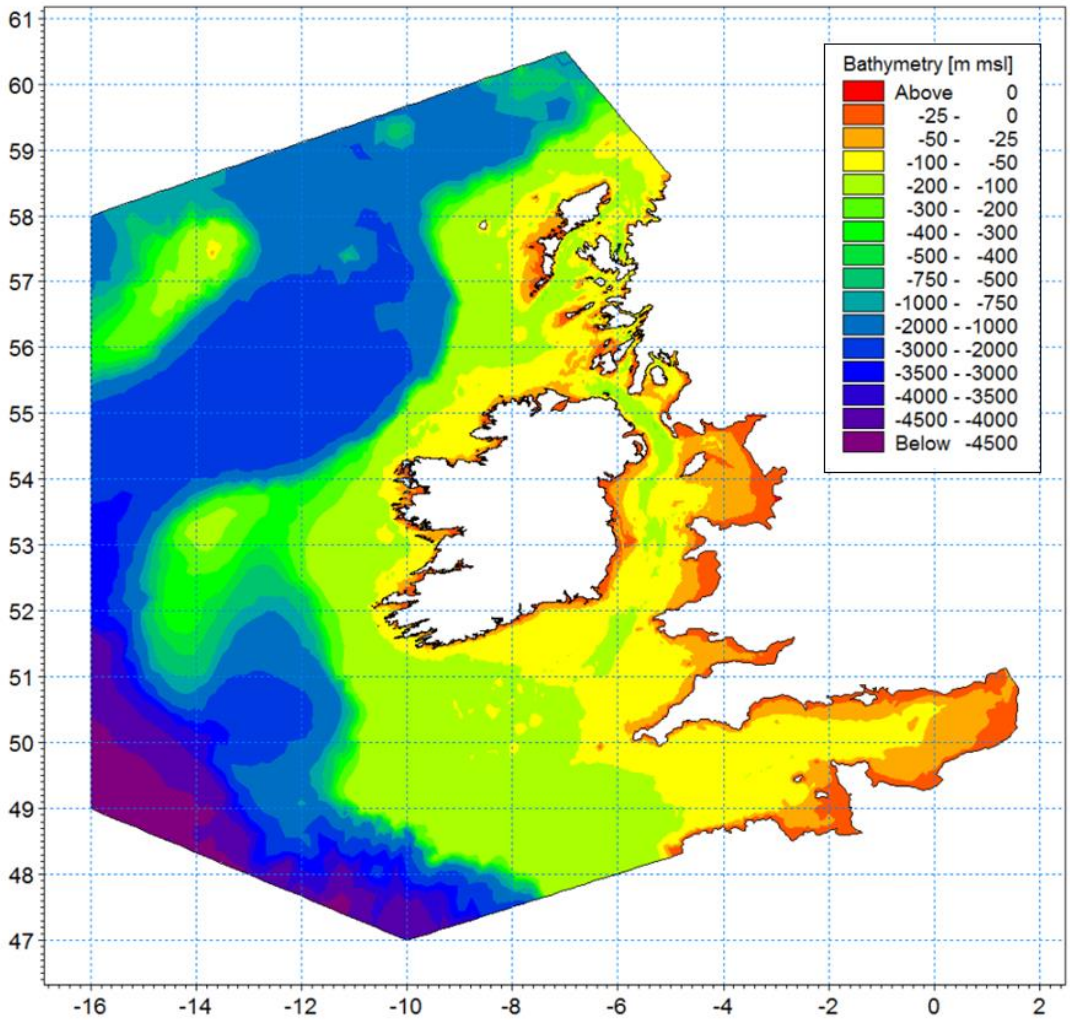

Figure 3.4: Extent and bathymetry of RPS' Irish Sea Tidal and Storm Surge model

4 SEDIMENT DISPERSION MODELLING

4.1 Summary of works

The proposed maintenance 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

Given the extensive nature of the proposed dredging works it was necessary to first rationalise the modelling approach. Therefore, taking a conservative approach, RPS modelled the dispersion of sediment plumes arising from dredging operations during the primary maintenance dredging years.

As detailed in Table 2.1, the total volume of material to be dredge during these years equated to *c.* 669,855m^3 (inclusive of max contingency) compared to a total dredge volume of 356,667m^3 (inclusive of max contingency) during the secondary dredge years. In the primary maintenance dredging years, approximately 95% of the 669,855m^3 of material is to be dredged using a Trailer Suction Hopper Dredger. As such, RPS selected these events to assess and quantify using the numerical models outlined in Section 3.

Taking a “worst case scenario” approach, RPS assumed that the TSHD operations would be undertaken on a 24/7 basis. Based on this assumption, it was anticipated that the TSHD operations during the primary maintenance dredging year would be completed over the course of 16 days and *c.*123 individual dredging cycles. A typical dredging cycle which has been used for this modelling study is presented in Table 4.1 below.

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	65	
Dumping	10	
Sailing from Dump	55	

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. This dredge path is reflective of the dredging operations summarised in Figure 2.1 excluding any areas that would be dredging used a Water Injection Dredging (WID) approach (i.e. in the area of Crosshaven Pier).

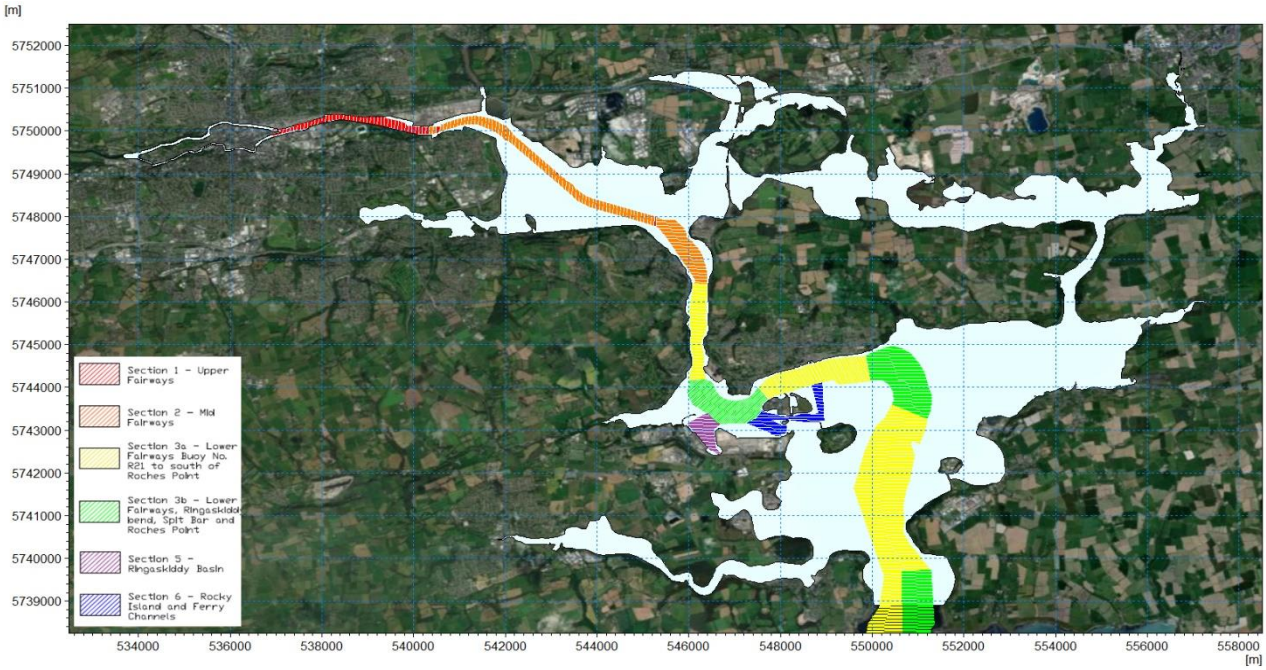

Figure 4.1: The path used to define the location and movement of the dredging source term

The composition of material to be dredged was determined via a series of historical sediment samples that were analysed for previous maintenance dredging applications (see Section 2.1). The results of these samples indicated that approximately 87.2% of material to be dredged was comprised of silt. Given the lack of detailed sediment grading curves for these samples, 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.

The percentage of fines lost at the TSHD head was assumed to be 3%, this equated to a loss of *c.*45.3kg/s during active dredging times (i.e. 30min of every 3hr 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 12.8% 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 – Upper Fairway

The total suspended sediment concentrations [SSCs] during typical dredging operations within the upper fairway area of Cork Harbour are presented in Figure 4.2 to Figure 4.5. 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 Upper Fairway

Figure	Tidal Phase	Description
Figure 4.2	Mid-flood	Sediment plume at the end of a dredging operation
Figure 4.3	High water	Sediment plume +3hrs. The dredge plume from the proceeding cycle can also be seen in this figure.
Figure 4.4	Mid-ebb	Sediment plume +6hrs. The dredge plume from the proceeding cycle can also be seen in this figure.
Figure 4.5	Low Water	Sediment plume +9hrs

An assessment of the sediment plume envelopes created as a result of dredging within the upper fairways found that the maximum total SSCs generally peaked at *c.* 425mg/L. These sediment plumes were subsequently advected along the fairway by the prevailing tides until the plumes dispersed to below 4mg/L.

Based on Figure 4.2 to Figure 4.5, it will be seen that the extent of the sediment plumes created by the proposed dredging operations are confined almost exclusively along the centrelines of the fairways.

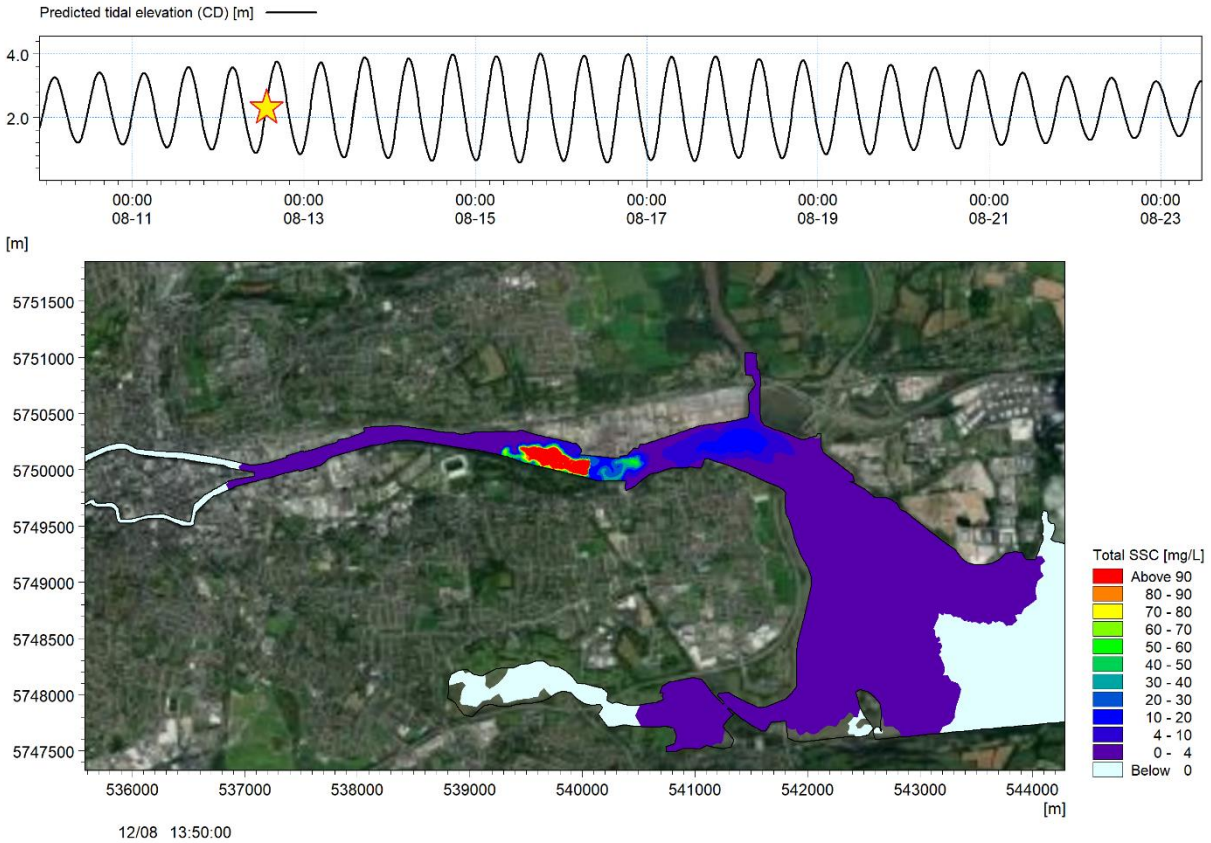

Figure 4.2: Sediment plume envelope created from TSHD operations in the upper fairway

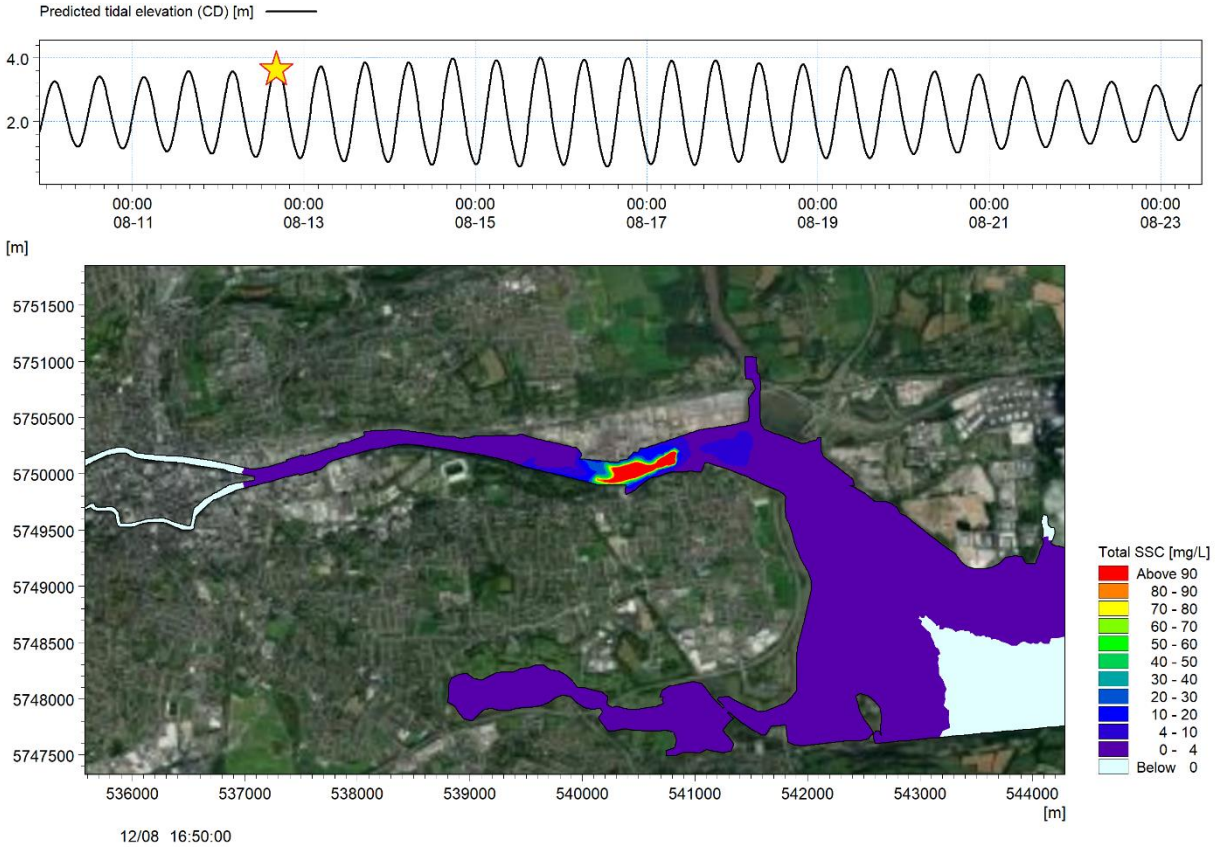

Figure 4.3: Sediment plume envelope created from TSHD operations in the upper fairway +3hr

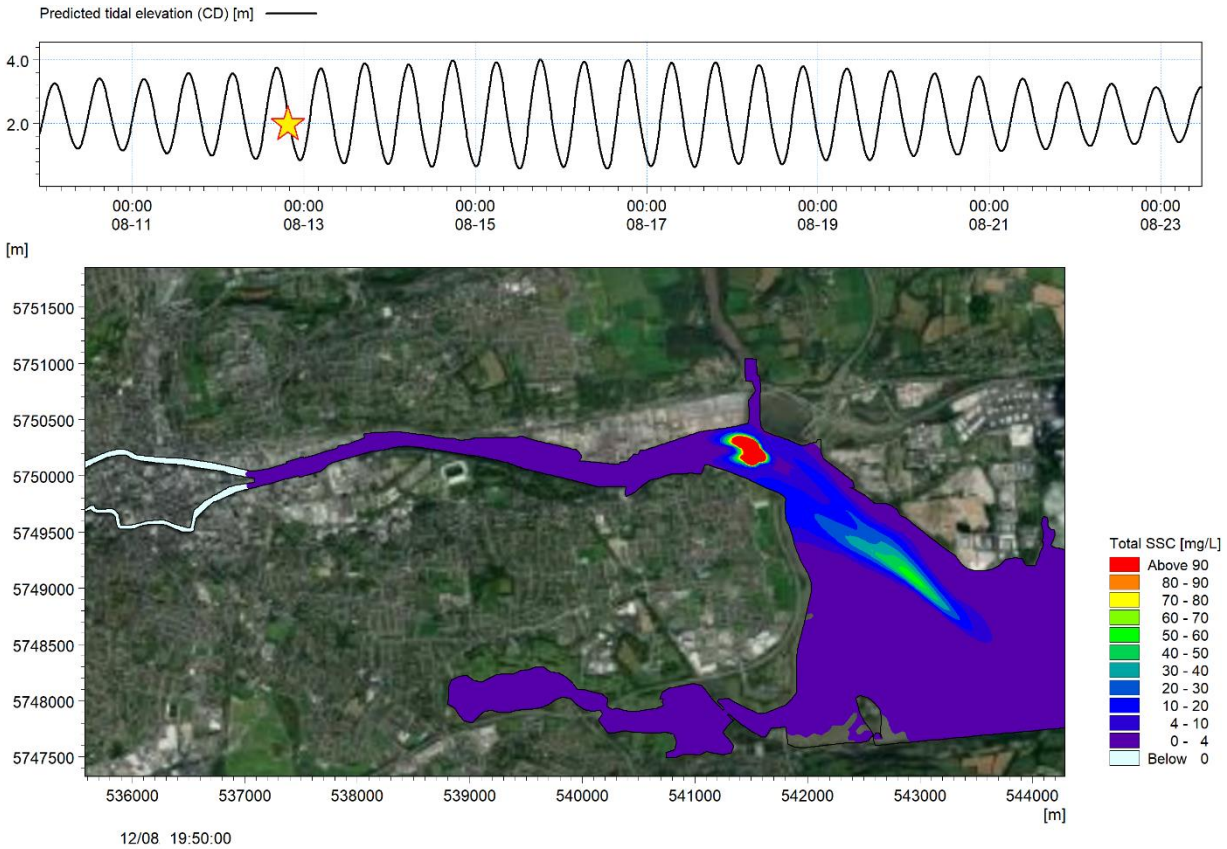

Figure 4.4: Sediment plume envelope created from TSHD operations in the upper fairway +6hr

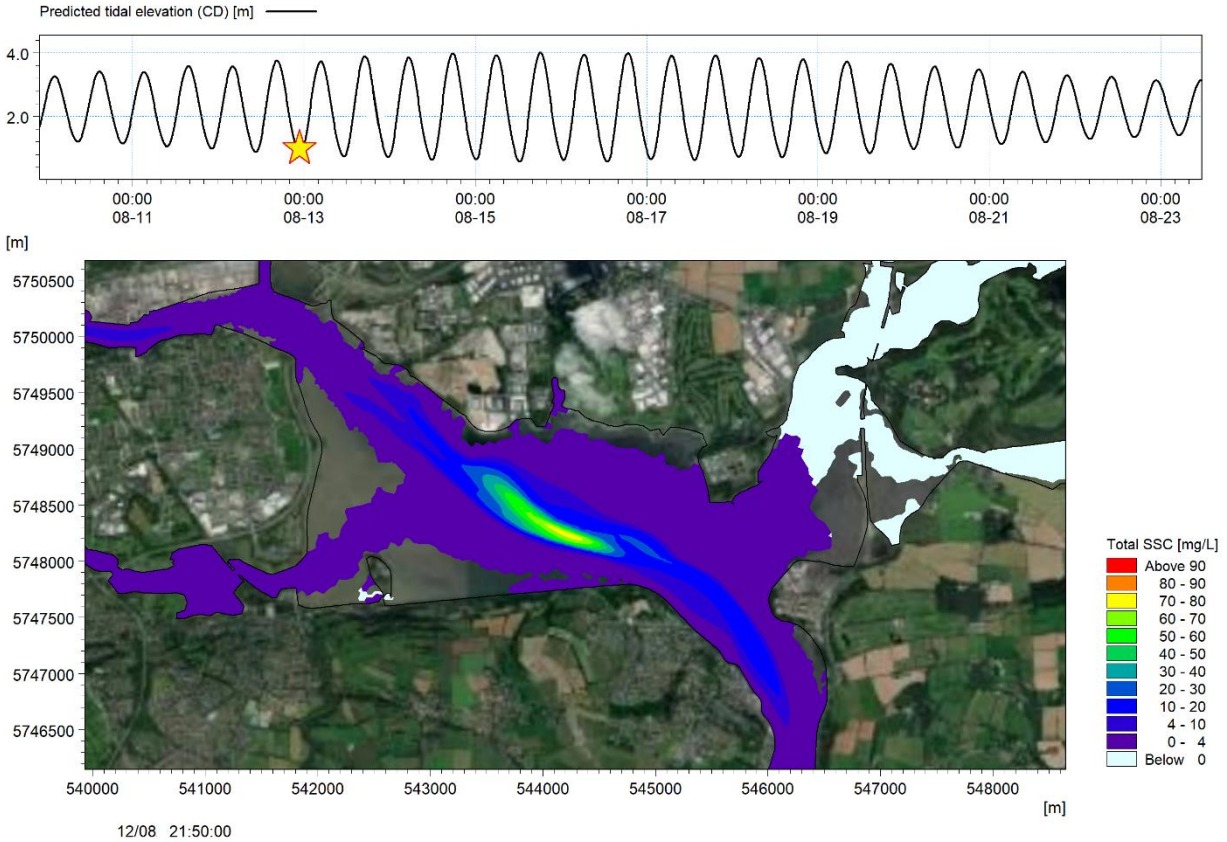

Figure 4.5: Sediment plume envelope created from TSHD operations in the upper fairway +9hr

4.2.3 Typical Plume Simulations – Mid Fairway

The total suspended sediment concentrations [SSCs] during typical dredging operations within the mid fairway area of Cork Harbour are presented in Figure 4.6 to Figure 4.9. A summary description of these plots has been presented in Table 4.4 below.

Table 4.4: Summary description of the sediment plumes for the Mid Fairway

Figure	Tidal Phase	Description
Figure 4.6	Mid-ebb	Sediment plume at the end of a dredging operation
Figure 4.7	Low water	Sediment plume +3hrs
Figure 4.8	Mid-flood	Sediment plume +6hrs. The dredge plume from the proceeding cycle can also be seen in this figure.
Figure 4.9	High water	Sediment plume +9hrs

An assessment of the sediment plume envelopes created as a result of dredging within the mid fairways found that the maximum total SSCs generally peaked at *c.* 350mg/L. However, unlike the sediment plume envelopes within the upper fairway, plumes in this area quickly dispersed to below 50 mg/L due to the larger volume of surrounding water.

It will be seen that the resultant SSC plume envelopes are generally confined to within the deeper regions of the fairways during most phases of the tide. However, at high water it will be seen that a fraction of the dredge plume envelopes disperses past Hop Island to the west and towards Foaty Island to the north east. Despite this, total SSCs in these areas remain less than 10mg/L.

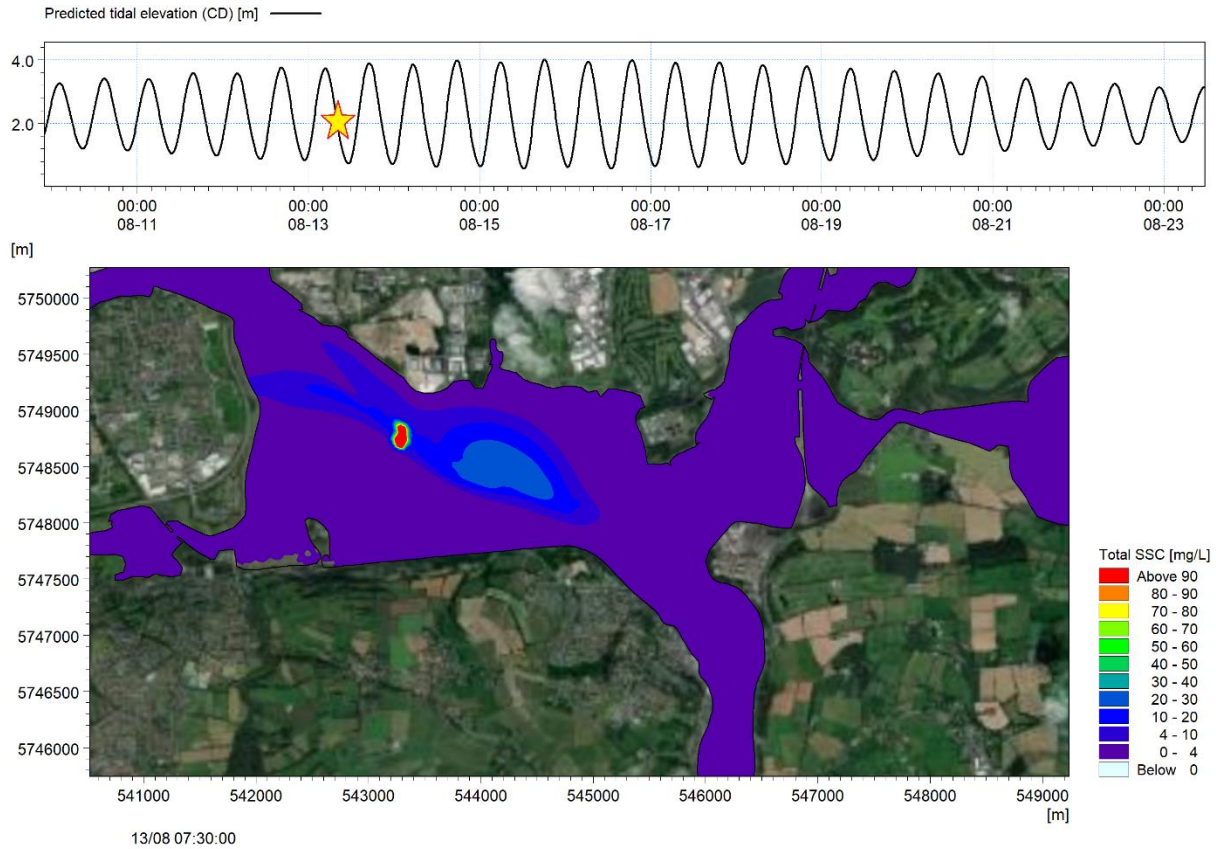

Figure 4.6: Sediment plume envelope created from TSHD operations in the mid fairway

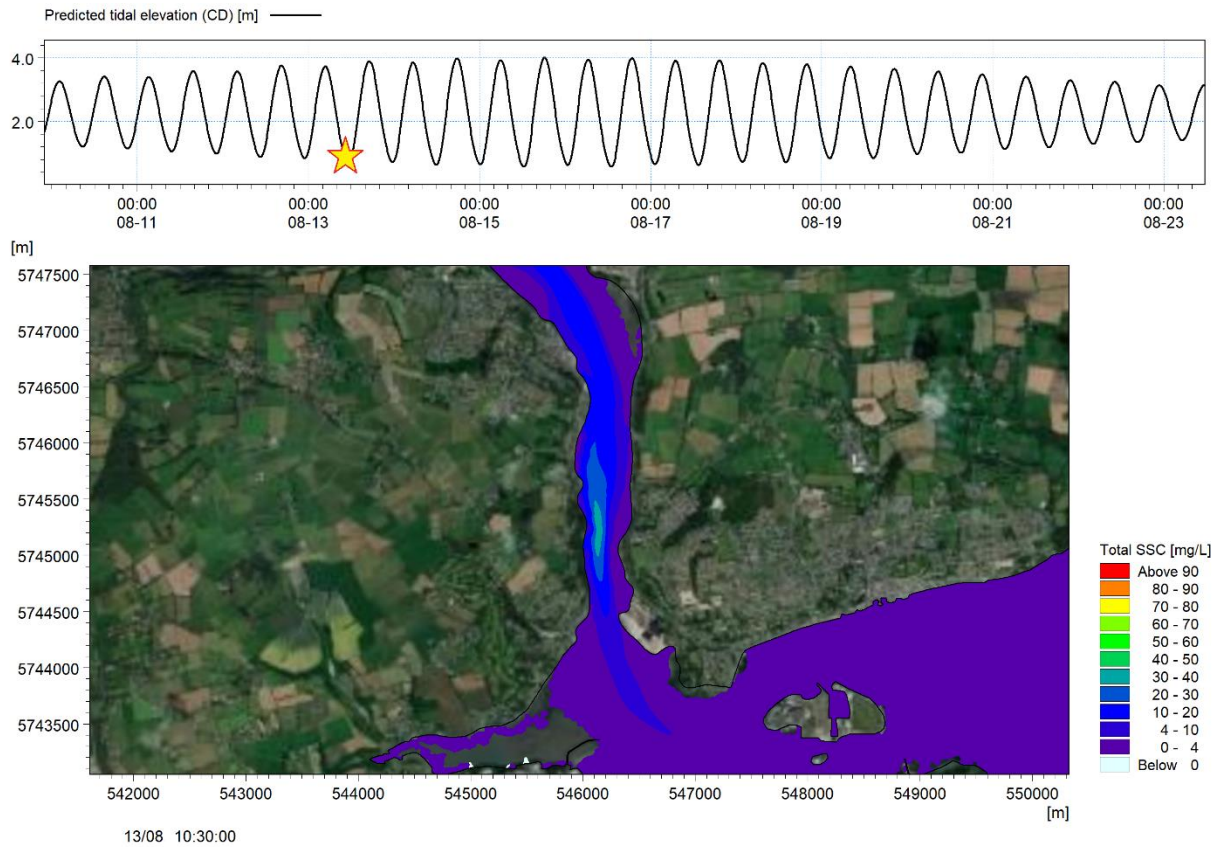

Figure 4.7: Sediment plume envelope created from TSHD operations in the mid fairway +3hr

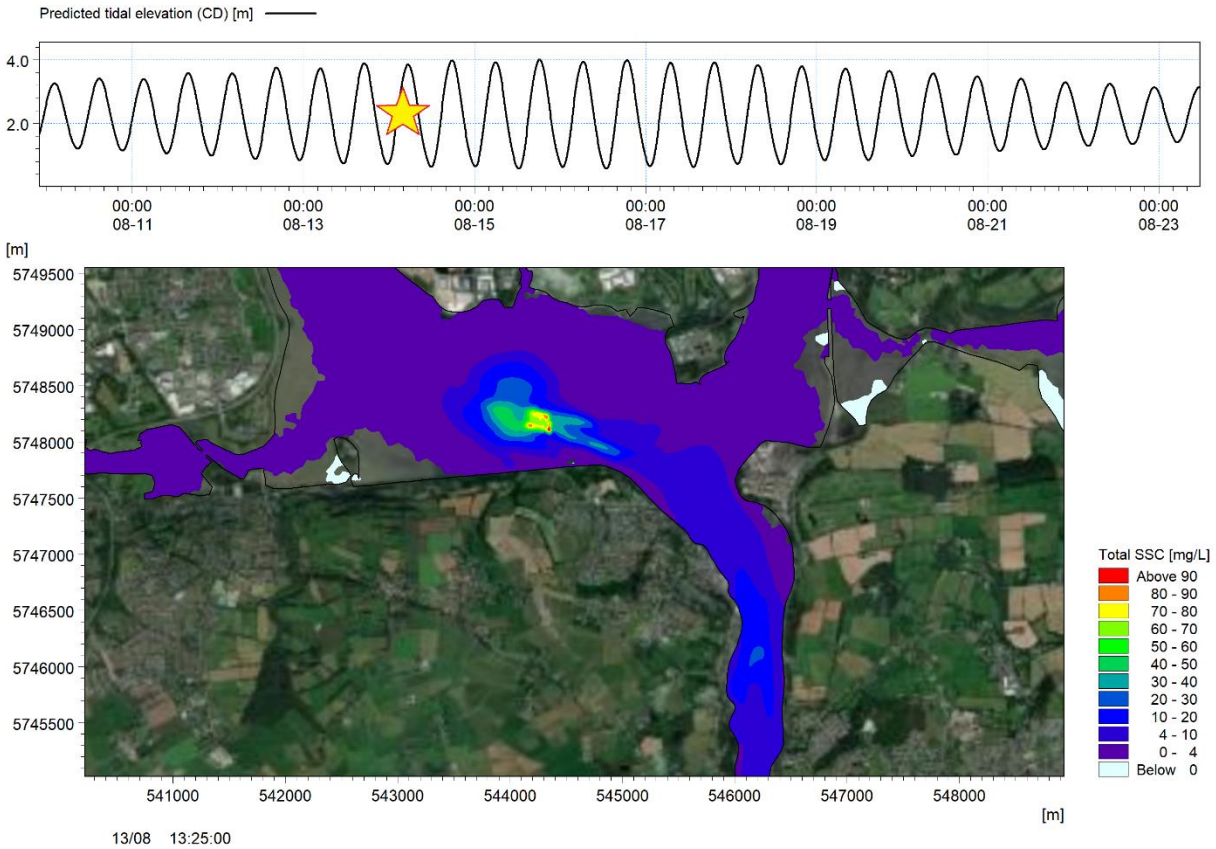

Figure 4.8: Sediment plume envelope created from TSHD operations in the mid fairway +6hr

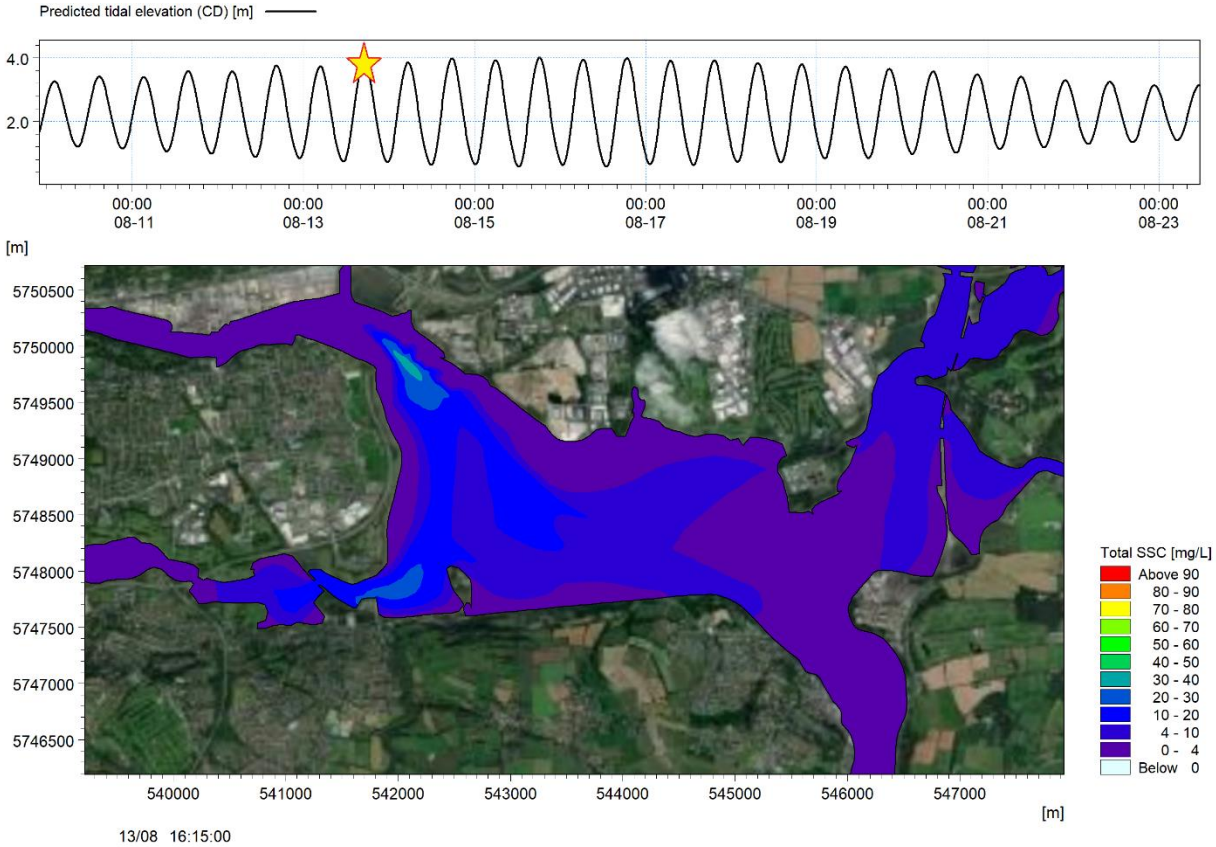

Figure 4.9: Sediment plume envelope created from TSHD operations in the mid fairway +9hr

4.2.4 Typical Plume Simulations – Ringaskiddy Ferry Port

The total suspended sediment concentrations [SSCs] during typical dredging operations within the Ringaskiddy Ferry Port are presented in Figure 4.10 to Figure 4.13. A summary description of these plots has been presented in Table 4.5 below.

It should be noted that the total volume of material to be dredged from Ringaskiddy Ferry Port equated to approximately 35% of all material to be dredged by TSHD. As such, the numerical model was adjusted so that the source term was active within this area for an equivalent of *c*.45 dredging cycles.

Table 4.5: Summary description of the sediment plumes for the Ringaskiddy Ferry Port

Figure	Tidal Phase	Description
Figure 4.10	Mid-ebb	Sediment plume at the end of a dredging operation
Figure 4.11	Low water	Sediment plume +3hrs. The dredge plume from the proceeding cycle can also be seen in this figure.
Figure 4.12	Mid-flood	Sediment plume +6hrs. The dredge plume from the proceeding cycle can also be seen in this figure.
Figure 4.13	High water	Sediment plume +9hrs. The dredge plume from the proceeding cycle can also be seen in this figure.

An assessment of the sediment plume envelopes created as a result of dredging within the Ringaskiddy found that the maximum total SSCs could exceed *c.* 1000mg/L. The concentration of the initial sediment plumes generated in this area were generally much higher relative to those throughout the rest of Cork Harbour. This can be attributed to the hydrodynamics of the area whereby the sheltered nature of the site and low current flows results in minimal mixing and dilution of the sediment plumes.

The sediment plume envelopes created during the dredging of Ringaskiddy do not generally disperse far from the Ferry Port.

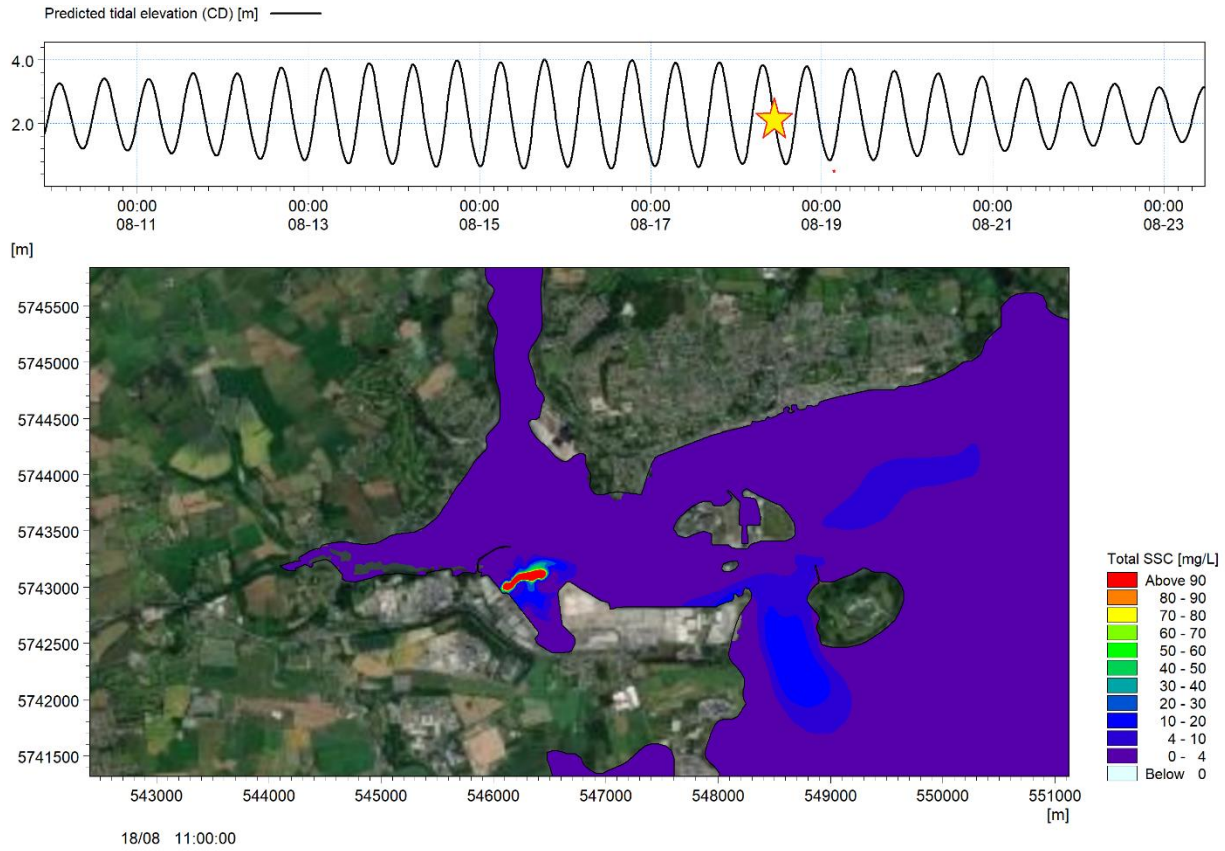

Figure 4.10: Sediment plume envelope created from TSHD operations in Ringaskiddy

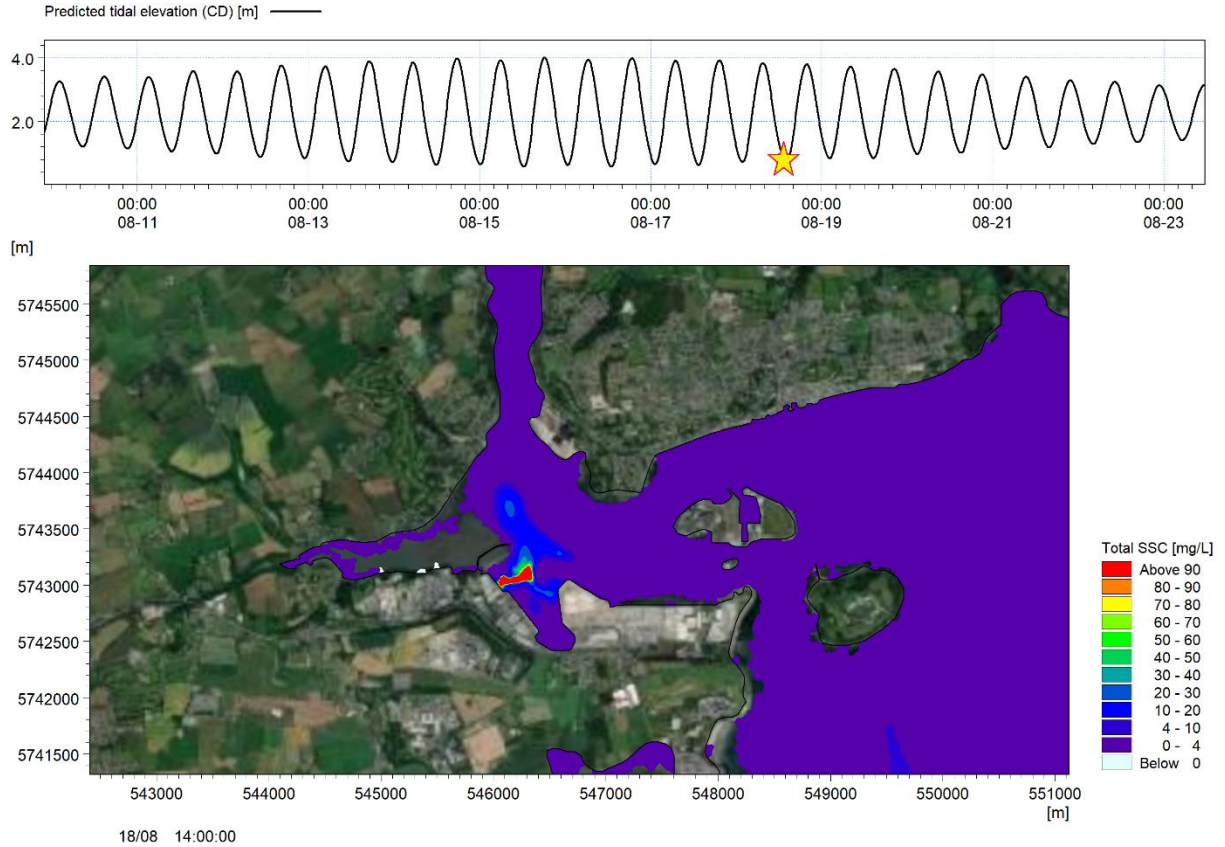

Figure 4.11: Sediment plume envelope created from TSHD operations in Ringaskiddy +3hr

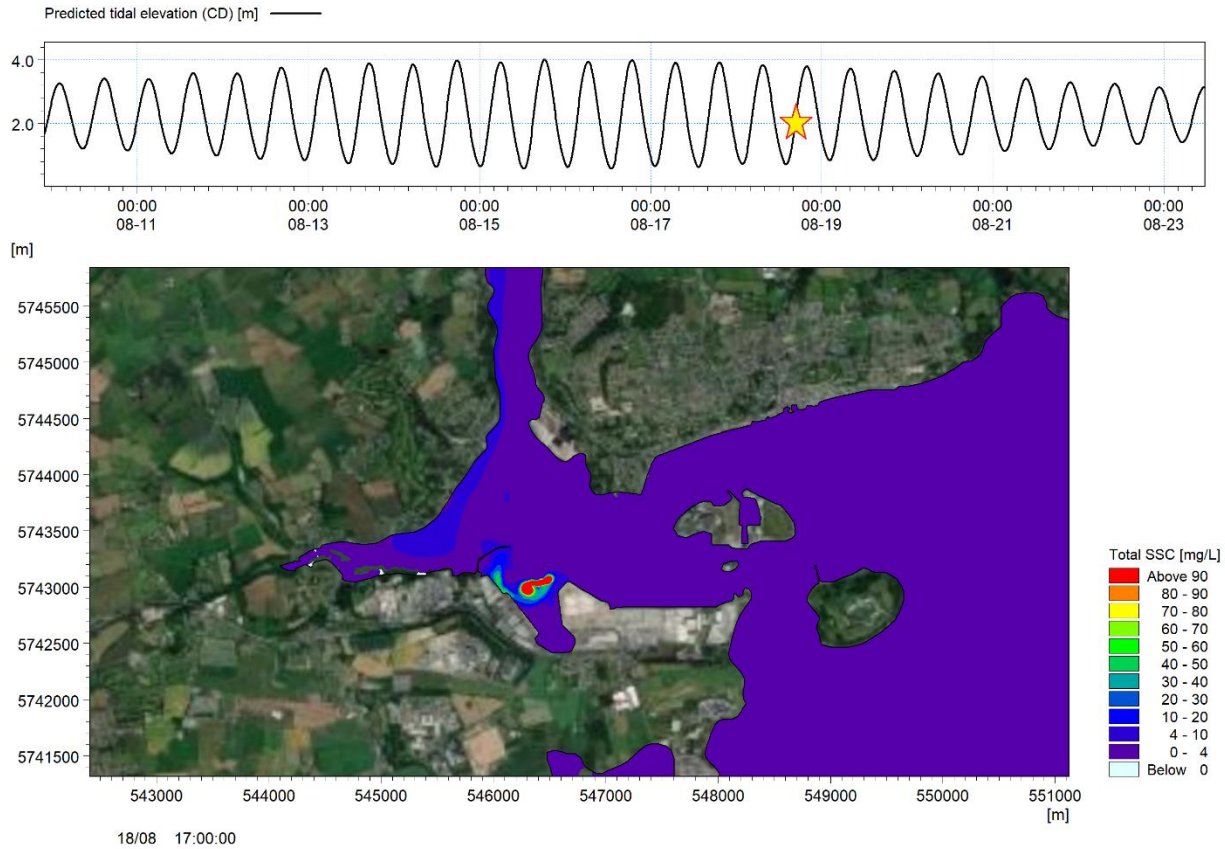

Figure 4.12: Sediment plume envelope created from TSHD operations in Ringaskiddy +6hr

Figure 4.13: Sediment plume envelope created from TSHD operations in Ringaskiddy +9hr

4.2.5 Typical Plume Simulations – Lower Fairway

The total suspended sediment concentrations [SSCs] during typical dredging operations within the Lower Fairways of Cork Harbour are presented in Figure 4.14 to Figure 4.17. A summary description of these plots has been presented in Table 4.6 below.

Table 4.6: Summary description of the sediment plumes for the Lower Fairway

Figure	Tidal Phase	Description
Figure 4.14	Low water	Sediment plume at the end of a dredging operation
Figure 4.15	Mid-flood	Sediment plume +3hrs
Figure 4.16	High water	Sediment plume +6hrs. The dredge plume from the proceeding cycle can also be seen in this figure.
Figure 4.17	Mid-ebb	Sediment plume +9hrs. The dredge plume from the proceeding cycle can also be seen in this figure.

An assessment of the sediment plume envelopes created as a result of dredging within the lower fairways found that the maximum total SSCs generally peaked at *c.* 150mg/L. These sediment plumes were subsequently advected along the fairway by the prevailing tides until the plumes eventually dispersed to below 4mg/L. The concentration of these sediment plumes was generally much lower than those in regions of Cork Harbour due the large volume of water available for initial mixing. Consequently, sediment plumes in this area tended to have a greater extent but lower concentration.

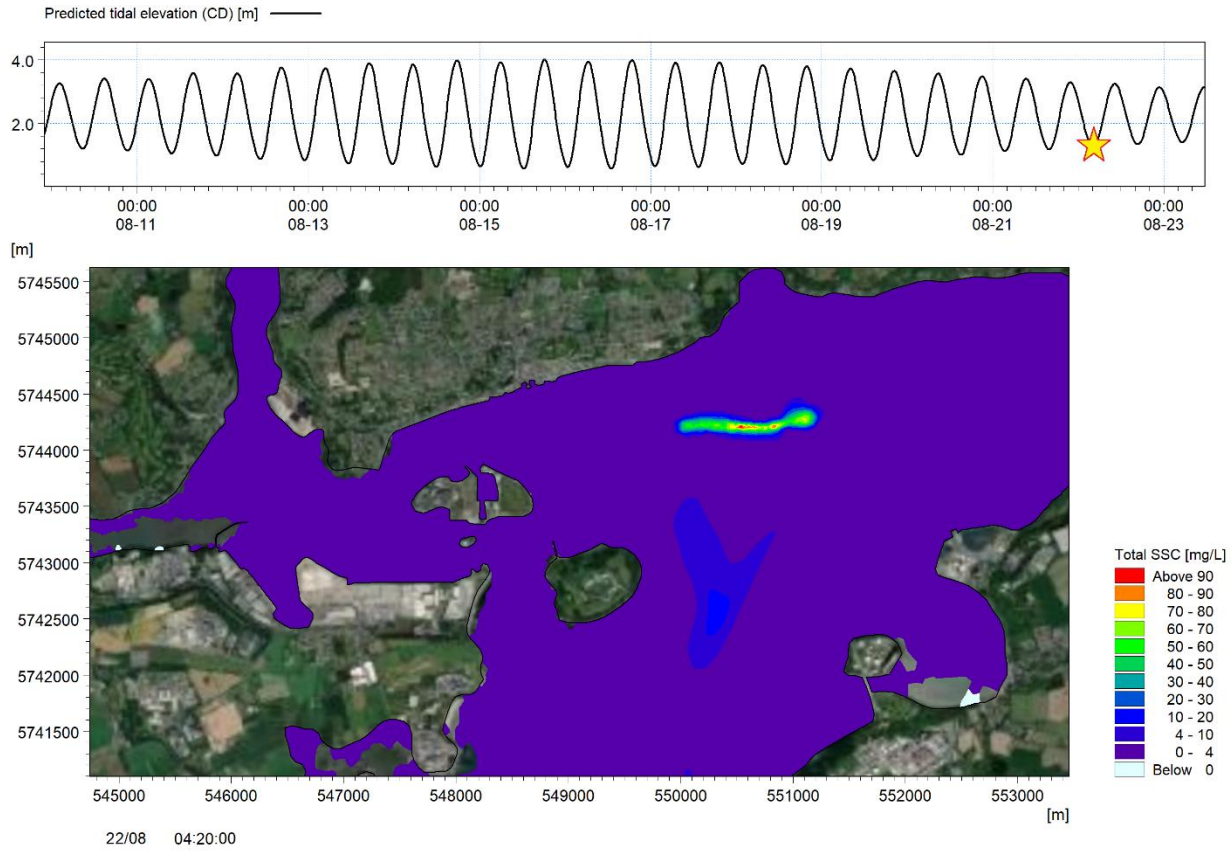

Figure 4.14: Sediment plume envelope created from TSHD operations in the lower fairway

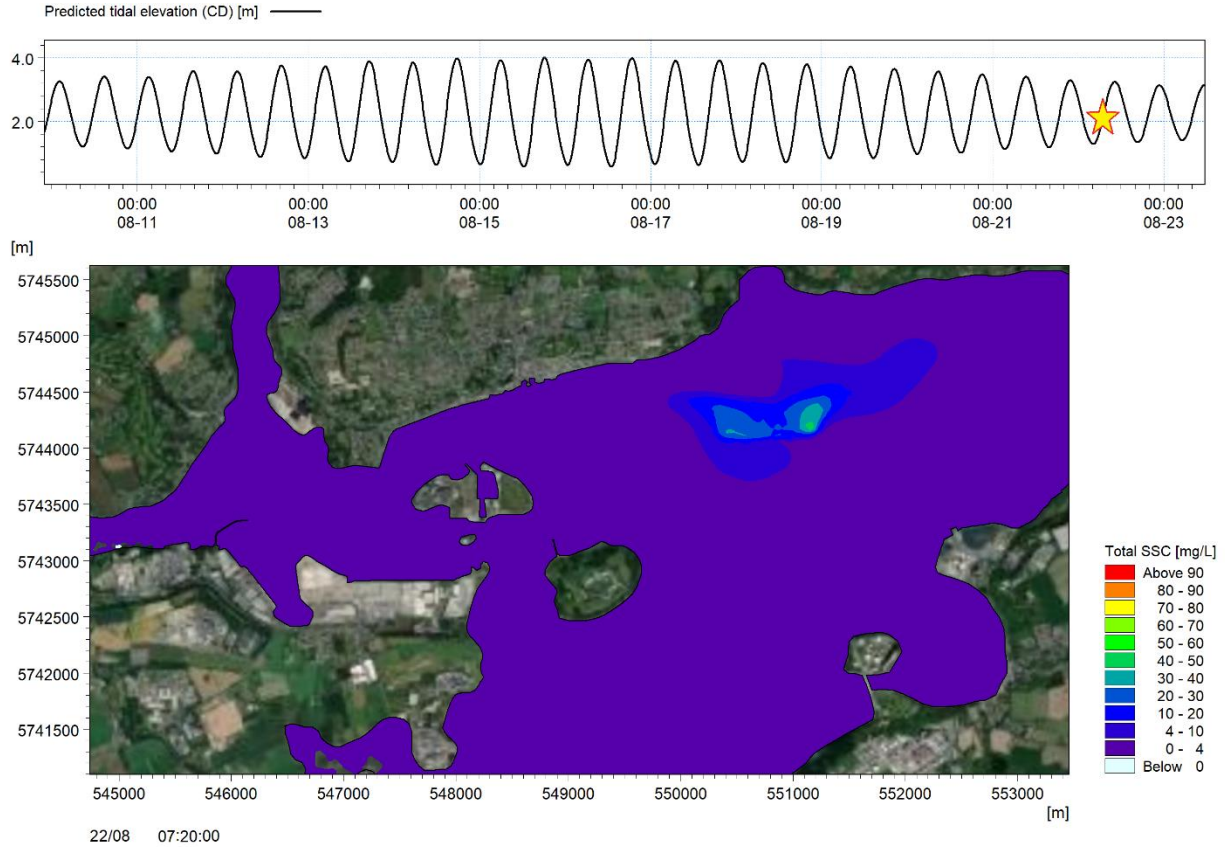

Figure 4.15: Sediment plume envelope created from TSHD operations in the lower fairway +3hr

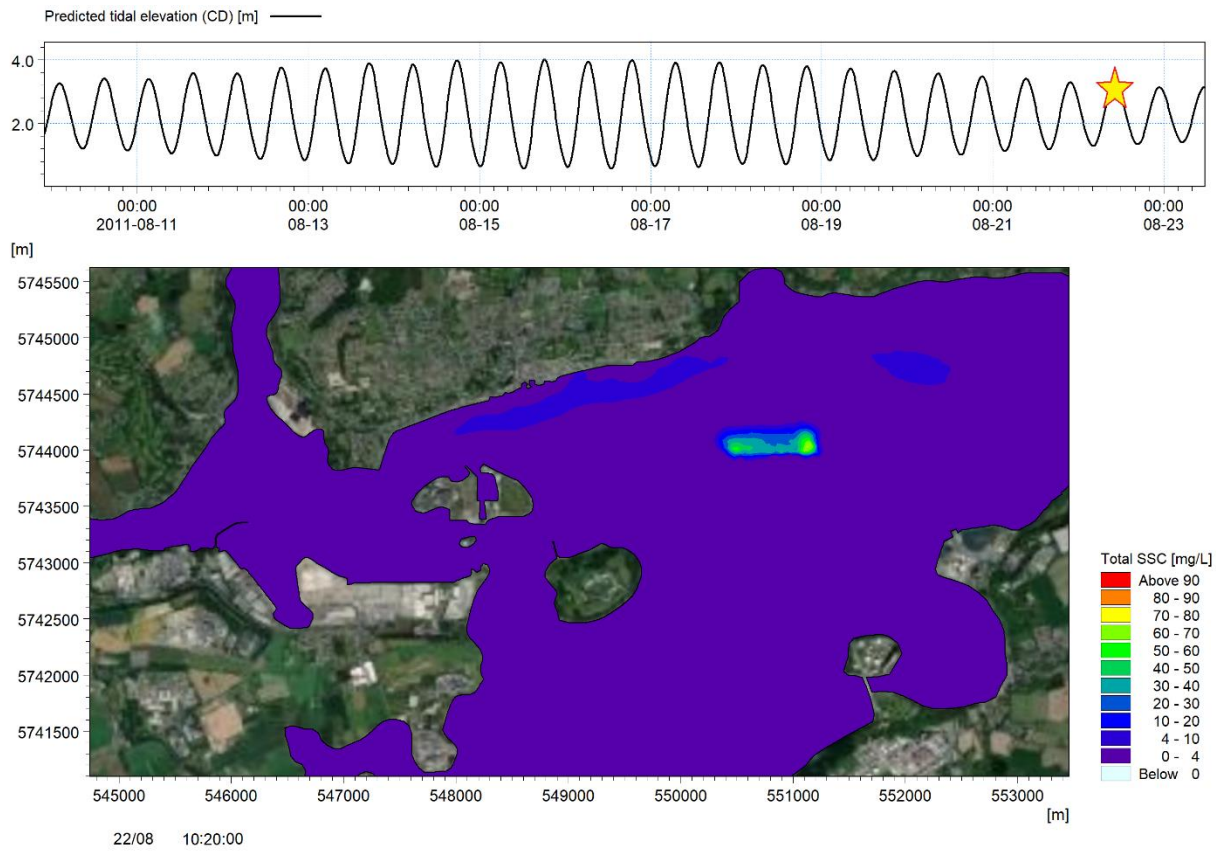

Figure 4.16: Sediment plume envelope created from TSHD operations in the lower fairway +6hr

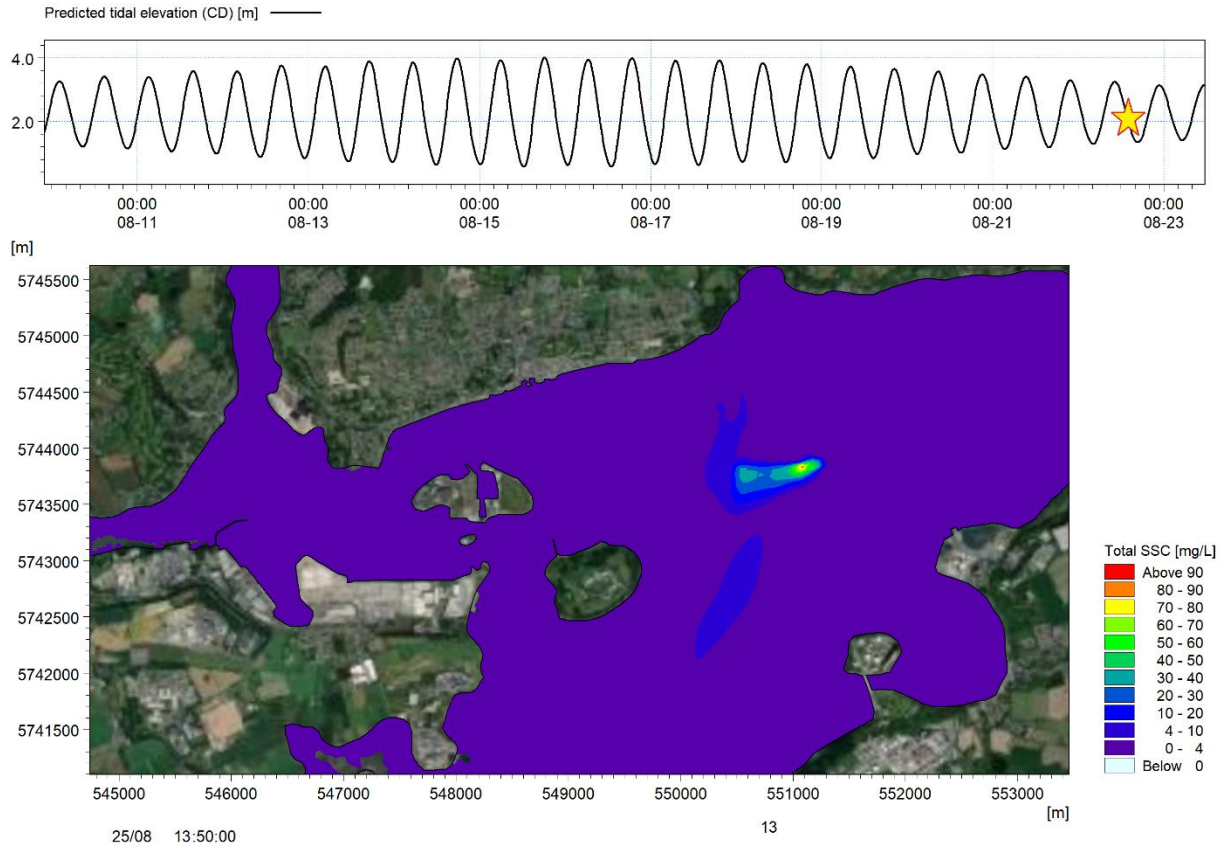

Figure 4.17: Sediment plume envelope created from TSHD operations in the lower fairway +9hr

4.2.6 Average and Maximum Sediment Plumes

Having presented actual total suspended sediment plume envelopes for dredging activities within various areas of Cork Harbour, this Section of the report presents the statistical mean and maximum total suspended sediment plumes for the primary maintenance dredging works which lasted approximately 16 days.

Figure 4.18 which illustrates the statistical mean total suspended sediment plume envelope demonstrates that the average total SSC throughout Cork harbour does not generally exceed 3mg/L during the 16 days of dredging. 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 higher average total SSC of up to 10mg/L.

The maximum total SSC plume envelope observed from the dredging simulations is presented in Figure 4.19 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 outside of the Ringaskiddy Ferry Port the maximum total SSCs do not generally exceed 500mg/L. However, a closer inspection of this data found 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.

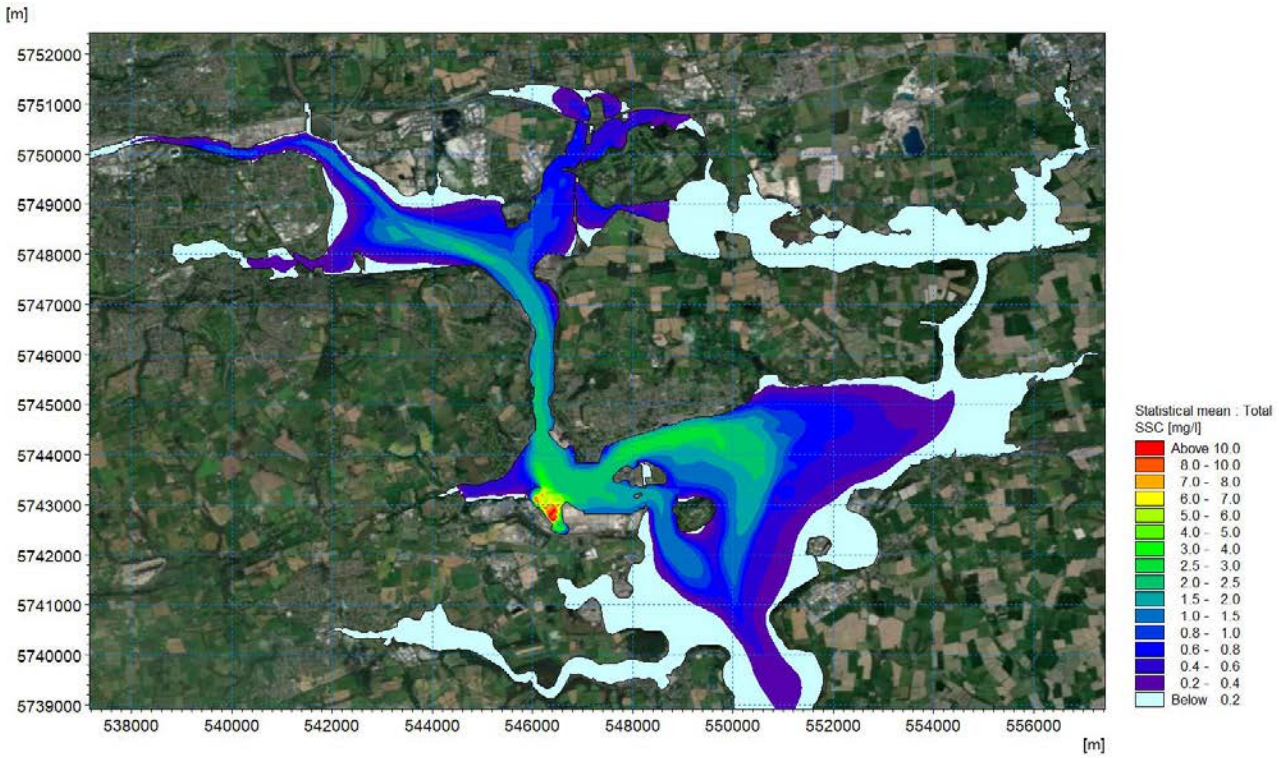

Figure 4.18: Average total suspended sediment concentration within Cork harbour during the course of the 16 day primary maintenance dredging operation

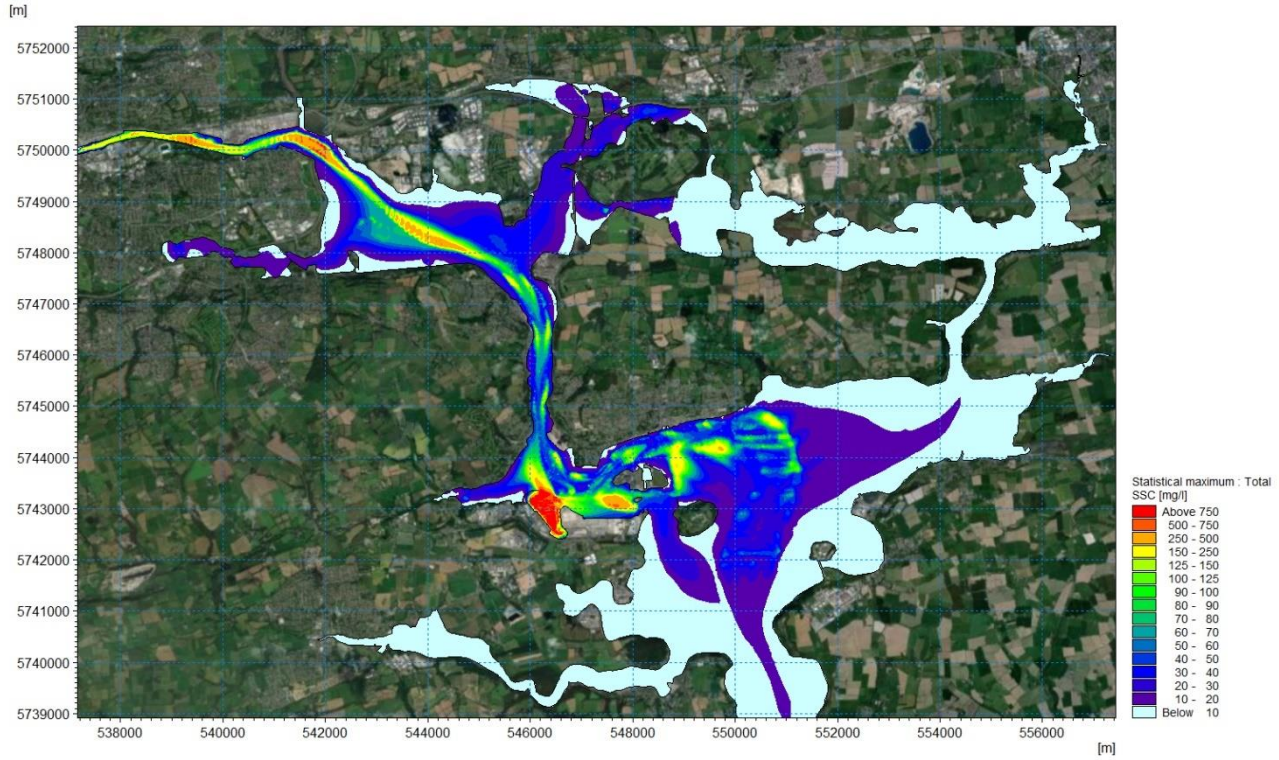

Figure 4.19: Maximum total suspended sediment concentration within Cork harbour during the course of the 16 day primary maintenance dredging operation

4.2.7 Sediment Deposition within Cork Harbour

Sediment deposition throughout Cork Harbour at the end of the 16-day primary maintenance dredging operations is illustrated in Figure 4.20 overleaf. The general lack of sediment deposition in this figure demonstrates the strongly dispersive nature of Cork Harbour. The only region where there is any notable deposition is within the Ringaskiddy Ferry Port whereby the constrained tidal flows prevent suspended sediment from being flushed from within the Port. Despite this, deposition levels within the Port were generally less than 0.06m. This sediment would be removed by the passing TSHD once it had settled.

Beyond the Ringaskiddy Ferry Port, there was several localised areas within the harbour where there was approximately 3-5mm of sediment deposition as illustrated in Figure 4.20.

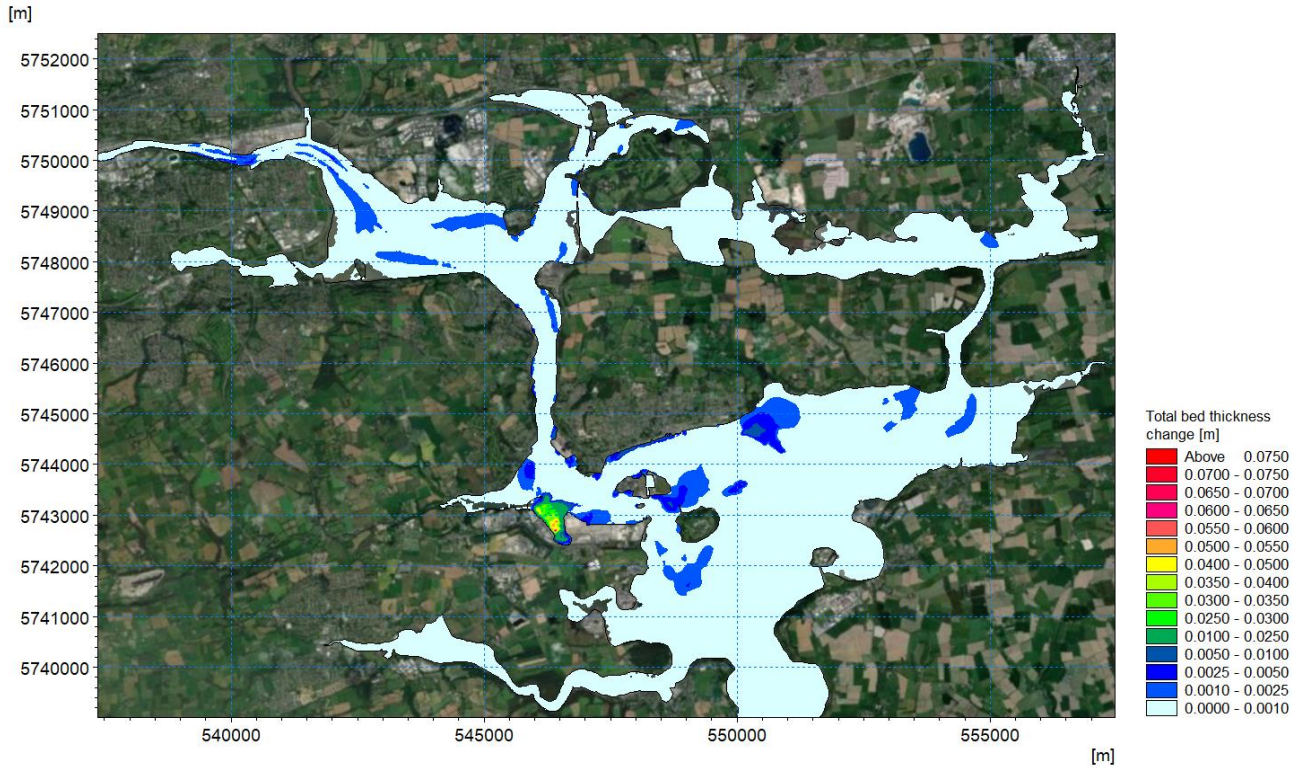

Figure 4.20: Total bed thickness change within Cork harbour following the 16 day primary maintenance dredging operation

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 primary maintenance dredging operation within Cork Harbour, RPS also analysed and assessed the dispersion and settlement of material released from dumping dredged material at the licensed disposal site approximately 8km south of Roches Point.

As summarised in Table 4.8, dumping activities would last for approximately 10min in every 3-hour dredging cycle. Given that the proposed TSHD had 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 87.2% of silt material, with the remaining 12.8% being sand material. These sediment fractions where therefore defined in the numerical model as per the specifications presented in Table 4.7 below.

This dumped material was introduced as a source term that traversed the disposal site illustrated in Figure 4.21.

Table 4.7: 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 TSHD operations would be undertaken on a 24/7 basis. As such, the findings presented in the following Section of this report represent approximately 669,855m^3 of sediment material being dumped at the licensed disposal site over the course of 16 days which is equivalent to *c.*123 individual dumping cycles. Other relevant parameters relating to the dredging operations that were used in the numerical modelling are presented in Table 4.8 below.

Table 4.8: Dredging and sediment specifications used to inform the numerical modelling programme

Parameter	Value	Unit
Dredger Capacity	8,000	m^3
Cycle time	3	hrs
Load factor	0.57	
In-situ Wet Density	1.45	t/m^3
In-situ Dry Density	0.69	t/m^3
Designed disposal per day	25,000	dry t

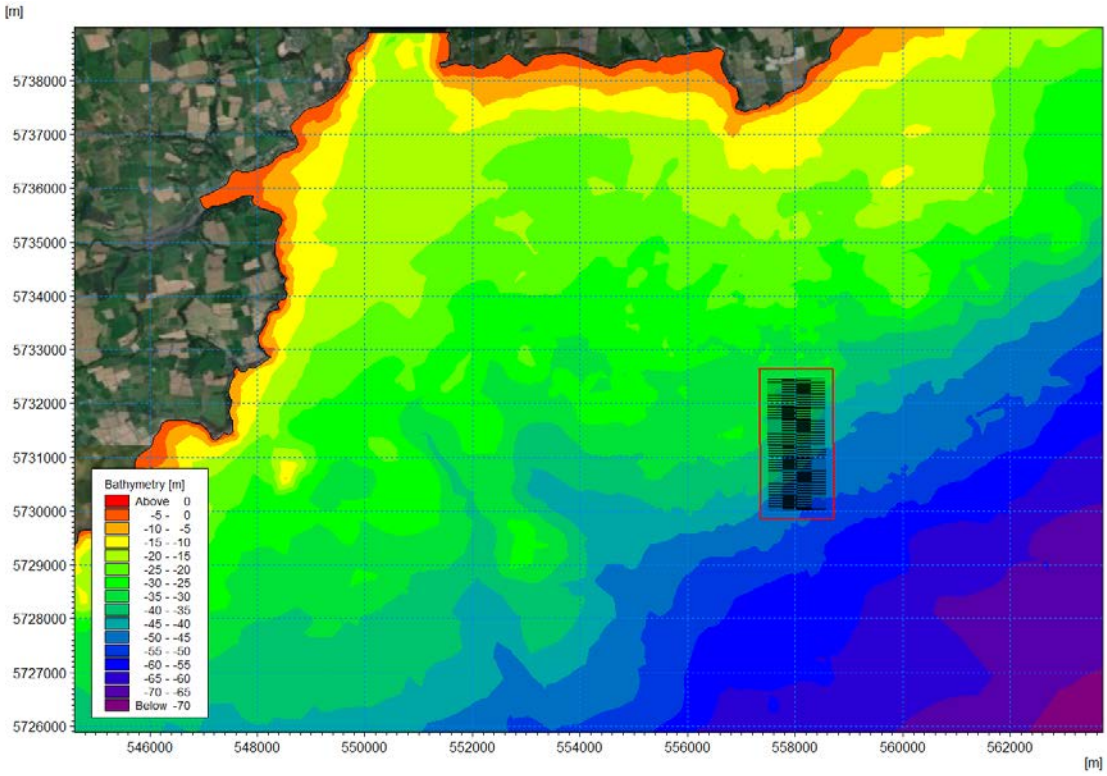

Figure 4.21: The path used to define the location and movement of the dumping source term

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 16-day primary maintenance dredging operation is presented in Figure 4.22 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 4.2mg/L and is quickly dispersed to less than 0.5mg/L approximately 2km from the disposal site boundary.

Sediment deposition at the licensed disposal site at the end of the 16-day primary maintenance dredging operations is illustrated in Figure 4.23 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 4mm.

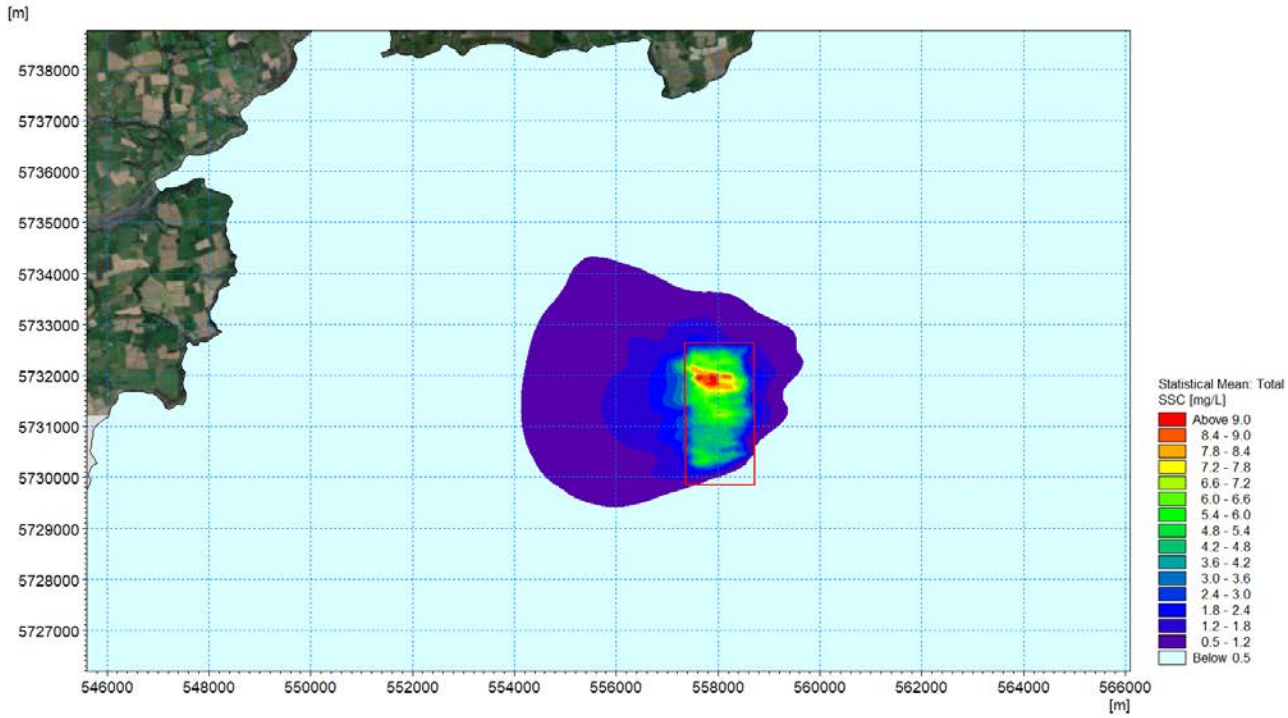

Figure 4.22: Average total suspended sediment concentration at the licensed disposal site during the course of the 16 day primary maintenance dredging operation

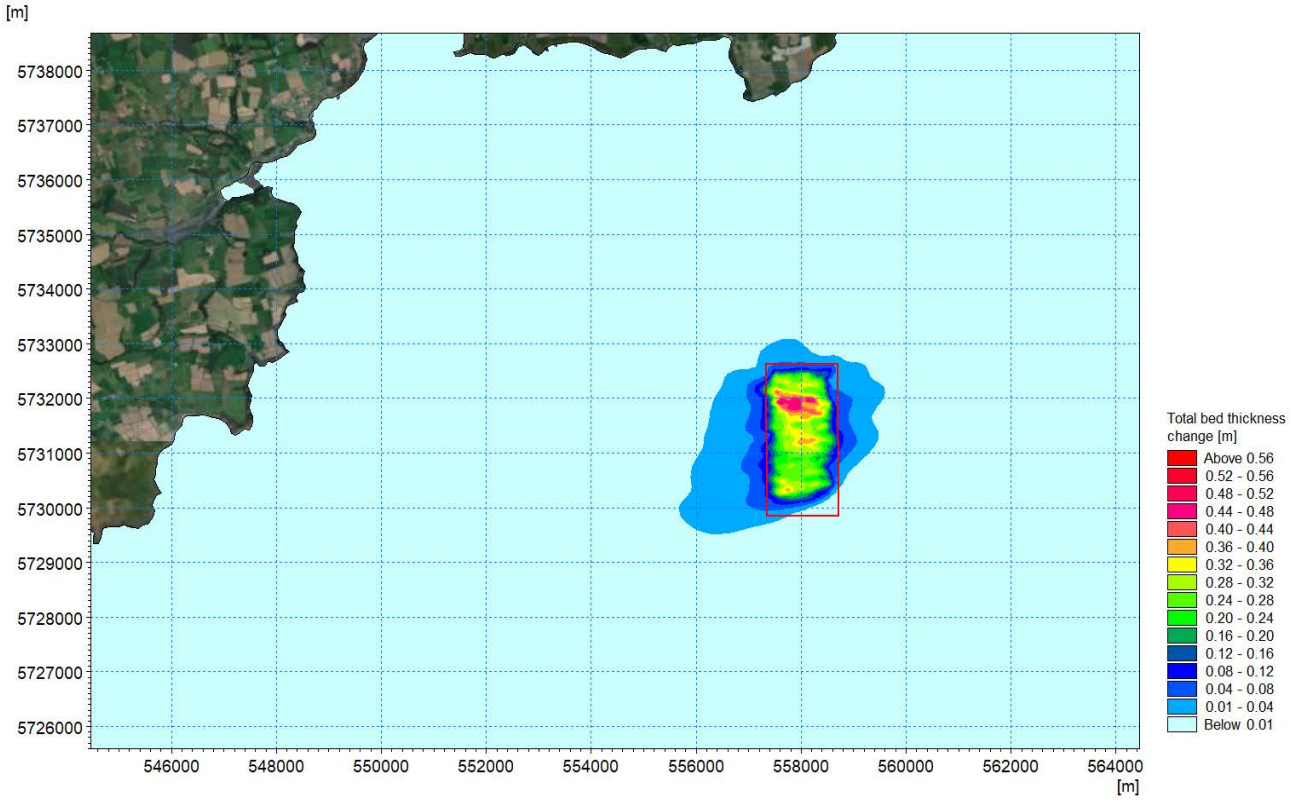

Figure 4.23: Total bed thickness change at the licensed disposal site following the 16 day primary maintenance dredging operation

5 CONCLUSION

A modelling programme was undertaken to evaluate both the dredging and disposal phases of the proposed primary maintenance dredging operations within Cork Harbour; 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 primary maintenance dredging operations which included the dredging and disposal of 669,855m^3 material found that the average total SSC throughout Cork Harbour did not generally exceed 3mg/L during the 16 days of dredging. 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 10mg/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 within the harbour as a result of the dredging operations was minimal, with only a few localised areas of the harbour accreting 3-5mm of sediment.

An assessment of the dumping phase of the primary maintenance dredging operations found that the average total suspended sediment concentration beyond the immediate vicinity of the licensed disposal site did not generally exceed 4.2mg/L. This sediment plume quickly dispersed to less than 0.5mg/L approximately 2km from the disposal site boundary.

Almost all the sediment dumped during the primary 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 4mm.

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 **Error! Reference source not found.**. 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.

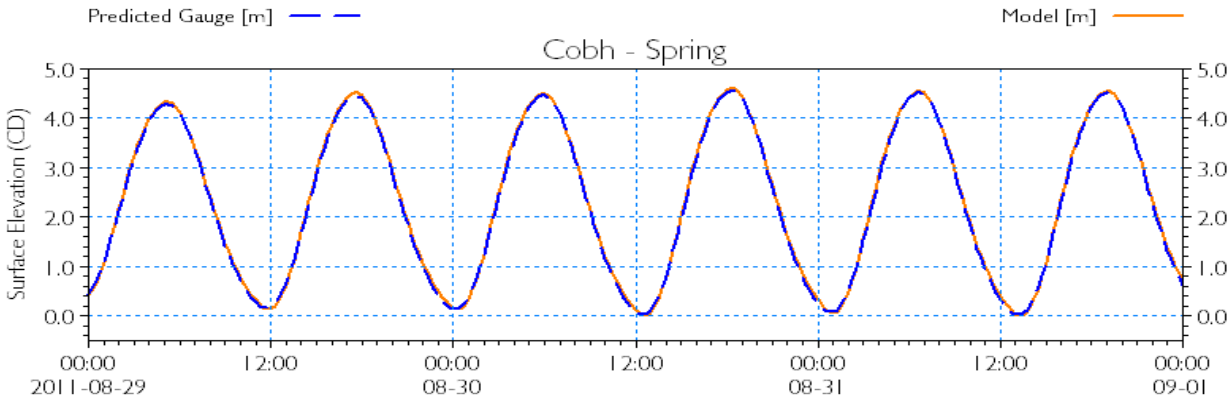

Figure 5.2: Tidal Elevation from Gauge and Model Data - Cobh Spring tide

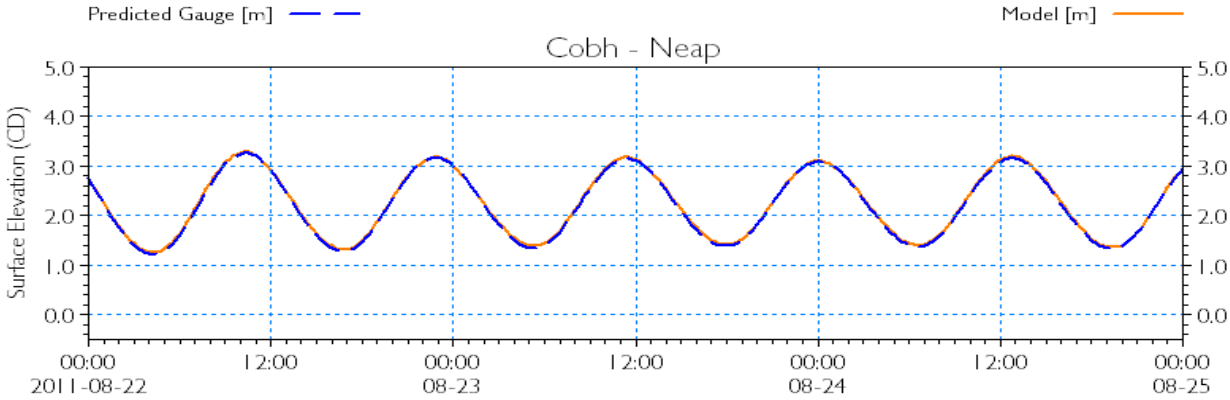

Figure 5.3: Tidal Elevation from Gauge and Model Data - Cobh Neap tide

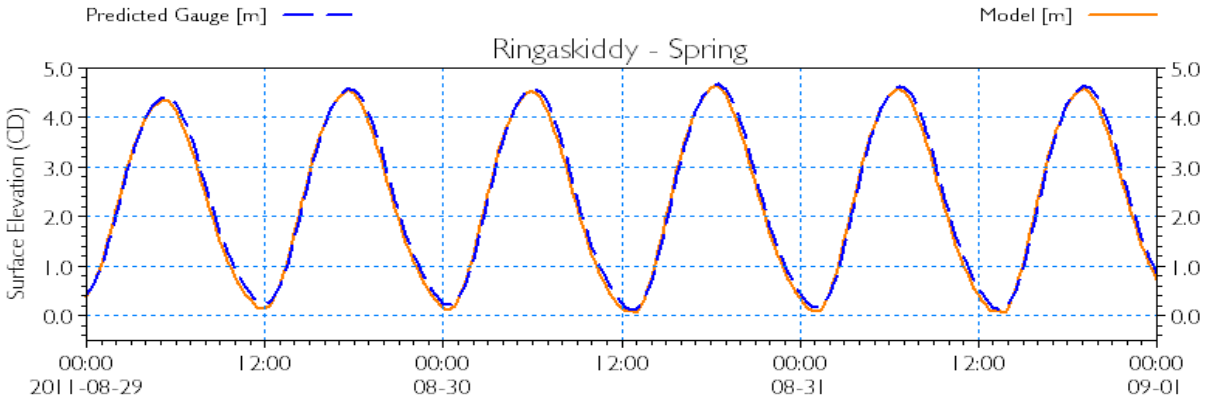

Figure 5.4: Tidal Elevation from Gauge and Model Data - Ringaskiddy Spring tide

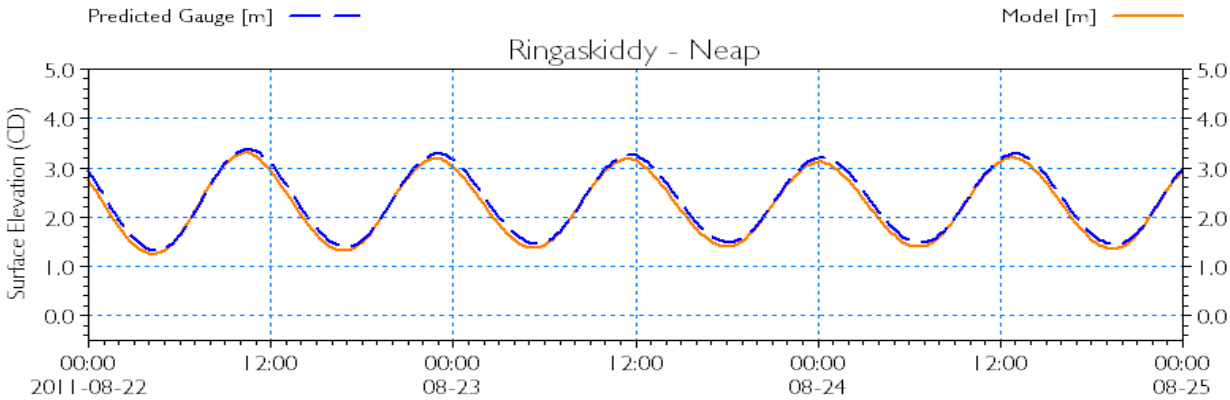

Figure 5.5: Tidal Elevation from Gauge and Model Data - Ringaskiddy Neap tide

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.

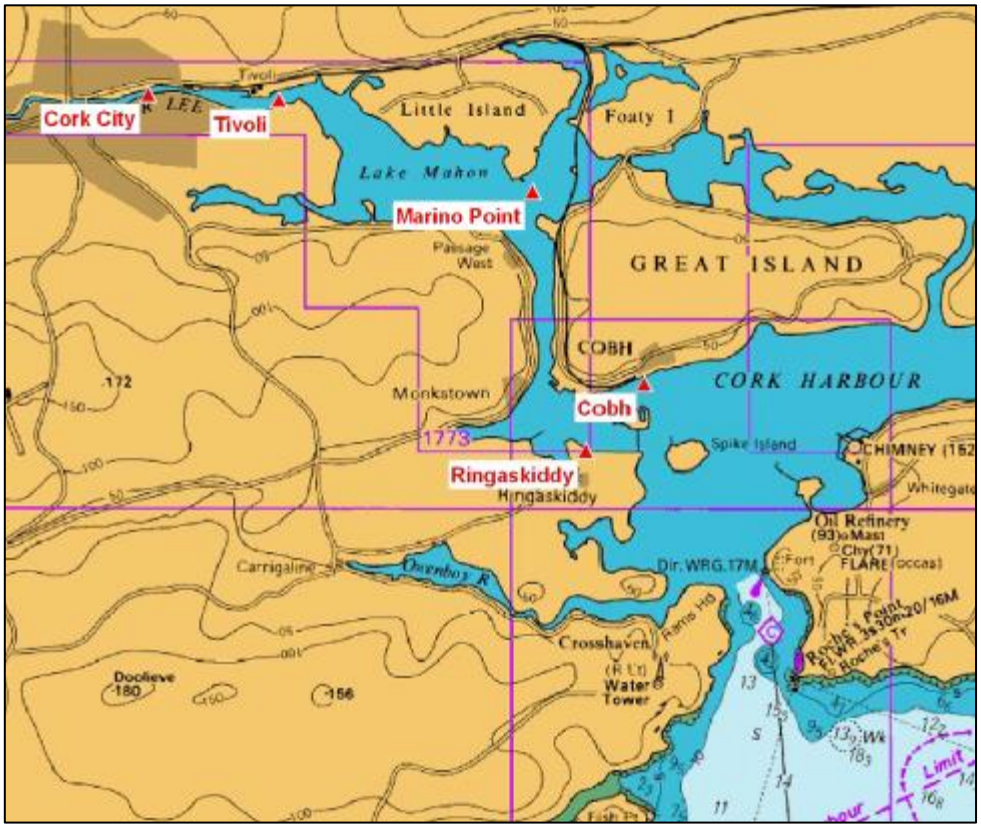

Figure 5.6: Calibration locations for data presented

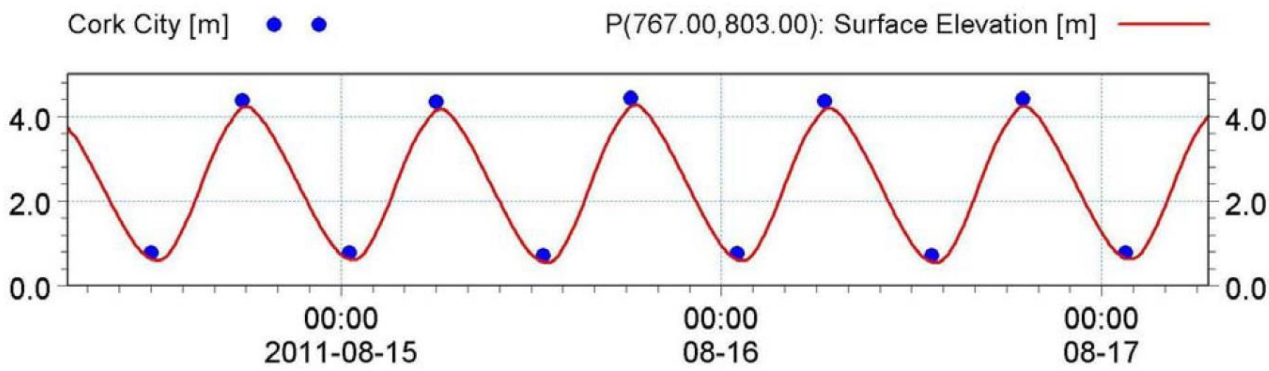

Figure 5.7: Simulated and predicted tidal elevation Cork City

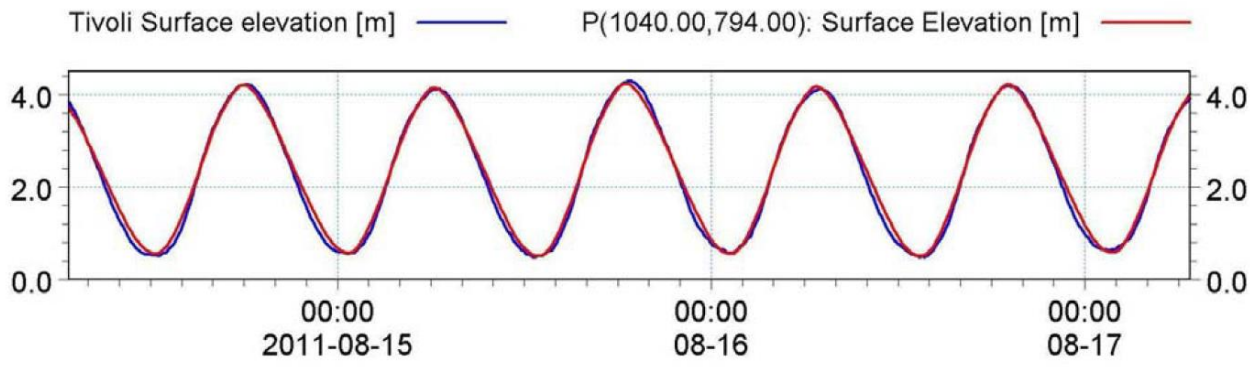

Figure 5.8: Simulated and measured tidal elevation Tivoli

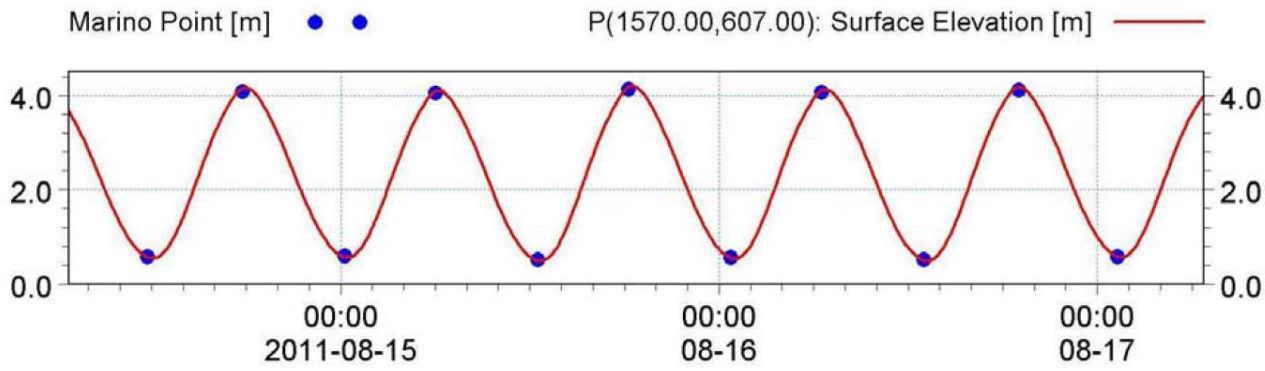

Figure 5.9: Simulated and predicted tidal elevation Marino Point

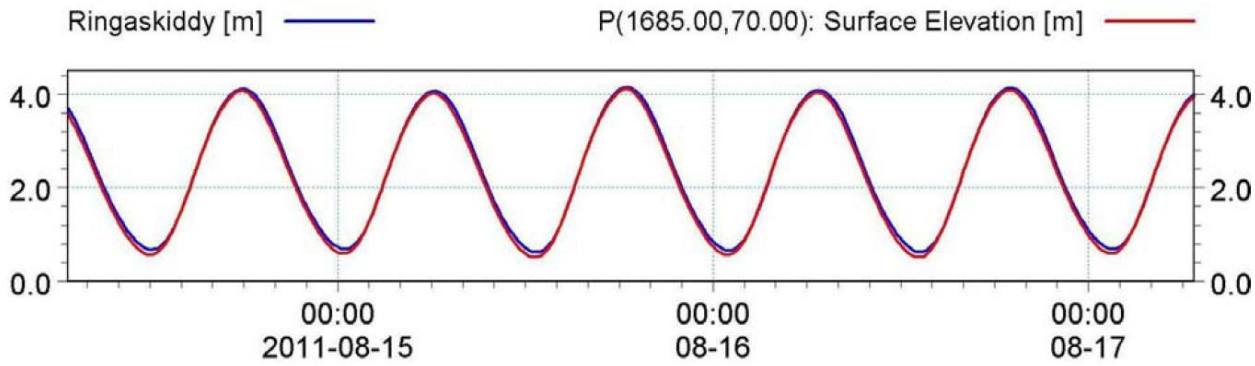

Figure 5.10: Simulated and predicted tidal elevation Ringaskiddy

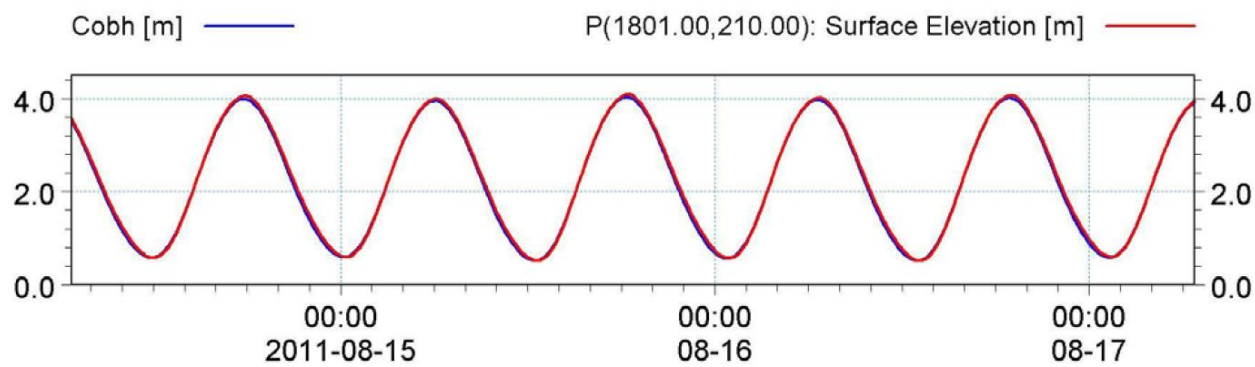

Figure 5.11: Simulated and measured tidal elevation Cobh